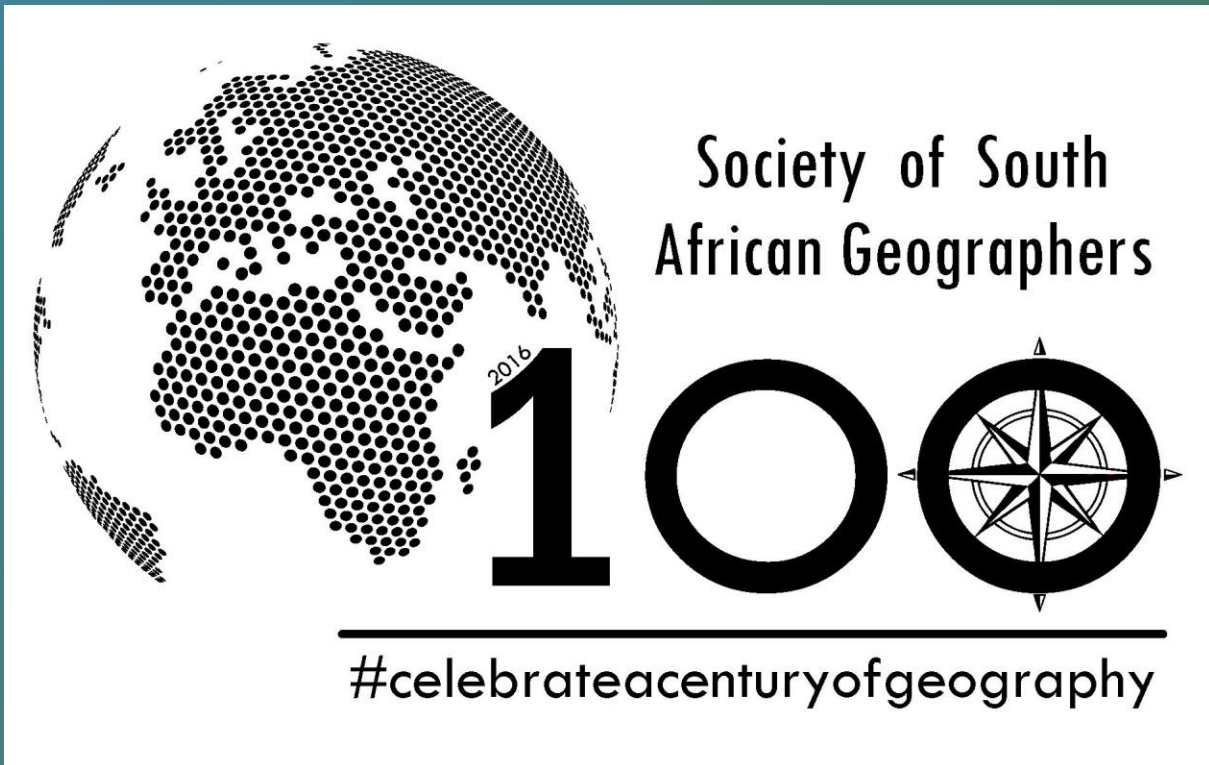


#Celebrateacenturyofgeography:

Proceedings of the Centenary Conference of the Society of South African Geographers



Editors:

Ronnie Donaldson, Gustav Visser, Jaco Kemp & Jan de Waal

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Society of South African Geographers
2016

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CONTENTS

ON GEOGRAPHY AND GEOGRAPHERS.....	1
The long and short pasts of South African geography	
- <i>Graeme Wynn</i>	2
Chance encounter at a pivotal moment in Southern Africa history: A personal narrative	
- <i>William Stanley</i>	9
URBAN GEOGRAPHIES – LOCAL ECONOMICS, POLICY, PLANNING, HOUSING	14
New directions in the South African beer industry: Interpreting the growth of craft beer	
- <i>Christian M. Rogerson</i>	15
Re-energising business incubation policy in South Africa: Learning from international experience	
- <i>Christian M. Rogerson</i>	22
Tracking the policy environment for creative industries in South Africa	
- <i>James J. Gregory & Christian M. Rogerson</i>	30
Residential mobility practices: A revolving door syndrome for low-income families in the global south?	
- <i>Ibrahim Yakubu, Manfred Spocter & Ronnie Donaldson</i>	38
The development of the urban policy agenda in South Africa: The role of the South African cities network	
- <i>Diane Abrahams</i>	47
A new lease of life, or not? Living condition changes of Southern African Development Community (SADC) migrants in the metropolitan municipalities of South Africa from 2001 to 2011	
- <i>Lodene Willemse & Trevor Chikowore</i>	54
Cape Town and its employment centres: Monocentric, polycentric or somewhere in-between?	
- <i>Stephan Krygsman, Tom de Jong & Otto Verkoren</i>	66
Grounded architectural practice: Exploring spatial capacity building in informal settlement upgrading	
- <i>Rudolf Perold, Ronnie Donaldson & Oswald Devisch</i>	78
The impact of mine construction on noise levels in Chaneng: A rural village in Northwest Province	
- <i>Barend van der Merwe & Nico Kotze</i>	85
The contribution of urban poultry farming to food security and employment in Jos, Nigeria	
- <i>Solomon Wuyep & Nico Kotze</i>	95
An explorative study on household recycling behaviour in the City of Johannesburg	
- <i>Thea Schoeman & Julian Schmidt</i>	105
Impact of urban agriculture on poverty reduction in Osogbo, Nigeria	
- <i>S. Yakubu, S.A. Adeniyi & M.O. Obidiya</i>	116
LAND, PEOPLE AND THE ENVIRONMENT.....	124
Contested land in peace parks: The case of Greater Mapungubwe - <i>Ndidzulafhi Innocent Sinthumule</i>	125
Fisheries in transition: Fishers' perceptions of the new South African small-scale fisheries policy and its implementation	
- <i>Samantha Williams</i>	133
Transforming Namibia's communal land: From labour reserves to sites of accumulation	
- <i>W. Werner</i>	141
Towards understanding the effects of informal harvesting of sand forest in Maputaland, South Africa	
- <i>R. Nel, K.F. Mearns & M. Jordaan</i>	147

TEACHING, TECHNOLOGIES, MAPS AND PRACTICALS	157
Tweeting and environmental awareness: Social media's contribution	
- <i>A. Pretorius, E. Kotzé and E. Kruger</i>	<i>158</i>
Mapping censuses in South Africa: 1911 towards 2011	
- <i>André Brand, Rob Anderson & Helene Verhoef</i>	<i>170</i>
Mobile technologies for data collection in sub-Saharan Africa: An outlook to the future of mobility research	
- <i>Justin van Dijk & Stephan Krygsman</i>	<i>180</i>
A scaffolded soil science curriculum: A practical project approach	
- <i>Milton Milaras & Tracey McKay</i>	<i>190</i>
TOURISM GEOGRAPHIES.....	200
Recent trends in South African student tourism research	
- <i>Gustav Visser</i>	<i>201</i>
Tourism geographies of the past: The uneven rise and fall of beach apartheid in South Africa	
- <i>Jayne M. Rogerson</i>	<i>212</i>
The geography of festival and tourism development: The case of Cameroon	
- <i>T.M. Tichaawa</i>	<i>219</i>
Governance of tourism in Kwazulu-Natal, South Africa	
- <i>P.S. Khuzwayo</i>	<i>226</i>
The uneven geography of South Africa's adventure tourism sector	
- <i>Tracey McKay</i>	<i>235</i>
The influence of weather on South African tourism experiences: American perspectives	
- <i>Julia Kathryn Giddy, Jennifer M. Fitchett & Gijsbert Hoogendoorn</i>	<i>245</i>
PEOPLE AND CLIMATE	251
Understanding pastoralists' knowledge of climate change and variability in arid Namibia and South Africa	
- <i>M.N. Angola, K.P. Ntombela, M.I. Samuels, M. Swarts, C. Cupido, N.E. Haimbili, M.E. Menjono-Katjizeu & M. Hoabes</i>	<i>252</i>
Life history: An alternative methodology for vulnerability research?	
- <i>Matilda Azong & Clare Kelso</i>	<i>267</i>
Environmental history and vulnerability: Lessons from the past	
- <i>Clare Kelso</i>	<i>277</i>
ENVIRONMENTAL PROCESSES, CONDITIONS AND GEOGRAPHICAL TECHNOLOGIES	287
Detecting and mapping small subsistence farms on floodplain wetlands using WorldView-2: Comparison of support vector machine and maximum likelihood classifier algorithms	
- <i>M.E. Dlamini, E. Adam & J.G. Chirima</i>	<i>288</i>
Land cover change induced by military action: A case study of two South African military training areas	
- <i>Hezekiel Bheki Magagula</i>	<i>301</i>
SWAT and OBIA based sediment yield analysis in the Tsitsa catchment of the Eastern Cape province, South Africa	
- <i>S. N. Pretorius, H. L. Weepener, J. J. le Roux & P. D. Sumner</i>	<i>315</i>
A mineralogical study of South African lunette dunes sediments using ERF: A case study of the western Free State panfield	
- <i>M. Rabumbulu</i>	<i>324</i>
Appendix A: Conference programme	339

Foreword

James Hutcheon, a 29-year-old Scot, launched the South African Geographical Society on 8 June 1917. To celebrate the marvellous achievement of reaching 100 years, the now known Society of South African Geographers (SSAG) hosted a centenary conference in Stellenbosch between 25 and 28 September 2016. In attendance were 220 delegates, mostly from South Africa, but also representation from 13 countries around the world (Canada, England, Ghana, Ireland, Lesotho, Namibia, Netherlands, New Zealand, Nigeria, Norway, Malawi, USA, and Zambia). Four esteemed scholars delivered academic key-note addresses: professors Jennifer Robinson, Abdi Samatar, Etienne Nel and Maano Ramutsindela. The main sponsor of the conference, ESRI, also hosted a panel keynote session.

The 167 oral presentations covered a wide range of sub-disciplinary themes including, among many others, food security, geographies of enterprise development, health and vulnerability, tourism studies, land and politics of access, literacy and learning, GIS development and techniques, mapping and analysis, corruption, and critical environmental dynamics. The most presentations were however located within the sub-discipline of urban geography and covered issues of urban renewal, housing, governance, informality, mobility, poverty, and spatial planning. For a list of all the parallel session presentations see Appendix A. A total of 21 posters were also exhibited.

After the conference, 41 papers were submitted for possible inclusion in the proceedings. With the exception of two papers (the personal narratives of Wynn and Stanley), all were reviewed by one of the editors and two anonymous referees. Based on the referee reports and resubmission evaluations, a total of 34 papers were accepted for inclusion in the proceedings.



Group photo of delegates at the SSAG centenary conference (photo: courtesy of Anton Jordaan)

The editors wish to thank the following referees for their valuable inputs and assessments of papers:

Mark Boekstein, Willem de Clercq, Helen de Klerk, Stephanie Dippenaar, Danie du Plessis, Michael Dyssel, Manie Geyer, Vincent Kakembo, Claire Kelso, Sanette Ferreira, Tyrel Flugel, Issahaka Fuseini, Gijsbert Hoogendoorn, Anele Horn, John Isunju, Eric Mashimbye, Tracey McKay, Kevin Mearns, Zahn Munch, Robyn Pharoah, Nitesh Poona, Christian M. Rogerson, Jayne M. Rogerson, Manfred Spocter, Adriaan van Niekerk, Hannes van der Merwe, Samantha Williams, Trish Zweig.

Ronnie Donaldson, Gustav Visser, Jaco Kemp & Jan de Waal (Editors)
December 2016, Stellenbosch

ON GEOGRAPHY AND GEOGRAPHERS

THE LONG AND SHORT PASTS OF SOUTH AFRICAN GEOGRAPHY

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Prompted by the SSAG Centenary Conference in Stellenbosch, and the volumes produced for that occasion by Barnard, by Visser, Donaldson and Seethal, and by the *SAGJ*, this paper notes the relatively long and robust history of university geography in South Africa, before identifying a paucity of historical work in the discipline and reflecting upon the implications of this truncated past

Centenaries spawn commemorations – and prompt reflection. In September 2016 the SSAG marked 100 years of university Geography in South Africa at its biennial conference in Stellenbosch. As with most such things, of course, beginnings are actually more indeterminate than the events honouring them. Geography was first taught, at tertiary level in South Africa, at Victoria College (later Stellenbosch University) in 1914. The first geographer appointed to lecture in the subject (J. M. Hutcheon) also founded the South African Geographical Society and initiated publication of *The South African Geographical Journal* on joining the South African School of Mines (later University of the Witwatersrand) in 1917. Geography was officially recognised by the Joint Matriculation Board as a university subject in 1918, and courses in physical and economic geography were taught at Rhodes University thereafter. But the first department did not take shape until 1920. In that year two women taught courses in Geography: M. M. le Roux at Stellenbosch, and A. W. Vaughan at Transvaal University College. By 1922 there were four departments and now there are 20 (including a branch of Australia's Monash University — for department histories see the essays in Visser, Donaldson, and Seethal, 2016). Judging from the 225 (or so) people who attended the Stellenbosch meeting, and the photographs of departmental personnel included in the conference program, the community of professional geographers in South Africa has come close to achieving gender balance and reflects the diversity of the “rainbow nation.” There may not be proportional representation, but white males no longer dominate the discipline numerically, in the way that they did through its first half-century and more.

This is a history worth marking. It stands positive comparison with the development of university geography in other “British dominions.” In Australia, the first department was established in Sydney by Griffith Taylor in 1921, and the subject gained a foothold in each of the five other state universities through the following two decades. But Taylor was controversial, he left Australia for North America in 1927, and there was little expansion through the hard times of depression and war. Although the number of universities, departments, and geography staff members increased during the post war boom, and a national Institute of Australian Geographers was established in 1959 (adding its own publication *Australian Geographical Studies* [now *Geographical Research*] in 1963 to the *Australian Geographer* published by the Geographical Society of New South Wales since 1928), there were few large departments and all of them were either merged with other subjects or discontinued between 1978 and 2002 (Jones, 2014; Strange and Bashford, 2008).

In New Zealand, Charles Cotton, the influential geomorphologist and disciple of William Morris Davis (who taught and inspired Lester Charles King, subsequently of Natal University College and President of SSAG in 1943) became professor of Geology and Geography at Victoria University College in Wellington when the Department of Geography was established there in 1946, the same year that departments were established in Auckland and Otago (Crozier and Priestley, 2011; Carruthers, nd; Roche, 2011; Pawson, 2012). George Jobberns, a geologist, had been appointed foundation professor of Geography at Canterbury University College four years earlier, after five years as the country's sole lecturer in the subject at that university (Soons, 1998). The New Zealand Geographical Society also had its beginnings among a group of enthusiasts for the subject in that southern city in 1939, but was not launched officially until 1944. The first issue of the *New Zealand Geographer* appeared the next year.

The institutionalization of Geography in Canada also lagged developments in South Africa. The University of British Columbia became the first Canadian university to recognize Geography as an academic division when the name of the department of Geology and Mineralogy was changed to Geology and Geography in 1922-23. However, Griffith Taylor was the first appointee trained in the field (in English Canada) when he was named inaugural professor at the University of Toronto in 1936. Two other universities in Ontario appointed geographers in the late 1930s. The first UBC instructor trained as a geographer was not appointed until 1945, and the programme there achieved departmental status only in 1959. In Québec, Benoît Brouillette, whose

1931 Université de Paris degree made him the first Canadian to receive a PhD in the field, taught at Le École des Hautes Études Commerciales in Montreal from 1931, but the province's first institutes of Geography were established only after World War II (at Laval, the Institut d'Histoire et de Géographie in 1946 became the Institut de Géographie in 1955 and a Département in 1969; at Université de Montréal the Institut de Géographie founded in 1947 became a Département in 1962). The Canadian Association of Geographers l'Association canadienne des géographes, and *The Canadian Geographer /Le Géographe Canadien* were both established in the early 1950s (Warkentin and Simpson-Housley, 2001). In none of these three countries, Australia, Canada, and New Zealand (I would judge from my own experience rather than systematic analysis), has Geography achieved the levels of diversity and gender parity evident in South Africa.

Although most geographers pay scant attention to the history of their discipline, South African scholars borrowed from their cricketing counterparts in celebrating a “hundred not out.” Metaphorical bats were raised to the “blazers” in the pavilion at the Stellenbosch conference, as meeting rooms formerly known as “Auditorium 1”, “Seminar room” and so on were temporarily re-designated in honour of a handful of the discipline's founders: James Hutcheon (who died early, in 1921); Piet Serton (founding professor at Stellenbosch appointed in 1920); Francis Plummer (head of the Pretoria department, 1926-1950); William Talbot (first head of the UCT department, 1936); and John Wellington (Hutcheon's successor at Wits and head there, 1926-1957).

Conference packages for those attending SSAG 2016 also reinforced the significance of the century, and extended it backward. They included a slender volume authored by W S (“Barnie”) Barnard of Stellenbosch, but left incomplete at his death in 2010. This has now been brought to print by his former students Ronnie Donaldson and Gustav Visser. Full of wisdom, and gracefully, indeed charmingly executed, *Encountering Adamastor* summarizes the beginnings of universities and geography in South Africa and considers the roles of time and place, character and circumstance in shaping the contributions of three of South Africa's founding geographers: Piet Serton, E H L Schwarz, and Siegfried Passarge.

To continue the cricketing analogy, this slim volume carries us back before the start of the game, to time in the nets, wicket preparation, and the coin toss, as it were. Passarge, a German scholar, spent only 31 months in South Africa in 1896-1899. But he produced 45 publications on Southern Africa, and guided “local geographical discourse toward professionalism.” Like Passarge, the English-born Ernest Schwarz trained as a geologist. Employed by the Geological Commission of the Cape of Good Hope in 1896 before accepting the chair in geology at Rhodes University College in 1905, he achieved notoriety (as “Schwarz of the Kalahari”) for his scheme to reduce the aridity of much of the South African interior by diverting the Zambezi River to flood the Etosha Pan and the Makgadikgadi Depression; the plan was hopelessly impractical but it roused many South Africans to greater awareness of their environment. Serton, an economic geographer recruited from the Netherlands, was South Africa's first human geographer. A follower of Vidal de la Blache and Hettner he regarded area studies as the culmination of the geographer's art and wrestled, quietly, through his long and distinguished career with the social and political tensions of his adopted country. As Barnard has it (p.65): “Passarge opened the South African discourse of geography ... Schwarz took it into the public arena [and Serton] gave it professional beginning and continuity.”

But that was then and this is now. Although *Encountering Adamastor* is designated the first in a series of volumes on the life-histories of South African geographers (and “Barnie” Barnard clearly intended to include essays on Talbot and Wellington in his project), both the relatively long and robust past of South African geography and the attention lavished on founding figures in 2016 provoke reflection upon the current state of the discipline. Here we need to distinguish between the history of geography and everyday practice in the field in thinking about the place of the past in the discipline. If geography is what geographers do (which is to say the research by which most of its practitioners mark their contributions to the field rather than the genuflections to elders that chronicle its evolution), the papers presented at the centennial conference (a sample of which appear in this volume) point to a significant foreshortening of historical perspective in South African geographical scholarship.

It is true that the past has often occupied a somewhat liminal space in the discipline. As environmental determinism fell into disrepute in the second quarter of the twentieth century, several geographers sought to establish a unique and defensible pedigree for their subject. Looking backward to the work of a preceding generation of practitioners, they might have identified several possible routes forward. But, Richard Hartshorne, the foremost among those who would define the discipline, turned to reading early German geographers and seized upon the distinction drawn by Immanuel Kant between history the study of time and geography the study of space. As articulated in *The Nature of Geography*, chorological sciences, among which geography belonged, considered “the arrangement of things in space” and historical sciences dealt with “the temporal progression of events in time.” In this view Geography was “the study of the areal differentiation of the earth surface” and focused, resolutely, on spatial patterns that existed at particular moments in time; it considered the past “only to explain the situation in the time chosen” (Hartshorne, 1939, 138-48, 178, 184-5). By 1959, Hartshorne had softened his rigid orthodoxy

(which he claimed to have found in Hettner), He conceded that "History . . . must be in greater or less degree geographic," and admitted that the distinction between history and geography was "not one of separation but of difference in purpose and emphasis" (Hartshorne 1959, 103-4, 179).

Historical geography flourished in the space thus created. In North America (and reflecting a slightly different historical trajectory shaped by local circumstances) in the United Kingdom, and in Australia and New Zealand, many departments appointed one (or more) historical geographers, many of whom contributed significantly to the understanding of those parts of the world upon which they worked in the last half of the twentieth century. South Africa was somewhat different. The absolute and relative numbers of historical geographers based in South African departments certainly lagged those in England and Canada. In the late 1990s only four of almost 200 university academics in the country listed historical geography among their interests, and only six of more than 300 geography theses completed at South African universities proclaimed themselves historical geographies (Hattingh, Fairhurst, and Vivier, 1998; Pirie and Moon, 1982). But the long European past of the country attracted the attention of scholars elsewhere, many of them expatriate South Africans; so, by way of examples, Leonard Guelke (1974) drew important insights into the socio-economic effects of pioneering from his University of Toronto doctoral work on the early Dutch frontier in the Cape, and a decade or so later Alan Mabin (1984) explored the making of colonial capitalism in the late nineteenth century Cape Colony in his Simon Fraser University dissertation. Complicating the picture of (ex)patriate work, Norman Pollock and Swanzie Agnew, South Africans educated in Oxford and Edinburgh but colleagues at the University College of Fort Hare in the 1950s before they returned to the UK in 1955 and 1960 respectively, collaborated on *An Historical Geography of South Africa* that traced the evolution of landscapes to 1910 (Maddrell, 2009; Seethal and Mimi, 2016).

Among local practitioners, A. J. Christopher stands out for the sheer number of publications that he has brought to print since 1970. They are devoted in the main to three topics that became, in temporal sequence and in approximate terms at least, the prominent concerns of his work: questions pertaining to land tenure and material landscapes, especially on the frontier; the colonial origins of the apartheid city; and the making and taking of censuses. Tallying several score articles and chapters as well as a large handful of books, this is an impressive oeuvre distinguished by painstaking archival research and a strong propensity to map the data uncovered.

Broadly, then historical geographical work on South Africa through the 1970s and into the early 1980s echoed many of the themes dominant in other new world societies in its focus on the frontier of European settlement broadly defined, and the control and exploitation of land and other resources (Conzen, Rumney and Wynn, 1993). Initially, at least, scholars in the UK probably had more influence upon the practice of historical geography in South Africa than they did in North America. Yet much of this early South African work shared with historical geography elsewhere the legacy of Hartshorne's definition of geography as the study of areal differentiation and his exclusion of historical narrative from the discipline; it said more about pattern than process, and about space than people. To adapt the old adage, its focus was on maps rather than "chaps."

In the 1980s, a younger cohort of scholars, influenced by local events and a new generation of intellectual leaders, within and beyond the country, brought new perspectives to somewhat similar themes, including the division of land and residential segregation. Attention was also turned, increasingly, to the rapidly expanding cities and the effects of forced removals, resettlement, and the new spatial and social order engineered by the Group Areas act of 1950. On balance it is probably fair to say that South African historical geographers were more heavily influenced than their counterparts elsewhere by the move, in British social and cultural history, to recognize and respect the experiences of "ordinary" men and women. This impetus – and the exposure of several South African scholars to emerging critical scholarship during doctoral training abroad -- transformed the writing of both social history and historical geography in South Africa in the last two decades of the century. Struggle, conflict, and resistance formed the basis of new archive-based narrative accounts of "the divided landscapes of industrial capitalism; ... the 'hidden spaces' ... [of] the marginalized and dispossessed" and the power relations involved in the creation of parks and wildlife reserves (Crush, 1992, 17; Brooks, 1992).

By contrast, and insofar as the centenary conference is any guide to the larger body of work under way in the discipline, human geography in South Africa today has virtually no interest in a past more than one generation deep. By my listening and reckoning (from the conference abstracts and other materials), there is a yawning chasm between the growing group of physical geographers interested in what we might call deep time (paleo-environmental reconstruction) and almost all other work which is focused on the present, sometimes reaches back to the beginning of the millennium, and only occasionally encompasses the last decade of the twentieth century (for work on deep time see Meadows and Finch, 2016).

This is a sweeping claim and like all generalizations it is subject to objections – but few of them, I would judge, undermine the essential point. The five conference presentations that offered more than cursory engagement with the past as prologue to the

present warrant consideration here. One offered a series of maps derived from South African censuses between 1911 and 2011 to “expose findings relating to official statistics”; a poster detailed the only recorded meteorite fall in South Africa, in 1838, and noted its scientific implications. Two papers reached back, at least nominally, a half century or so; one entered the 1960s to trace the changing population, economy, and morphology of Mafeking/Mafikeng-Mmabatho/Maheikeng; the other, on Namibia, identified parallels between the ongoing development of commercial farms on communal lands and the recommendations of the Odendaal Commission of the 1960s; Finally, a single paper, the only one acknowledging the intrinsic value of the past and using a range of archival methods and sources, reconstructed the livelihood strategies of a Namaqualand Khoikhoi population in the 18th century in an effort to understand the resilience or otherwise of the community in the face of climate change.

If I read, hear and figure aright, then, the 2016 SSAG conference offered an arresting indication of a new and overwhelming focus on the present among South African human geographers. Fossicking beyond the conference programme turns up some counter evidence, but not enough to overturn my argument. A handful of colleagues continue to list historical geography among their interests and continue to publish, relatively occasionally, in this sub-field (and others). Shirley Brooks offers a case in point. Trained in history and historical/ cultural geography at the (then) University of Natal and Queen’s University in Canada, now head of geography at the University of the Western Cape she lists her interests as: “Historical geography; Cultural geographies of nature; Environmental history; Political ecology; Critical conservation studies; Postcolonial land issues; Landscapes of ecotourism; Animal geographies.” Google Scholar lists 30 publications under her name. Many of these are historical, but none of those published in the last decade display the close archival work and deeply historical character of most of the items published before 2006 (e.g. Brooks 2005 and Spierenburg and Brooks, 2014). Similarly, Christian Rogerson, Gordon Pirie, and Sue Parnell all made important, innovative contributions to historical geography, the field in which they were trained, in the 1980s, but today they stand in South African scholarship as leaders in tourism geography and applied urban and policy research -- although Pirie continues to publish on the socio-cultural history of British Imperial Aviation and mobility in history, and Rogerson and Parnell occasionally publish historical/ retrospective pieces (Rogerson, 1986 and Rogerson, 2011; Pirie, 1986, Pirie, 2009 and Mom et al, 2009; Parnell, 1989, Parnell, 1991, and Harris and Parnell, 2012).

The SSAG Centenary Special Issue of the *South African Geographical Journal* largely confirms the sense that human geographers in South Africa have eschewed the past. Asked to showcase current research by their colleagues, authors of the dozen short review essays were also informed by the editors that “while they might wish to mention certain aspects of older literature to establish historical threads, the emphasis should be on some of the dynamic aspects of the contemporary.” Physical geographers aside, few contributors tug very long or hard at historical threads (Meadows and Finch, 2016; Holmes, Grab, and Knight, 2016). A discussion of military geography sketches the world wide decline of the subfield in the twentieth century and notes that it went unmentioned in a turn of the millennium assessment of the state of South African geography, to lay the ground for an anticipated “advance from the trenches” of near irrelevance (Smit, Magagula, and Flügel. 2016). Visser (2016, 432) dates the South African beginnings of tourism geography to a couple of studies from the early 1970s to celebrate the rise of tourism geography (always determinedly focused on the present scene) to its present position as, arguably, “the single largest sub-disciplinary focus of published South African human geographical research.” A “scan” of urban work pre- and post- 2000 characterizes twentieth century contributions as diffident and introspective and celebrates the assertive expansion of the field at the head of “a southern turn in urban studies” (Harrison and Rubin, 2016, 486).

Assessing the current status of, and new challenges confronting, South African geomorphology, Holmes, Grab, and Knight (2016, 412) nicely identify some of the forces behind this tectonic shift to the here and now. After making a case for geomorphology’s pivotal integrating role in physical geography, they move on to stress its utility in “addressing critical problems affecting twenty-first century South Africa... [including] climate-environmental change, food and water security, soil erosion and land degradation, coastal slope, beach and dune stability, and sustainable abiotic resource conservation and management.” In short, the number and magnitude of fundamentally geographical questions confronting contemporary South Africans (in the human as well as the physical realm) promise an immediate relevance (and all that accompanies that status) to those who purport to address them. “Relevance” – usually defined in instrumental (i.e. problem-solving) terms – has long been a siren song for geographers. In a utilitarian age, in a society and polity facing pressing problems of economic, social, and resource management and governance, and the enormous challenge of achieving a more just and sustainable order – its has an understandable allure.

Beyond this, the movement of South African human geography away from traditional forms of historical engagement with times past parallels a broader shift in geographical scholarship worldwide. Too complicated and multi- faceted to account for fully here, this certainly has something to do with the steady erosion, by successive waves of post- (modern, structural, etc.) theories and cultural, textual, and constructivist “turns”, of the conviction that humanists and social scientists provide accurate,

factual accounts of reality. As influential scholars shifted their concerns away from material forces and the forms to which they give rise, to ponder the ways in which humans constructed and interpreted the world, the historical geographer's long-standing devotion to mapping distributions and describing landscapes came to seem dull and outdated. Far from being a foreign country, to be considered on its own terms, for its intrinsic interest, the past was remade by critical theorists, as a mirror to the present. And perhaps the late-twentieth century lament of English historian Eric Hobsbawm that the current generation of young people had grown up "in a permanent present lacking any organic relation to the public past of the times they live in" was nowhere more true than in South Africa after 1994 (Hobsbawm, 1994, 3; see also Hunt, 2011).

In her SSAG conference paper "Unmasking Soweto Renewal" Elizabeth Block quoted a local resident to the effect that "no-one will allow the future to look like the past." That may be, but for this to be true one has to know the past. As Block pointed out, even such recent events as the Soweto Youth Uprising of 16 June 1976 that "profoundly changed the socio-political landscape in South Africa" (SAHO, nd) are misrepresented and misremembered (or vice versa): the shooting of 13 year-old (or was he 12? Official tourism/heritage websites differ) Hector Pietersen, one of the first casualties of the violence, is marked in the wrong location, and so too the statue showing the line of fire of the police in Moema Street is inaccurate. Symbolism has trumped fact, and tragic events are not so much commemorated as commercialized in the service of tourism.

Ignoring history may not condemn anyone to repeat it, but reflecting upon the radical foreshortening I perceive in contemporary South African geography I worry that a weak sense of the past and a lack of an historical point of view may deprive us all of perspective, enhance uncertainty about the wisdom and efficacy (or their opposites) of particular plans and actions, and leave us adrift. Having a clear sense of one's departure point (and how one came to reach it) remains, I think, a necessary prerequisite to setting an effective course to whatever destination one seeks.

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CHANCE ENCOUNTER AT A PIVOTAL MOMENT IN SOUTHERN AFRICA HISTORY - A PERSONAL NARRATIVE

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Abstract: My first visit to South Africa was in 1986. This marked the beginning of a long professional and personal relationship with the late Professor W.S. Barnard of the Geography Department at Stellenbosch University. Professor Barnard was instrumental in helping to organize the early stages of my subsequent research in SWA/Namibia and through personal contacts introduced me to key players in the SWA/Namibian fishing sector and the newly established tertiary education Academy in Windhoek. His earlier working relationship with the late American Professor Richard F. Logan and their joint interests in desert ecology took on greater importance for my research after Logan read of my work. This paper recounts two significant events derived in part from their assistance and, admittedly, in no small part from my being in the right place at the right time during a period of intense international interest and profound political transformation in southern Africa. In addition to a foreign flag fishing trawler investigation the paper recounts the contentious reception to a highly controversial and hypothetical proposal for a world scale nuclear waste facility in Namibia jointly controlled by the soon to be established Namibian Government and The United Nations. Lastly, background to the manner by which marginal farms in severe drought prone areas in western SWA/Namibia were absorbed into what was to become Naukluft Park is examined in the context of Professor Richard Logan's investigations.

Introduction

After twenty-two consecutive research seasons in West Africa my arrival at Johannesburg Airport in 1986 opened a new vista on Africa. The human mosaic outside of the terminal was in sharp contrast to what had been experienced in Liberia, Sierra Leone and war torn eastern Nigeria. My first week in the country was spent touring rural areas in what then was the Transvaal. Afterwards, using a combination of train and bus, I arrived in Cape Town and set out to visit the Geography Department at UCT where Professor Richard Fuggle received his visitor warmly. The impact of sanctions against South Africa hit home when he admitted that I was only his second visiting foreign geographer in some time. The first was from Taiwan. He suggested that I visit Professor W.S. Barnard in Stellenbosch on my return to Johannesburg. My initial meeting with Professor Barnard led to yearly return visits to Stellenbosch and to a close personal relationship with him and his family. Prof Barnie as he was called by students or just Barnie by his friends encouraged my research plans in SWA/Namibia and boosted my first visit with the names of several contacts, individuals who might be called upon for assistance. Professor Barnard's doctoral research on physical processes had been in the Namib Desert but by this date his interests had shifted in large measure to human geography. I came to appreciate him not only as a first class researcher and scholar but as someone whose breadth of interest in geography ranged from physical processes to political-cultural landscapes and the history behind them. Geography at Stellenbosch and geographers throughout South Africa owe a debt of gratitude to this man.

Whereas Professor Barnard's research had been in the southern and western areas of the Namib Desert he also seemed well informed on the border war and its origins in East Caprivi. His two sons would soon be approaching the age of military obligation making the issue all the more important. Proud of his heritage and patriotic he nevertheless shared misgivings concerning the expanding conflict. I quickly appreciated his wider perspectives on landscape change. My generation of geographers in the United States has not been adequately taught the value of a strong foundation in physical geography to support endeavors in other branches of the subject. Professor Barnard's research on those several mostly foreign born individuals who built the foundations for university level geography in South Africa is a case in point. Unfortunately, he died before completing this seminal work but others took up the task and those of us attending this conference have evidence of the result in one of the conference handouts.

I previously had read an intriguing introductory paper of his on the turn-of-the-century Walvis Bay boundary controversy between Germany and Great Britain. The two countries agreed to use a Spanish arbitrator who eventually denied Britain's claim to the mouth of the Swakop River and its important seaport. Barnie later published an expanded version of this paper in the South African Geographer. This paper had been one factor in my desire to work in SWA/Namibia. The following draws upon several experiences in South Africa and SWA/Namibia during these first visits and my participation in or reaction to them. It was a period of profound change in southern Africa

First impressions

My first few days in the country were spent driving about the rural Transvaal to better appreciate this land so much in the news. A Scottish great aunt had worked in South Africa early in the last century and her postcards to my mother were among my childhood memories. My arrival at the outskirts of Ellisras coincided with a serious political confrontation. Conservative protestors waving the old South African Republic flag were confronted by scores of policemen to ensure that a member of government could speak without violent disruption. There had been several serious incidents in the preceding days. Fists were thrown and arrests made and, interesting as it was, the more profound scene catching my eye was that of a woman with baggage on her head and a child on her back assessing the turmoil. She likely did not understand the particular dynamics of this situation but could see that something most unusual was occurring. Whites were fighting other whites. Earlier, in Belfast, a South African Railroad inspector befriended me in the lobby of our small hotel and took me to one of the few take-out food emporiums. Here was a true railroad man, proud of his profession but lamenting the decline of rail passenger service. As with so many South Africans he was concerned for sanctions and the role of the United States and others in their implementation. He clearly saw some of ramifications that might emerge from change. As an aside, South Africa maintained its passenger rail system for nearly two decades after the American system had for all practical purposes collapsed.

Travel from Johannesburg to Port Elizabeth was by train and a sleeper no less. My compartment companion was a tough looking policeman who quickly made his dislike of Americans all too clear. In fairness, I surmised it was Washington's policy rather than a blanket indictment. He had colleagues in nearby compartments but eventually returned and engaged me in conversation. Unrest in the Port Elizabeth area was drawing in police reinforcements. Upon mentioning that I had fought in Korea as a marine during that conflict he slowly warmed-up to his bunk mate. By the next morning we were on good enough terms that he invited me to join him for whatever policing operation was planned. I respectfully declined. Arriving early morning by rail in Port Elizabeth reminded me of a similar arrival years earlier in Philadelphia. The scene was akin to one gigantic and seemingly endless garbage dump. Plastic bags littered the ground; the Philadelphia scene would have been mild in comparison. I better appreciated more of the background behind the unrest..

The next day I boarded an early morning bus to Cape Town. I don't recall the specifics but rail service wasn't available. It was an all day journey made pleasant by easy conversation with nearby passengers and the passing panorama of much beauty. Arriving in Cape Town my seat companion suggested that I join her for coffee while she awaited her ride. The social-racial dynamics of the day reappeared in the restaurant when an agitated white male entered into a tirade with two non-whites on the racial issue. More interesting from my perspective was the disapproving attitude on the part of other patrons.

1986 and 1987 were significant in Namibia's emergence as an independent state. Conflict on the northern border was intensifying with relentless international political, economic and social pressure on South Africa to reach an accord, both by perceived friends and known enemies. To reach the North by automobile one first needed to pass through the south of the country and this region held a certain fascination. In my case, population density, climate, vegetation and land use were in sharp contrast to what I had experienced in West Africa. Skeletal in nature, the transport infrastructure immediately attracted my interest as this was my doctoral research topic in Liberia. During and after World War 1 South Africa had only to build two relatively short rail lines to connect their system to the one already constructed by Germany in SWA. It was not until well into the present century that Namibia added to this rail system by a largely Chinese funded line linking the mining center at Tsumeb, and its access to the country's rail grid, to the Angolan border. This new railroad traverses the Ovambo cultural heartland and serves at least two objectives--facilitating increasingly important trans-border commerce with Angola and boosting the SWAPO Government's base electoral support group by improving transport access. Allowing for several transfers and not being in a hurry one can travel by passenger train from the Angolan border to anywhere in South Africa served by rail passenger service. The traveler should not count on a sleeper.

Maritime theme

One of the contacts suggested by Professor Barnard was Dr. Jannie Jurgens, Director of Research at the Fisheries Department in Windhoek. He and I spent considerable time discussing *this* sector's importance to the country's economy and the problem of over fishing especially in the current political environment. One of my questions concerned the scope of territorial intrusion by foreign flag trawlers. He admitted to not having specific figures but surmised the problem was real and growing. He asked if I would be interested in joining a fisheries inspection vessel due to sail in a few days. In return, he would appreciate having my assessment of what was occurring off shore. I quickly accepted.

The "ORYX" had been Italian and was donated to the SWA/Namibian Government for Fisheries Department use. As an inspection vessel it lacked the speed necessary to catch many if not most of the trawlers operating in national waters but living quarters were almost luxurious. As it evolved, speed was of little significance in the foreign trawler inspection scheme. The

ORYX sailed on what turned out to be a seven day cruise. Hardly out of Walvis Bay harbour the captain picked up messages from trawlers at anchor in the port that we were on our way. During the next days all of which were in good weather I personally identified more than one hundred Soviet flag trawlers, several each from Spain, Rumania, and Japan together with a single sighting of an Israeli fishing vessel. Many of these ships were close in-shore and taking full advantage of the muddled political situation. The primary deep water fishing nations had gone so far as to use the United Nations umbrella to establish a new SE Atlantic fishing zone. Each of the fishing countries ascribing to this pact had a vote including SWA/ Namibia. Voting was meaningless and the sole purpose of the pact appeared to be nothing less than the legalizing of an open season on offshore SWA/Namibia fish stock. If this wasn't enough, the fisheries inspectors aboard the ORYX appeared to have minimal interest in enforcing whatever rules existed (net size, number of nets and taking into the nets and not returning to the ocean prohibited species) and were far more intent in obtaining gifts from the trawler captains. One might fairly call such gifts to be bribes. One instance stands out. The ORYX carried a rubber dinghy powered by an outboard motor. Our two inspectors and their helper set forth to board a stopped Soviet flag trawler a few hundred meters away. The helper remained in the dinghy while the inspectors went aboard the vessel. In little more than an hour they came back into sight and began to maneuver down the gang plank. I watched closely as they descended somewhat clumsily carrying boxes of different sizes. Once back aboard the ORYX they were hesitant to expose their loot but from all indications the boxes contained vodka, sausage and what could have been furs. Protecting fish resources seemed to be an afterthought. Perhaps these inspectors knew that their job security and opportunity for graft was soon to end.

More to the point, Dr. Jurgens in the research office had no control over inspections. He suspected the broad parameters of the problem but knew little of the specifics. The entire operation was a gigantic charade. The South African Air Force made daily reconnaissance flights observing the trawler fleets. Many if not most of the vessels showed no respect for territorial waters but South Africa was hardly prepared to combat these intrusions by force and not only due to the Soviet Union's trawlers being the most conspicuous violators. Interestingly, shortly after independence and the installation of Namibia's first government a popular financial investment by ranking officials was in existing registered fishing companies and newly established ones.

The once rich fishing grounds in these cold off shore waters are attested to by the height of guano deposits on some of the islands. Over fishing pushed the industry northward toward Angolan waters in search of better catches. This in turn made round trips from Walvis Bay more time consuming and expensive. There were at the time open discussions concerning the need to construct a fishing port to the north of Walvis Bay somewhere astride the Skeleton Coast. Nothing came of these discussions but the very idea inflamed the environmental community in SWA/Namibia. Even a relatively small port with breakwaters would have required massive disruptions in the desert ecology in order to bring in the necessary equipment and supplies and to provide surface transportation for shipping fish catches to inland markets. Any fish processing infrastructure that might be built in the port area could only have added to the disruption.

Toxic waste theme

In Windhoek I earned about a pro-seminar held monthly at the Center for Tertiary Education, an institution created to provide an opportunity for higher education in Namibia. It was a response to the already established UN Center for Namibia housed in Lusaka, Zambia. Speakers brought up the topic of waste disposal and the NIMBY issue (not in my back yard). Discussions were heated and occurred at a time when newspapers were reporting nefarious activities mostly on the part of Swiss businessmen seeking permission by whatever means to dump toxic chemical waste presumably from Switzerland of the shores of West Africa. Bribing of officials was common knowledge. The seminar moderator asked me if I would be interested in offering paper for the following month's meeting. I accepted and set forth to prepare my lecture.

Here I was sitting in a classroom in a soon to be newly independent country, one that would shortly be in a need of enormous financial infusions to support its programs for social-political change. Elsewhere, developed countries were looking for locations where their unwanted industrial waste might be stored openly and at a price. I recalled the ongoing controversy in my own country where the state of Nevada was vigorously contesting Washington's decision to build a gigantic deep underground and very costly nuclear storage facility. It was designed to house spent nuclear rods from the several score American power generating stations. To date, billions of dollars have been spent to prepare this storage facility in the Nevada desert and still no waste is stored there. The project has become a political football. President Obama recently declared that the site will be closed in order to appease political allies in Nevada. Military nuclear waste is stored elsewhere. Having this background in mind, I decided to go 'for the sky' theoretically in my forthcoming paper. Sitting with a calculator and identifying countries with known nuclear power generating programs, projected cumulative initial fees could amount to more than \$7 billion for joining the proposed nuclear waste disposal club and still greater amounts of money thereafter for yearly storage and maintenance charges. Furthermore and as a possible solution to the evitable questions of corruption, this proposal envisioned the entire waste (industrial and nuclear) scheme be placed under the joint control of Namibia's soon to be new government and a specially

configured monitoring organization in the office of the United Nations Secretary General. Another piece of the proposal entailed the construction of a nearby world scale technical training center to train nuclear waste storage technicians from participating and future candidate countries.

The audience consisted of a dozen or so participants including two wearing the uniform of Nature Conservation. Post discussion questions were civil but with some pointed comments. A few days later, I received a phone call from the seminar convener asking if I would be prepared to repeat the lecture only this time to a larger group comprised primarily of Nature Conservation personnel. I grumbled about why these people were not at the original talk but nevertheless agreed to a repeat session. Imagine my thoughts when I entered the lecture hall packed with attendees. There wasn't an empty seat and it was standing room for late arrivals. After the customary introductions and my emphasizing the multitude of variables in the topic, I began what was to prove a long and stressful talk. Time to time I looked at the audience and it appeared to be a mix between those scribbling furiously and those scowling at me. The question and answer period was long and emotional. I knew beforehand just what a contentious issue I had entered into but still imagined myself being reasonably neutral about the various ramifications. Nevertheless, I had seriously misjudged the present mood in the country. Nature Conservation prided itself on a long history of protecting the natural environment and topics concerning toxic and even nuclear waste had become frequent daily news items. Here was an American academic with a topic almost guaranteed to create controversy; I soon regretted my choice of topics. Some good surely came from it; Namibia's constitution drafted shortly afterwards contains language that prohibits disposal in the country of any toxic waste "not produced" in Namibia. Personnel in Nature Conservation surely had a hand in helping to insert this clause and no doubt my lecture had some bearing on their action.

Environmental theme

As a young academic Professor Barnard had been contacted by a visiting American Geographer from the University of California in Los Angeles who first visited southern Africa in 1956. Professor Richard F. Logan specialized in arid regions and rightly imagined that the Namib and California deserts shared many characteristics. Not shared was the human imprint. Logan sought Professor Barnard's assistance to undertake a joint field investigation in SWA/Namibia but Stellenbosch teaching obligations interfered. Eventually, Professor Logan found collaborators from Nature Conservation in Windhoek at least one of whom Barnie had recommended. The background to the pending research involved the number of farmers residing often precariously on the western margins of the Namib Desert and the financial cost to government for supporting them. Some of this settlement occurred at a time when there may have been sufficient rainfall to warrant marginal animal husbandry endeavors and where policy in these pre-independence administrations favored expanding the agricultural frontier, often with poor white farmers. Rainfall in this region is sporadic and often as not insufficient to provide a decent livelihood from animal husbandry. Government in time realized that the great majority of these farmers were hopelessly in debt, usually to government agencies, and where each year many of them became even more indebted.

Nature Conservation eyed portions of this region as a potential significant conservation zone and a convergence of goals materialized. Logan and his collaborators used their research season going from farm to farm itemizing positive and negative characteristics of the particular unit. The investigators acquired from government specific indebtedness figures for each farm and, then, comprised a priority list for action. Professor Logan sequestered himself in a caravan on the grounds of a suburban Windhoek hotel and spent several weeks analyzing field notes and preparing a comprehensive report for use of government. To facilitate the transfer of land from private back to state ownership, the caveat to the farmers was a promise to forgive all indebtedness in addition to offering a market price to acquire the property. Most farmers took the opportunity with the result that these properties became building blocks for portions of the future Naukluft Nature Park. A constant outflow of tax monies to support habitation infrastructure on marginal farms reverted over the long run to a source of tourist monies for Namibia's government and private tourist enterprises plus a major ecological boost to the country.

Concluding remarks

Namibia's nationwide tourist industry is thriving whereas the fishing sector is not as vibrant as once was the case. Clearly, over fishing is the culprit. The city and port of Walvis Bay are thriving with the growth of imports to serve the country's expanding economy and the important uranium extraction sector. Nearby Swakopmund depends upon a different growth model, one based on retirees, a growing service sector and significant tourism. Elsewhere, countries with nuclear power generating plants continue to seek acceptable waste storage facilities but are obliged to continue with prevailing policy to use on-site storage at the particular plant site. This is a problem only destined to grow as worldwide needs for electricity increase with much of new demand to come from nuclear power. The ugly reality behind the need to store nuclear waste for the centuries defies rational disposal solutions, yet allows those involved to defer decisions to future generations. Did a hypothetical proposal in a Windhoek lecture room a quarter century ago possibly warrant new assessment in a country that has become a significant contributor to the world's nuclear power industry with uranium mining? Namibia's frontier with Angola is active with trans-border trade and

development instead of border conflict. The once volatile political-military environment in southern Africa is history. Lastly, a meeting in Stellenbosch in late September 2016 provided an opportunity for the late Professor Barnard to be honored by South African geographers and geographers elsewhere.

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URBAN GEOGRAPHIES – LOCAL ECONOMICS, POLICY, PLANNING, HOUSING

NEW DIRECTIONS IN THE SOUTH AFRICAN BEER INDUSTRY: INTERPRETING THE GROWTH OF CRAFT BEER

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Abstract: New directions emerging in the South African beer industry are examined as part of a growing international scholarship on the beverages sector. Since 1994 there has grown a new segment of the local beer industry, namely the economy of craft beers. The aim is to interpret this new focus in the South African beer industry. The study contextualises the emergence and growth of this vibrant third segment of the country's beer economy within an international scholarship around neo-localism which is viewed as a response to the homogenizing forces associated with globalization.

Introduction

As Homer Simpson states beer "is the cause and solution to all of life's problems" (cited in Chapman, 2015: 21).

Reindustrialisation is a major policy focus in terms of current economic planning in South Africa. This is a direct reaction to the chronic underperformance of the country's economy relative to the global economy and more particularly relative to the performance of other emerging economies. The policy focus by the national Department of Trade and Industry on reindustrialisation is a response to the loss of at least 250 000 manufacturing jobs since the 2008 financial crisis. The essential focus is to revive the competitiveness of the country's manufacturing sector and spur much needed job creation with special attention given to the auto sector, clothing and other forms of labour absorptive manufacturing (Rogerson, 2014).

Outside the policy limelight, however, one sector which has experienced growth and expansion despite the financial crisis is the production of alcoholic beverages and more especially that of beer manufacture. The historical development of the beer industry in South Africa has been oriented around the consolidation of South African Breweries (SAB) as the country's monopoly brewer for the national 'clear' beer market (Mager, 2008, 2010; Tucker, 1985). In addition, there is a second and highly distinctive segment of beer manufacture which is the market for 'traditional' sorghum based beers (Rogerson, 1986). Formerly the production of sorghum beer was a municipal monopoly before falling under the control of SAB which sold out to United National Breweries, part of the multinational Diageo drinks group which owns brands such as Guinness, Baileys and Johnnie Walker. Since 1994 there has been established a third segment in the South African beer industry, namely the growth of an economy of craft beers. The emergence of craft beer production in South Africa exhibits parallels with similar developments occurring in the global North in particular with industry change occurring in USA, Canada and parts of Europe (Eberts, 2014; Herrera, 2016; Maye, 2012; Patterson & Hoalst-Pullen, 2014; Reid, McLaughlin & Moore, 2014).

In much of the global North the beer industry recently has experienced a radical 'makeover' in terms of landscapes of production and consumption. In the USA Elzinga, Tremblay and Temblay (2015: 248) argue that the stimulation of demand for craft brews has (re) invented beer as a serious consumption good to be paired with food, rather than simply as a liquid that quenched thirst on a hot day or offered an inexpensive buzz. Among others Chapman (2015, p. 102) highlights that the formerly monolithic world of beer has been transformed by a new beer culture distinguished by "variety, diversity, ingenuity, creativity and unbridled excitement". It is observed that the culture, economy and landscape of beer has been "turned upside down in a fruitful quest for new beer paradigms" (Chapman, 2015, p. 102). Furthermore, as Withers (2017) points out, what was once considered a beverage for the ordinary person or working class man (and woman!) is now transformed into a sophisticated and complex consumer product that spans across many demographic entities – from hipster to hippie – and with high end restaurants offering a beer list that frequently matches the length and depth of wine lists. In another recent intervention Sugar (2016) shows that the growth of craft beer allows women to 're-engage' with beer and the social ritual of its consumption in contrast to the hostile portrayals and male spaces associated with macro-brewers and their advertisements.

In terms of examining the new directions shaping South Africa's beer industry the specific focus here is on reviewing and explaining broadly the growth of the craft beer sector as a small (lesser-recognised) fragment of the re-industrialisation of the country's economy. The discussion must be read as part a wider and growing international literature around the geography of beer in general and of craft beverages in particular. Research on the geography of beer is expanding in significance as is indicated by the regular hosting of thematic sessions on this topic at the annual meetings of the Association of American Geographers. Scholarship by geographies on beer covers a range of issues around production, consumption, local development impacts, sustainability and regionalism. Although writings on the geography of beer are dominated by US scholars there is a

growing international corpus of writings on a range of different themes (Patterson & Hoalst-Pullen, 2014). Among selected prominent contributions writings are those concerning changing spatial patterns of beer production (Baginski, 2008; Baginski & Bell, 2011; Batzli, 2014; Elzinga et al., 2015; Maye, 2012; McLaughlin, Reid & Moore, 2014; Reid et al., 2014), local urban and regional impacts (Dillivan, 2010; Mathews & Picton, 2014; Pechlaner, Raich & Fischer, 2009; Weiler, 2000), sustainability (Grunde, Li & Meri, 2014; Hoalst-Pullen, Patterson, Mattord & Vest, 2014), beer tourism (Alonso, 2011; Bujdoso & Szucs, 2012a, 2012b; Munar, 2012; Murray & Kline, 2015; Plummer, Telfer, Hashimoto & Summers, 2005; Rogerson & Collins, 2015a, 2015b, 2015c; Rogerson, 2016; Slocum, 2016; Spracklen, Laurencic & Kenyon, 2013), and a complex array of issues around place-making, consumption and identities (Eberts, 2014; Flack, 1997; Fletchall, 2016; Holtkamp, Shelyton, Daly, Hiner, & Hagelman III, 2016; Mathews & Paton, 2016; Schnell & Reese, 2003; Shears, 2014).

Globalization and neolocalism

The march of globalization has been accompanied by the homogenization of products and services (Schnell, 2013). The homogenization of consumption has been driven by multinational brands which have significantly changed how the majority of individuals purchase different goods and services (Scholte, 2008). What Marsella (2005) styles as “hegemonic” globalization only engages minimally the participation and decisions of local populations and instead is driven by mass advertising which confuses consumer needs and wants as well as limits the range of offering in terms of product variety. As a consequence consumers are channelled to buy and prefer certain brands of products which are the outputs of the same multinational “hegemonic” companies many of which have factories throughout the world with the sale of products and services usually in accordance with prices set by global market forces (Marsella, 2005; Schnell, 2013).

In recent years product standardization and the unification of consumer behaviour trends through globalization has resulted in changing business landscapes. As stressed by Murray and O'Neill (2012, p. 900) “product differentiation and niche market segments are becoming increasingly important to today’s discerning consumer”. One global manifestation of this trend is the appearance of a surge in demand for craft-based products which is a wider movement in which people demand goods and services that have a connection with the ‘local’. Among others, Goodman, du Puis and Goodman (2011), Jordan (2007, 2015, 2016), Murray and O'Neill (2012) and Schnell (2007, 2011) all draw our attention to global manifestations of this phenomenon in, for example, the growth of alternative food networks, boutique wineries and the rising demand for gourmet coffees, artisan cheese making, humanely raised and slaughtered meat and poultry, artisan bakeries and bread products or the mounting interest in heirloom seed stock produce. At the broadest level of interpretation the international growth of craft beer must be interpreted as another facet of the emergence and strengthening of a so-called “counter-movement” to globalization which emphasizes the importance and vitality of artisanal production and local connections. It is argued in the experience of the USA that local communities have begun to recognize how the essential parts that make their community unique and authentic are disappearing through the expansion of multinational brands such as ‘Walmart’ which is described as being the “poster child for destruction of local economies” (Schnell, 2013, p. 73).

The term neo-localism is applied widely now to describe this phenomenon (Schnell & Reese, 2003). For Brain (2011, p. 9) the concept of neo-localism “represents a lens for discussing the ways in which individuals experience the impacts of globalization”. Although there are different claimants to the term often the origins of neo-localism are attributed to Shortridge (1996, p. 10) who described it as the “the deliberate seeking out of regional lore and local attachment by residents within a community”. The resurgence of ‘local identity’ as a concept can be attributed also to the works produced by several cultural geographers (de Wit, 2013; Flack, 1997; Schnell, 2011, 2013; Schnell & Reese, 2003). Flack (1997) views it essentially as referring to a movement of people to rejuvenate and preserve the local, unique, quality, and personal aspects commonly associated with their local communities. Schnell (2013) forwards that the foundations of neo-localism can be associated with different ways in which the term “local” is perceived as well as understood by participants through several interconnected neo-local movements. Schnell (2013) describes the trend towards individuals and communities becoming more engaged with this so-called counter-movement as predominantly because the term ‘local’ is essentially perceived “as a primary form of identity, and the promotion of people thinking of themselves not only in the sense of abstract symbols, but also in terms of what they buy, what they eat, whom they interact with, and identifying not only with their own places, but with the idea of place itself” (Schnell, 2013, p. 82).

Accordingly, there has been considerable growth and support for development of this alternative neo-local counter-movement. It is observed that throughout most of history people have practiced cultural norms and followed local traditions which were effectively achieved by living in ‘local communities’. Hence they were accustomed to eating locally produced foods only within close proximity of their household residence (Schnell, 2013, p. 56). It was only through various processes associated with globalization including improved communications and more sophisticated travel technologies that the ‘sense of place’ attached to certain localities began progressively to be eroded (Schnell & Reese, 2003). The concept of neo-localism is distinguished

therefore from that of the older form of 'localism' by being the outcome of consumer free will and conscious choice. Indeed, neo-localism as a manifestation of an old form of localism is also noticeably different in the context of being aware of the rest of the world, and thus open to interactions with it, whereas the old localism tended to minimize outside links and preference strong closed 'local' boundaries (Bramanti, 1999, p. 18).

To a certain degree neo-localism is understood as a revived concept which embodies creativity, resourcefulness and ingenuity but simultaneously possesses a defensive nature. In some recent studies one of the most distinct themes reflected in neo-localism writings is the re-evaluation of the 'local'. For Dillivan (2012) neolocalism is a relatively new social awareness movement and simultaneously regarded as an attempt to go back to original roots by rejuvenating local economic, social, and cultural practices as entrenched in past traditions and moral values. Schnell (2013) suggests that the foundation of neo-localism link to the different ways in which the term "local" is perceived as well as understood by participants through several interconnected neo-local movements. Arguably, it is stressed that "local is always shifting its meanings, both in time and in context" (Schnell, 2013, p. 65). Moreover, the term "local" is constantly being scrutinized, and imbued with a variety of connotations based on contemporary world affairs (Schnell, 2013, p. 65). Currently, the rise of alternative food networks (AFN's) is the most visible expression of neo-localism (Goodman et al. 2011). But, neo-localism finds expression also in the exceptional growth of local food networks such as community-supported agriculture, farmers markets and farm-to-school programmes as well as locally-based music festivals, support for locally-owned businesses, and enforcement of restrictions on the amount of high-end transnational retail companies which can be located within particular localities. Overall, in the neo-local movement it is contended that individuals and communities long for something in their localities to attach themselves in order to cultivate or enhance local identities.

Craft beer as expression of neo-localism

Over the past 30 years there has appeared an international trend for an increase in the production and consumption of craft beer. For example, in the USA in 1966 there was only one craft brewery whereas currently it is estimated that the number might be more than 2000 (Herrera, 2016; Reid et al. 2014). In particular, it is observed that a surge of craft micro-brewery establishments occurred after 1978 with a 'Beer Renaissance'. Correspondingly, as an increasing number of craft breweries began operations, "a craft beer culture began to emerge" (Chapman, 2015; Duggan, 2015). Weiler (2000, p. 171) describes the period of the 1980s as witnessing "a veritable explosion in craft brewing". According to Herrera (2016, p. 13) there are several underpinnings of this cultural shift in US beer consumption. Changes in consumer preferences are accounted for variously by certain groups (such as hipsters) opting not to support beer conglomerates, the growth of word-of-mouth recommendations, increased disposable incomes and higher education levels which encouraged a preference for variety and quality over homogeneity and quantity (Herrera, 2016). The dominance of increasingly standardized lager and light beers produced by a small cohort of macrobreweries triggered a counter movement in beer consumption. According to Dillivan (2012) this reaction against industry consolidation and lack of variety started in the USA during the 1980s as consumers began to show a renewed interest in 'older' European beer styles, such as porter, pale ales and brown cask ales, stout and bitters.

Arguably, therefore the USA offers a classic case of the craft beer movement being a reaction to the "the homogenous, bland-tasting beer" produced by mass or macro-brewers (Choi and Stack, 2005: 79). It is argued many consumers perceive craft beer culture "as being unique and authentic in opposition to commercialized mass-produced beer" (Munar, 2012, p. 7). Overall, the switch of US consumers to craft beers and away from imbibing mass-produced light, tasteless and uniform lagers was the stimulus for the expansion of the craft beer industry. This phenomenon is summarised by Herrera (2016, p. 14) as follows: "People gravitate towards craft beers over American lagers due to a number of reasons, including: small breweries ability to deliver high quality products, a preference of products brewed through traditional methods, a form of self-expression in choosing unique products from the 'coolest' breweries with even more unique names like 'Hoppy Ending Pale Ale' or 'Board of Zeus', and expressing expert knowledge in the form of acting as a 'beer connoisseur'". Some observers argue a cultural case that craft beer producers 'Cool Mobilise' around a hot cause, namely the blandness of mass produced beer (Withers, 2017). The consumer choice of craft beer thus becomes almost an act of resistance as well as a means of distinction and personal taste choice to combat product boredom due to market homogeneity.

Overall the burgeoning of craft breweries is inseparable from the evolution of a business model that involved differentiating themselves from macro-brewers (Herrera, 2016). For Duggan (2015, p. 4) this includes an emphasis upon the 'authenticity' of craft beer products and a propensity for constant innovation, the development of new beer styles often with no precedent, and importantly an effort to connect with customers through distinctive and individualistic business approaches. In USA the adoption of 'sustainable' business practices is part of the craft brewing culture as a whole and how micro-brewers distinguish themselves from larger macro-beer producers (Withers, 2017). Craft breweries exemplify one of many ways that communities reaffirm local identities in the wake of the impacts of globalisation on homogenising tastes and products (Flack 2007; Schnell

& Reese 2003, 2014). In American research it has been disclosed that craft microbreweries refract neolocalism in the marketing of their products variously through using local place names, people, events, landscape features and icons on their labelling and in the names of their beers to establish associations with the local environment and culture (Fletcher, 2016). In addition, as shown recently by Mathews and Patton (2016) this can include also references to ethnic ties such as Scots-Irish in Appalachia or Mexican/Latino cultural heritage in the Southwest.

Neolocalism is thus a critical concept invoked to account for the international growth of the craft beer industry. Holtkamp et al. (2016, p. 66) view it “a conscious effort by businesses to foster a sense of place based on attributes of their community”. This reconnection occurs through processes wherein craft breweries concentrate efforts upon ‘the local’ by utilizing the naming and labelling of their beers to create a sense of place and strengthen ties with local communities (McLoughlin et al., 2014, p. 137). Indeed, Schnell and Reese (2003, 2014) state explicitly that neolocalism is evidenced in the active, conscious and maintenance of attachment to place. In addition, Eberts (2014, p. 176) points out that because brewers usually must draw their key raw ingredients, such as barley and especially hops, from a variety of non-local sources necessarily they rely on evoking localness primarily through “the art of brewing itself and the narratives of place they employ in their marketing”.

Overall, it must be understood that the craft beer movement in the United States is not an isolated phenomenon. Craft breweries are rapidly expanding also in the United Kingdom, across much of Europe, Australia, New Zealand, parts of Asia and most recently in South Africa. The growth of craft microbreweries provides an example of attachment to place as a refraction of the neo-localism movement. Among others Flack (1997) and Schnell and Rees (2003, 2014) contend the global craft micro-brewing phenomenon is anchored upon strong attachments between beer and localities. Much of the growing volume of international scholarship on craft beer unpacks how a locality/region shapes a product and how that product in turn shapes local settings pointing out that the production of craft beer is dependent in part on ingredients but more particularly “on the brewers and localism of beer styles” (Patterson & Hoalst Pullen, 2014, p. 1). According to Dillivan (2012) as the neo-localism movement strengthens so does the potential interest in purchasing local beers and of visits to local microbreweries. For Schnell and Reese (2003, p. 46) craft breweries signify a partial response to the “smothering homogeneity of popular national culture” and a corresponding desire to “re-establish connections with local communities, settings and economies”. Issues relating to consumers brand loyalty for craft breweries recently have been interrogated in North Carolina by Murray and Kilne (2015) who reveal that connections with the community are the most important factor influencing brand loyalty amongst local residents.

A conclusion that is an introduction

In common with observed trends in North America, Europe and Australia, there has appeared a craft beer sector of microbreweries in South Africa (Rogerson, 2016), which is a forerunner for similar growth occurring in other parts of Africa (Zalkind, 2014). This paper has sought to contextualise the establishment of the craft beer industry in South Africa as part of wider international trends. It is argued that following global trends and triggered by the enormous consolidation of (now) SABMiller with its production of increasingly standardized lager and light beers, there has emerged a counter-movement in the country’s beer industry which resembles trends in other parts of the world. Specifically, there has occurred a reaction against consolidation and lack of variety offered to local consumers which has resulted in consumer interest in ‘older’ beer styles, such as pale ales, porter, brown cask ales, stout and bitters (Corne and Reyneke 2013). The pathways to reindustrialisation in South Africa will be diverse and in the case of the country’s beer industry neolocalism is of crucial significance as an explanatory lens.

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RE-ENERGISING BUSINESS INCUBATION POLICY IN SOUTH AFRICA: LEARNING FROM INTERNATIONAL EXPERIENCE

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Abstract: South Africa's Department of Small Business Development recognises the need to develop a new policy framework for re-energising and repositioning business incubators to meet critical challenges for national development. Policy development can usefully be informed by the international experience of business incubation. This paper examines 'best policy' practices for incubation across four critical sectoral issues, namely (1) agribusiness, (2) gender, (3) climate change, and (4) culture, creativity and tourism. The outputs provide a set of 'best practice' benchmarks and a base for informing the establishment of a new policy framework.

Introduction

One of the most enduring policy commitments of national government in South Africa since the 1994 democratic change has been support for development of the small, medium and micro-enterprise (SMME) economy. Despite government commitments and increased support for the sector South African SMMEs have not reached their intended impact, anticipated or desired by policymakers (Rogerson, 2004). The South African SMME economy continues to experience high mortality rates with SMMEs failing to grow sufficiently to create the expected employment opportunities. Against this background South Africa has introduced a number of initiatives to strengthen the SMME economy through the enactment of business incubators (SEDA, 2015). In common with the international experience South Africa, through the Department of Trade and Industry (DTI), has identified business incubation as a viable tool to help SMMEs grow and become successful (DTI, 2013). The workings of these business incubation programmes have been examined and critiqued in a series of studies (Lose & Tengbeh, 2015; Masutha & Rogerson 2014a, 2014b, 2015; Sandheep & Thomas, 2011). The lead actor for galvanizing business incubation is now the Small Enterprise Development Agency (SEDA) which is starting to develop a new National Incubation Policy for the support of business incubation in the country. In addressing that objective South Africa can usefully learn lessons from a review of international experience.

The aim in this paper is to present certain findings from an international policy review of sectoral initiatives around business incubation and thereby provide 'best practice' benchmarks for situating South African policy and practices. The analysis draws from the findings of academic investigations as well as from the international policy inputs provided from the Information for Development Programme, which aims to assist in developing policy frameworks and implementation strategies for business incubators (InfoDev, 2010a, 2010b, 2010c, 2010d, 2010e, 2011a, 2011b, 2014, 2016).

Learning from international experience

A recent overview of international business incubator research pointed out "research on business incubators is broad in scope, heterogeneous, contradictory, and largely inconclusive" (Albert-Morant & Ribiero-Soriano, 2015, p. 2). In examining best practice for a national incubation policy for South Africa a desk-top analysis was undertaken of four vital sectoral issues around business incubation. Specifically, attention focuses on several important sectoral issues in respect of business incubation, namely climate change and innovation centres; gender and business incubators; culture, creativity and tourism; and, agribusiness incubators as potential drivers for rural development and change.

Climate innovation centres

In response to global climate change several countries are reorienting their economies towards a pathway of low-carbon, green growth paths through the deployment and diffusion of new technologies for climate change adaptation. Over the past few years there has emerged a special form of business incubator which is targeted to accelerate the development, deployment and transfer of locally relevant climate technologies (Climate Innovation Centre, South Africa, 2016a; InfoDev, 2010f). Under the Climate Technology Programme (CTP) which links to InfoDev and the World Bank climate challenges are to be reconfigured into growth opportunities for dynamic small and medium enterprises. With CTP support SMEs can assist in emissions reduction and enhance climate resiliency whilst at the same time enable developing countries to capture greater value in the innovation value chain, build competitive sectors, competitive enterprises and nurture new sources for job creation.

Climate change is framed as an economic opportunity rather than an inevitable threat with the opportunity for new innovation and investment in clean technologies which can assist in strengthening local economies, reduce climate risk as well as to

advance Sustainable Development Goals. For example, in the case of Kenya 80 percent of the country's population is currently not served by the electricity grid and thus constitutes a large potential market opportunity for innovative clean-tech solutions (InfoDev, 2010f). In Kenya local entrepreneurs are being encouraged to respond to these challenges and opportunities by launching new innovative wind and solar technologies that not only foster employment opportunities but also offer viable off-grid solutions to the country's most marginalized poor communities (InfoDev, 2015). For other parts of the global South climate smart agriculture is another critical sector where clean technologies, including new climate-resilient crops and the making of highly efficient irrigation systems, can contribute to enterprise development, agricultural expansion, and climate change adaptation.

Under the auspices of the Information for Development the flagship activity is the design, implementation and roll out of a network of Climate Innovation Centres. The CICs are described as "entrepreneur and new venture support facilities tailor-made to respond to a country's development challenges" by providing "holistic support that goes beyond traditional incubation". At these CICs the emphasis is upon targeted support through business incubators to assist clean tech entrepreneurs launch new businesses, create employment opportunities and furnish disadvantaged communities with cleaner energy, water, food and air whilst reducing consumption of natural resources. Elements of the basket of targeted support can encompass seed-financing, specialized policy interventions, specific network linkages as well as technical facilities and business training. It is argued that such policy interventions can effectively harness "economic opportunities in developing countries through entrepreneurship and small and medium enterprise (SME) development in the climate technology sector". Climate change targets for emissions reduction can be addressed in part by helping local SMEs to commercialize and scale innovative private sector solutions to climate change.

The focus by InfoDev for these CICs is across a number of countries in the global South and currently seven CICs are currently active or planned. These locations include the Caribbean, Kenya, Ethiopia, Ghana, Morocco, Vietnam and South Africa. The CICs as locally-owned institutions are to drive innovation by evolving new models for countries in the global South to participate more effectively in clean technology sectors. These CICs are to provide a suite of services to local clean technology SMEs and climate innovators by offering also:

- Business advisory services and training to build local capacity;
- Seed financing to bridge funding gaps; and
- Policy support to promote more effective policies and sector regulations.

Overall, according to the Business Plan for the Kenya Climate Innovation Centre:

In addition to supporting promising new technologies and ventures, these centres also could provide access to finance, access to equipment and facilities, market information, policy advocacy, technical assistance, and facilitate national and international collaboration. In this way, a center acts as a national focal point, or 'one-stop-shop' to aggregate efforts in promoting the growth of locally relevant, indigenous climate innovations and to facilitate cross-border technology collaboration (InfoDev, 2010f, p. 12).

Since its foundation in 2012 Kenya's CIC has been described as one of Africa's leading edge business incubators and aims to catalyse a wave of new clean technology innovation in the country (InfoDev, 2015). Further, it seeks to galvanize new private sector-led solutions to clean-tech growth and contribute to sustainable development objectives (World Bank, 2014). The Climate Innovation Centre in South Africa (CICSA) is a strategic Green Economy Initiative of the Innovation Hub, which is a subsidiary and established by the Gauteng Provincial Government through its Department of Economic Development (InfoDev and the Innovation Hub, 2012). The CICSA is described as "a technology and business incubator dedicated to supporting South African start-ups and small businesses operating in the green economy space by offering them access to finance, technical and business advisory facilities, information and markets" (Climate Innovation Centre South Africa, 2016a). Through its endeavours it is anticipated that South African clean-tech entrepreneurs can be enabled to "profitably develop, commercialize and scale-up their innovative clean technology ideas and concepts, creating jobs and accelerating a greener and more inclusive economic development in the process" (Clean Innovation Centre South Africa, 2016a). At its launch in March 2015 McLean Sibanda from the Innovation Hub highlighted the imperative to address South Africa's pressing environmental concerns of energy, water and waste management, and that one of the centre's core priorities was improvement in the quality of life for township residents in Gauteng (Jeffrey, 2015). It is stressed that CICSA will afford climate technology SMEs with access to highly flexible, stage appropriate risk capital at all stages of innovation albeit with resources concentrated in the early growth stage through grant, seed and scale-up financing (Clean Innovation Centre South Africa, 2016b). This said, it is acknowledged

that CICSA must “strike a balance between social inclusion, policy alignment, environmental impact and economic benefit” (Clean Innovation Centre South Africa, 2016b).

Gender and business incubators

There is growing international recognition that women entrepreneurs have specific issues, needs and challenges which demand “a gender analysis in order to better understand their needs and motivations and fully utilize their potential” (InfoDev International Women Working Group, 2010, p. 4). It can be argued that a case exists for establishing dedicated business incubators for women start-up entrepreneurs as part of augmenting the supply of services to women entrepreneurs as a whole and for a strengthening of regional and global networks in order to better support women business incubation and entrepreneurship.

Many observers maintain that women business incubation represents a tool to forge sustainable businesses through mentoring and continued support to women which goes beyond the usual business incubation activities of the provision of space, services and training. It is considered further that women business incubation is a vehicle for generating strong networks among women entrepreneurs as “when they are among themselves, women entrepreneurs feel more comfortable and confident they become more open and willing to share knowledge and experience” (InfoDev International Women Working Group, 2010, p. 10). Overall, whilst it is acknowledged the tools pertaining to women business incubator programmes are little different from those already applied in business incubation “the general approach needs to be different for (potential) women entrepreneurs” more especially in male-dominated societies in which restrictions may be imposed on women’s activities (InfoDev International Women Working Group, 2010, p. 10). As a consequence, in several countries there have been movements for the establishment of either ‘stand alone’ women incubators or as a specialised track within existing incubator needs. In particular, in parts of Asia – South Korea is a leader - a momentum exists for women business incubators. In India good incubation practice either is to target women graduates or to promote women’s businesses as “a family business”.

Across sub-Saharan Africa the proportion of dedicated business incubators for women is estimated as around 1 percent of the existing cohort notwithstanding the fact that women entrepreneurs across the region encounter specific barriers to business development. Indeed, it is evident that the number of women business incubators in the global South is still very limited particularly as compared to the extent of involvement of women entrepreneurs in national economies. One partial explanation for the underdevelopment of women business incubators relates to the focus in many countries (such as China, Malaysia, Japan) upon technology-based enterprises which are not the general sector focus of women entrepreneurs. Nevertheless, it remains that the specific needs of women entrepreneurs often are either not well understood or are ignored by policy makers. This occurs as a result frequently of an environment in which little awareness or knowledge exists about women business incubation or women’s entrepreneurship. The case for women-dedicated incubators derives from the argument that women do not enjoy the same opportunities as men in many societies. More specifically, it is maintained as follows:

Women business incubation is needed because women have different demands , they also have different priorities and motivation when starting or conducting their business. Women need specific networks and/or need to be introduced to existing networks; they prefer being mentored by women, in addition their triple work burden (home, family, business) don’t allow them to work on ordinary schedule, consequently they will need different services (InfoDev International Women Working Group, 2010, p. 11).

In such circumstances the business incubators can serve as “an oasis of cultural safety” for women entrepreneurs in wider business environments where their entrepreneurship might not be encouraged. Among international development agencies and donor organisations there is growing consensus that because of cultural barriers and lack of knowledge about gender specific issues women entrepreneurs receive insufficient support from entrepreneurship programmes. This leads to the following recommendations:

- Governments in the global South should explore the potential for creating gender-based business incubators to facilitate the start-up and graduation of women-owned businesses.
- Incubation management training courses should incorporate gender issues and introduce specific training modules for women entrepreneurs.
- National, regional (or global) mentoring systems should be facilitated for women entrepreneurs (InfoDev International Women Working Group, 2010, p. 50).

Culture, creativity and tourism

In Brazil and a small number of other countries it was observed that there is a trend towards going beyond the conventional manufacturing or high technology focus that globally dominates business incubation programmes. Instead, there is a mounting recognition of the potential for establishing business incubators that are associated with innovation occurring in service sector activities. Service sector activities are regarded as central to knowledge-based economies. In recent decades, services have contributed substantially to value-added in advanced economies, up to 80% in some cases (Gallouj & Djellal, 2010). Traditionally, however, innovation has been associated with manufacturing activities, while services were assumed to be innovation laggards, technologically backward, or non-productive (Fagerberg, 2013). Indeed, as compared to the sector of manufacturing in which radical innovations are vital to enterprise competitiveness, innovations in services are often viewed as “secondary and capital-scarce” which results in them being often excluded from the scope of government interest and policy intervention (Decelle, 2006).

In recent years this somewhat negative view of the role of innovation in services has been tempered by the appearance of a growing stream of research which demonstrates the widespread occurrence of innovation and creativity in service enterprises. It is argued that whilst innovation in services is mostly non-technological, there is mounting evidence also of technological and intensive innovation in services (Gallouj & Djellal, 2010) as service sectors are becoming more knowledge-, capital- and technology-intensive. The innovation potential of knowledge-intensive services linked to ICTs, has received considerable recognition. It is against this backdrop of acknowledgement of the importance of innovation in services and correspondingly of the rising significance of services in national economies that some attention is being given to the potential of establishing service sector business incubators. The two service sectors that have garnered most attention are those of cultural/creative industries and tourism.

The category of cultural incubator has been acknowledged by InfoDev (2016, p. 3) as one of a range of different foci for incubators and correspondingly to determine the structure and types of services that would be appropriately offered. Nevertheless, the domain of business incubation has largely existed in relation to high-tech industries. Indeed, it has been argued that “a significant gap in the application of the incubation model to industries other than the high tech is evident” (Serup & Moscovis, 2012, p. 6). Over the past two decades creative industries have been seen as a lever for economic growth in the knowledge economy and a vital catalyst for urban economic growth and regeneration (Flew, 2013; Flew & Cunningham, 2010). In the international setting creativity is “the new gold of the global economy” and touted as the fuel of the modern global economy (Gibson, 2014). As one observer states: “Much of the excitement surrounding the creative industries is to be found in their potential to diversify economies and enable countries to leapfrog into a dynamic sector of the global economy” (Visser, 2014, p. 16).

It is against this backdrop that the relevance of innovating different forms of business incubator in relation to the specific requirements of creative entrepreneurs must be acknowledged. In recent works the differential characteristics between cultural industries and high-tech industries are recognised as the basis of reconfiguring an alternative business incubation approach to account for these issues and that might be applied to the start-up and growth phase of SMEs engaged in cultural/creative industries. Based upon the experience of Denmark the work of Serup and Muscovis (2012) offers the beginning of a best practice for operationalising business incubators for the creative economy. It is stressed that whilst there are some similarities between creative industries and high tech in terms of demand uncertainty, short product cycle and the necessity for innovation and creative inspiration there remain fundamental differences. Among key observed differences are the following:

- The driver for high tech is scientific innovation, for creative industries it is creative expression.
- The process of enterprise development in high tech is linear and methodical whereas for creative industries it is non-linear and inspiration driven.
- High tech SMEs are highly regulated and rigid whereas flexibility is the norm for creative industries.
- In terms of networking creative industries are denoted by what is termed a dense network of weak ties which impacts how creatives operate in terms of business collaboration.
- Locationally, creative industries are highly distinctive in terms of preferring their businesses in urban centres and often gentrified urban spaces where a combination of cheap rent, ‘cool location’ and a gathering of large numbers of young people serves as a hotbed for creative entrepreneurs.

- An important requirement is for a holistic work environment (often 24/7 operations) and flexible work space which relates to contracting and freelance nature of much business undertaken by creative enterprises (Serup & Moscovis, 2012).

Overall, the international direction is towards reconfiguring the traditional business incubator model to incorporate the specificities of creative industry entrepreneurs. In a similar fashion there is a parallel movement towards considering the specific needs of tourism businesses. This is driven by the vital importance of tourism as a sectoral driver in the global economy and particularly for certain countries and regions where deindustrialization has witnessed a shift towards post-productivist economies in which tourism plays a major role. At present the sophistication of debates around tourism business incubators is not as advanced as that for cultural/creative industries incubators. Nevertheless there is a growing interest in the potential of using business incubators to give momentum to tourism-led development in certain countries.

It is argued by some observers that incubators may be applied as a tool for tourism business development both in cities and in peripheral poorer regions where the tourism sector may be the key lead sector. In cities the best practice for tourism business incubators is currently that of the Welcome City Lab which is situated in Paris. The 1000sq metre site includes an open plan space for collaboration and conference rooms for the 30 selected incubatee entrepreneurs. In addition the start-ups enjoy the use of an experimentation area and a monitoring unit, once again unique features of a dedicated tourism business incubator (French Ministry of Foreign Affairs & International Development, 2016). In peripheral areas the business incubator can assume a significant role in enabling entrepreneurship in the communities they serve. Indeed, it is stressed that the “business incubator can be used for various objectives within the tourism sector, shaping it in a different way to support the specific needs of a region, branch (of tourism) or even entrepreneurship category” (Schiopu, Vasile & Tuclea, 2015, p. 480). The potential use of virtual as opposed to residential incubators for tourism development in peripheral regions is highlighted as potential good practice (Schiopu et al., 2015). As yet, tourism business incubators are a phenomenon of the global North and despite the critical importance of tourism for economies in the global South no examples are evident of tourism business incubators in this part of the world.

Agribusiness incubators

For countries of the global South one special form of business incubator that demands a strong focus is that of the agribusiness incubator. The significance of such kinds of business incubator is underscored by the observation in the 2008 World Development Report that “the potential of agricultural growth to reduce poverty is four times greater than the potential growth from other sectors”.

A major international review conducted for the World Bank supported the viewpoint that “agribusiness incubators provide a useful approach toward commercialization and modernization of agriculture and the development of an indigenous agribusiness sector in developing countries” (InfoDev, 2011a, p. 49). More specifically, it was concluded that agribusiness incubation must be viewed as a *complement* to three other approaches which have been used to achieve these goals, namely (1) the strengthening of farm organizations, (2) the promotion of large-scale agribusiness investment, and (3) value chain development in agriculture. It is stressed that the making of a competitive local agribusiness sector “requires an effective innovation and entrepreneurship ecosystem that enables the start-up and growth of innovative enterprises” (InfoDev, 2011a, p. 1). Moreover, it is contended from a review of 10 countries experience of agribusiness incubators that they can be vital change agents in the innovation and entrepreneurship system.

As with the case of creative industries or dedicated tourism business incubators, in the planning for agribusiness incubators good practice requires that the specificities of the sector must be taken into consideration. Arguably, the agricultural sector has distinct features that pose particular challenges for business incubator development. Regardless of sector, all innovative early stage entrepreneurs confront both technological and market-related risks. Nevertheless for agriculture and agribusinesses these also confront specific challenges in respect of biological risks (crop disease, insects), weather related risks (drought, climate change and global warming) and commodity price volatility. Furthermore, geography is an important consideration as agribusinesses usually operate in peripheral, sometimes remote regions, which are characterized by underdeveloped or limited infrastructure and skills bases. It is argued therefore that in order to be effective development vehicles “business incubation applied to agribusiness must therefore adapt to these particular circumstances” (InfoDev, 2011a, p. 1).

The international record of the practice of agribusiness incubators suggests that they are promising, if not even increasingly essential, components for agricultural progress in the global South, including South Africa (InfoDev, 2014b). A review of global experience points to the important conclusion that the majority of agribusiness incubators “have been successful in creating sustainable and competitive enterprises that outweigh the cost, while diffusing a number of technologies as well as

product and process innovations” (InfoDev, 2011a, p. 3). Often agribusiness incubators emerge and are structured as public-private partnership arrangements. This said, agribusiness incubators are not an homogeneous phenomenon. Three major sub-groups of agribusiness incubators are differentiated from international experience:

- Agribusiness sector/value chain incubators;
- Agricultural research commercialization incubators; and
- Technology transfer agricultural incubators.

It must be understood that within each of these three different sub-groups of agribusiness incubators that significant variations may occur in respect of the forms of public-private partnerships, affiliations, target clientele, business models and organisational design (InfoDev, 2011a).

Overall, six critical ingredients are identified that underpin successful agribusiness incubators operating in countries of the global South. These pertain to the ability or capacity of the agribusiness incubator to do the following:

- Assist entrepreneurs to manage the risks involved through a blend of technology, institutional and networking strategies;
- Understand the functioning of the value chain in which agribusinesses are inserted and assist enterprises with positioning by linking together farmers and enterprises in order to meet consumer demands for stable, quality and affordable products.
- To identify and demonstrate innovative business projects in agriculture/agribusiness and to energise take-up of these innovative ideas.
- To adapt the focus of the business incubator to particular market opportunities and failures.
- To have a pro-active business orientation in searching out market opportunities.
- To embed incubation design essentials such as leadership with a business mindset, excellent knowledge of agriculture and learning skills (InfoDev, 2011a).

In final analysis it is stressed from the international experience that agribusiness incubators must be viewed as part of broader packages of strategic policy interventions for agricultural and rural improvement. They cannot be stand alone interventions and viewed as a panacea or magic wands for addressing rural underdevelopment and poverty. Instead, agribusiness incubators – if they are to be successful – must be integrated with other interventions to assist agricultural improvement such as assistance to farmer organisational development, improving the business environment as a whole, the promotion of rural innovations and technology, and initiatives for value chain development (InfoDev, 2011a).

Conclusion

Although progress has been made in the appearance of different incubator models further diversification is needed in the range of business incubators that have received support. The need exists to shift the narrative and policy attention beyond only associating incubators with agriculture and manufacturing. Instead, the policy should recognise innovation occurring in the service sectors and incorporate business incubators for service sector enterprises. With the rise of tourism and creative industries in the South African economy these non-traditional sectors for business incubation intervention need to be further explored. With the critical problems of rural poverty in South Africa an essential need is for further innovation and experimentation in relation to agriculture and agribusiness incubation projects. An investigation should be undertaken of the case for developing a dedicated network of women-only incubators especially outside of the country’s major metropolitan areas. Added experimentation in business incubation can occur around climate adaptation and resilience with the imperative for new innovative solutions to the country’s need for low-carbon, green growth paths. The activities of the existing Climate Innovation Centre should be highlighted for awareness-raising with the possibility of encouraging a parallel CIC which would be devoted to addressing specifically rural interventions around locally relevant climate technologies.

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TRACKING THE POLICY ENVIRONMENT FOR CREATIVE INDUSTRIES IN SOUTH AFRICA

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Abstract: Since the late 1990s creative industries have enjoyed increased international scholarly and policy recognition. The policies linked to creative industries underscore the importance of the creative economy for urban economic growth and broadening of the knowledge-based economy. Despite global recognition of creative industries in Africa debates and research outputs are limited. The exceptional case is South Africa where government has recognised the importance of creative industries as a tool for economic growth and development. This paper tracks academic debates and the shifting policy environment for creative industries in South Africa and adds to the limited scholarly and policy discourse available on this topic in the local context.

Introduction

The relevance and economic importance of creative industries is on the rise worldwide (Garnham, 2005; Hartley, Wen & Li, 2015; Hesmonhalgh, 2013; Jones, Lorenzen & Sapsed, 2015; Kong, 2014; Marco-Serrano, Rausell-Koster & Abeledo-Sanchis, 2014). The past two decades have witnessed a marked surge in international academic and policy discourse on creative industries (Boix, Hervás-Oliver & De Miguel-Molina, 2015; Cunningham & Potts, 2015; Jones et al., 2015; Kong, 2014; Lampel & Germain, 2016; Long & Morpeth, 2016; Tremblay, 2015). It has been argued that creativity variously can be described now as “the new gold” or “fuel” of the global economy (Flew, 2014; Gibson, 2014). As argued by Lampel and Germain (2016) firms and governments increasingly view creative industries as pioneers of innovation and experimentation. Visser (2014, p. 16) states that: “Much of the excitement surrounding the creative industries is to be found in their potential to diversify economies and enable countries to leapfrog into a dynamic sector of the global economy”. Over the past two decades creative industries have been seen as a lever for economic growth in the knowledge economy and catalyst for urban economic growth and regeneration in many countries (Azevedo & Barbosa, 2015; Cruz & Teixeira, 2015; Flew, 2013; Flew & Cunningham, 2010; Francis, 2015). In particular, for cities and urban policy-makers creative industries are viewed as at the ‘cutting edge’ for economic development programming (Cunningham & Potts, 2015; Flew & Cunningham, 2010; Scott, 2004; Weiping, 2005).

Arguably, the term ‘creative industries’ began to appear in scholarly and policy discourse from the late 1990s. Of critical importance was the United Kingdom government’s acknowledgement of creative industries as central to the making of a post-industrial economy (Flew & Cunningham, 2010; Mommaas, 2009). The uptake of creative industries globally was given considerable impetus by the emergence and popularisation during the early 2000s of the concepts of the ‘creative city’ (Landry & Bianchini, 1995; Landry, 2000) and the ‘creative class’ (Florida, 2002, 2005). These studies together unleashed a wave of scholarly investigations around creative industries, urban development and policy formulation (Cunningham & Potts, 2015; Flew, 2010, 2013; Jones et al., 2015; Kong, 2014). In a recent analysis Sternberg (2016) maintains that creative industries have been highly popular with policy makers for leveraging economic development particularly especially since the advent of Florida’s (2002, 2005) works around the creative class. From the early 2000s the concept of creative industries diffused from Europe and North America and emerged also on the national policy agendas of several countries in the Asia-Pacific region including Australia, New Zealand, Singapore, South Korea and China (Banks & O’Connor, 2009; Cunningham, 2009; Daniel, 2013, 2014; Flew & Cunningham, 2010; Kong, 2014; Pan, 2015).

In many respects the rapid international policy spread of creative industries might be viewed as another example of a ‘travelling’ concept (Baptista, 2013; Robinson, 2011). Its diffusion or travels to the global South and growing influence upon urban development policies perhaps was inevitable especially as its spread has been assisted by support given from several United Nations agencies (Sternberg, 2016). In particular the UNCTAD (2008, 2010, 2013) has become an enthusiastic supporter of creative industries as a new engine of growth in developing countries (Flew & Cunningham, 2010; Flew, 2013). In addition UNESCO has also endorsed strongly a role for creativity and creative industries in development programming for the global South (Sternberg, 2016). The UNCTAD (2010) suggests that creative industries are a feasible development option for the global South since they are potential drivers of job creation, innovation and social inclusion, and expected to diversify economies. Generally, policy makers in the global South associate creative industries with poverty alleviation, basic infrastructure development, the enhancement of social inclusion, and the promotion of cultural heritage and diversity.

Overall, it is made clear that policy discourses and the development of creative industries is uneven and differences are observed between the global North and South. In particular, Cunningham (2009, p. 376) emphasizes that the policy take-up of creative industries outside the global North “has been more tentative and exploratory, allowing for more regional variations and adaptive to local circumstances”. In the global North there is a movement towards taking creative industries beyond the traditional culture and media sectors to encompass new media and digital content. By contrast, in the global South creative industries are often viewed as leverage to support the development of basic infrastructure (Cunningham, 2009). It is against this backdrop of divergent policy pathways surrounding creative industries that the article tracks the development of the policy environment for creative industries in South Africa. The policy review is prefaced by an examination of the so far limited research around creative industries in the South African context. Overall, this paper aims to broaden and deepen the existing academic and policy discourse on creative industries in South Africa in particular for economic geographers.

Creative industries in South Africa: What do we know?

According to Joffe and Newton (2012) creative industries in Africa as a whole have attracted limited scholarly and policy attention with the striking exception of South Africa where at all three levels of government – national, provincial and local – there is evidence of growing acknowledgement of the economic potential of creative industries. Nevertheless, despite policy recognition at a national, provincial and local level, there has been so far only a small amount of academic research undertaken on creative industries in the South African context. In one of the first academic investigations Rogerson (2006a, p. 6) noted “there exists little systemic published research on the organisation or workings of so-termed ‘creative-industries’ in South Africa”. Most of the earliest work on creative industries occurred through the findings of policy research studies and consulting reports many of which offer useful insights on the organisation and workings of creative industries. In terms of the different sub-sectors of creative industries, there have been a number of policy reports (supported by academic studies) which offer insight into their workings and challenges. Of special note is the release of the *Creative Industries Sector Report* (CISR) in 2008 commissioned by the National Department of Labour (2008) (Collins & Snowball, 2015). This particular study provides an in depth view on the composition, organisation and economic contribution of certain sub-segments of creative industries in South Africa as well as a breakdown on each of the various sub-sectors recognised in the country, viz., film, craft, music, performing arts, and visual arts.

From the limited material several debates can be distilled about creative industries in South Africa, which is referred to as a threshold country with an emerging economy (Booyens, 2012). According to Booyens (2012) most threshold countries focus on producing knowledge-intensive goods and services and follow knowledge-based economic strategies in order to catch up with the global North. This is evidenced in South Africa where national policies aim to transform the economy into a knowledge-based economy, including through the promotion of creativity and creative industries (Booyens, 2012). The beginnings of research on using creativity occurred in debates around ‘cultural industries’ with a landmark investigation appearing in 1998 with the publication of the *Creative South Africa: Strategy for realising the potential of the cultural industry* on behalf of the then national Department of Arts, Culture, Science and Technology. According to Booyens (2012) a strategic shift has occurred from cultural to creative industries over the past decade and a half with the introduction of a range of policy interventions and strategies. In common with policy foci within other countries of the global South (Sternberg, 2016), the promotion of creative industries in South Africa has been associated with various socio-economic objectives such as job creation, poverty alleviation and community participation; additional objectives include the enhancement of urban regeneration and cultural diversity (Booyens, 2012; Joffe & Newton, 2012; UNCTAD, 2010; 2013; Visser, 2014).

At the national scale Joffe and Newton (2012) highlight the existence of a number of impediments to the growth of creative enterprises in the country. It is difficult for local creative entrepreneurs to compete with internationally produced creative content. Compared to the international experience the creative workforce earns much less in South Africa and this reduces the capacity to create and innovate. In addition, there is observed a growing gap between a large number of graduates and limited job opportunities in the various creative industries sub-sectors. Further, for some creative enterprises, there is limitations in the size of the local market which is a consequence of a lack of investment in audience development. Overwhelmingly creative industries in South Africa are SMMEs. Because of the volatility surrounding creative industries there is also a lack of access to financial credit. The lack of coordination between various government departments and government agencies to support the creative industries is another impediment on their expansion (Collins & Snowball, 2015).

As observed above, national government’s recognition of cultural and creative industries can be attributed to the research produced by the Cultural Strategy Group and the Creative South Africa Initiative (Visser, 2014). In a comparative international review on policy development surrounding creative industries Cunningham (2009) highlights that South Africa places creative industries as an important sector of ‘medium term priority’ with two core foci, namely to support the film and television industry

and to develop synergies between crafts and tourism. This said, Rogerson (2006a) forwards that whilst creative industries have garnered a degree of policy recognition at a national level, limited progress has been made in terms of the actual implementation of government policy initiatives to directly support the growth of creative industries. Indeed, it is argued that since 2000 “the major policy innovations for supporting creative industries have been undertaken at provincial and local level as part of wider urban economic development initiatives. The City of Johannesburg must be acknowledged as particularly pro-active in this respect by according recognition and growing support to the creative industries sector” (Rogerson, 2006a, p. 162).

Notwithstanding the potential for creative industries to function as catalysts for creating employment, skills development and generating social capital and cohesion, often they are viewed as exacerbating socio-economic inequality (Booyens, 2012). According to Cunningham (2009) in the South African context, harnessing, increasing and supporting the full potential of the creative industries to objectives of shared economic growth and development, reducing poverty and unemployment, nation building and deepening democracy must involve acknowledging and addressing one of the ongoing legacies of apartheid so far insufficiently dealt with, namely that participation in South Africa’s creative industries continues to be the domain of the privileged white minority. Booyens (2012) recognises the potential of creative industries to enhance urban regeneration, economic development and job creation, but stresses that it can also lead to exacerbating existing inequalities and marginalise working class residents. Overall, it is stressed that the benefits of urban renewal associated with creative industries are viewed as not necessarily reaching out to poor communities.

Arguably, there is evidence of rising scholarly interest focused on issues pertaining to creative industries in South Africa, particularly in Cape Town (Booyens, 2012; Booyens & Rogerson, 2015) and Johannesburg (Gregory, 2016; Rogerson, 2006a, 2006b). Beyond the country’s major urban areas Ingle (2010) focuses on the socio-economic impacts of the creative class based in the rural arid Karoo region of South Africa and explores the implications of creative industries for local socio-economic upliftment. Collins and Snowball (2015) analyse the transformation, job creation and subsidies in place to support creative industries in South Africa, with particular focus on the film and television sector. Elsewhere Snowball (2016) draws attention to neglected employment and diversity issues in creative industries. In terms of macro-geography Evans (2009) identifies Cape Town, Johannesburg and Durban as the three creative city hubs in South Africa. This said, it is apparent that minimal research has gone into determining the size and scope of creative industries in these cities. Among the few exceptions are Dirsuweit’s (1999) exploratory analysis of culture and information-based sectors in the greater Johannesburg region, Rogerson (2006a) on linkages between creative industries and the urban tourism sector in Johannesburg, and Booyens and Rogerson (2015) on creative tourism developments in Cape Town. Certain other useful investigations on specific sub-sectors of the creative industries must be noted. In a rich contribution Visser (2014) investigates the film industry and assesses the impact on urban change, spatial distribution of the film industry and its relationship to other social geographies in Cape Town and Johannesburg. Booyens, Molotja and Phiri (2013) explore the new media sector in Cape Town, Rogerson (2006b) tracks the development of Johannesburg’s emerging fashion industry and Ndlovu (2011) investigates the potential of the craft sector to contribute to inner-city regeneration. Finally, in a recent publication Gregory (2016) explores the linkages between creative industries and urban regeneration in the Maboneng precinct, Johannesburg.

Strengthening the policy environment for creative industries in South Africa

Creative industries have received policy recognition at a national level in South Africa for two decades. The release of the *White Paper on Arts, Culture, and Heritage* in 1996 by the National Department of Arts, Culture, Science and Technology (DACST) represents the first policy instrument relating to cultural industries in South Africa (Booyens, 2012). Rogerson (2006a) states that the importance of cultural industries was highlighted in 1998 by the appearance of a series of reports produced by DACST on Creative South Africa (Department of Arts, Culture, Science and Technology, 1998a). The mission of the DACST was stated as “to realise the full potential of arts, culture, science and technology in social and economic development, nurture creativity and innovation, and promote the diverse heritage of our nation” (Republic of South Africa, 1996, p. 5). The latter underscores the value of culture to meet the government’s broader objectives of economic development and job creation. The 1996 White Paper identified the following issues to be addressed; transparent and catalytic mechanisms for distributing public funds; transformation of all arts and culture institutions and structures; focus on redistribution, redress and access; human resource development of practitioners; administration and education; integration of arts and culture into all aspects of socio-economic development; the rights and status of practitioners, and access to sources of funding (Republic of South Africa, 1996).

In terms of policy, national government sought to establish an ‘arm’s length’ relationship with key stakeholders involved in creative industries through the formation of statutory bodies such as the National Arts Council of South Africa (NAC) established in 1997. The NAC is a national agency mandated by the Department of Arts and Culture (DAC) with the responsibility for developing South Africa’s creative industries by awarding grants to individuals and organisations in the arts

(National Department of Labour, 2008; Republic of South Africa, 1996). By addressing the seven crucial issues listed above the *White Paper on Arts, Culture, and Heritage* sought to achieve the following; “the provision of infrastructure, human resource development, greater access to public funds to support the creation and dissemination of art, the development of markets and audiences, integration with the RDP, increased funding for the arts, culture and heritage, and securing the rights and status of artists, it will indeed be possible for everyone to freely participate in the cultural life of the community, and enjoy the arts” (Republic of South Africa, 1996, p. 31).

Following the release of the *White Paper on Arts, Culture and Heritage* in 1996 the Department of Arts, Culture, Science and Technology subsequently commissioned the *Cultural Industries Growth Strategy* (CIGS) in 1998. After acknowledging the economic potential of the cultural industries research was conducted in 1998 to compile detailed sectoral reports on four industry sectors (Department of Arts, Culture, Science and Technology, 1998a, 1998b). The final summary document that came from the study was ‘*Creative South Africa*’ (Department of Arts, Culture, Science and Technology, 1998a). Particular sectors identified for their potential to create employment opportunities in rural and urban areas as well as to enhance international competitiveness were the film and video sector, music sector, craft sector and the publishing sector (Department of Arts, Culture, Science and Technology, 1998a). It has been argued that the *Cultural Industries Growth Strategy* (Department of Arts, Culture, Science and Technology, 1998b) spawned awareness within both various government departments and the cultural industries of the economic significance and the potential for economic growth (Joffe & Newton, 2012). This strategy set ambitious targets and goals for the development of cultural industries. Further, it aimed at encouraging self-awareness within cultural industries. The core recommendation of the *Creative South Africa* (1998) report was to establish a Cultural Industry Development Agency (CIDA) geared towards developing and building up cultural industries. Nevertheless, this agency was never established which is an indication of the gap between policy formulation and implementation in South Africa (Department of Arts, Culture, Science and Technology, 1998a; Joffe & Newton, 2012).

According to Joffe and Newton (2012) despite the efforts of the *Cultural Industries Growth Strategy* (Department of Arts, Culture, Science and Technology, 1998b) it took at least a decade for the value of cultural industries to be fully recognised at national government level. This said, it must be acknowledged that the release of the *White Paper on Arts, Culture, and Heritage* (Republic of South Africa, 1996) and the *Cultural Industries Growth Strategy* (Department of Arts, Culture, Science and Technology, 1998b) did lead to the recognition and the formation of various industry and government-led initiatives to support and grow creative industries in South Africa over next decade or so. Among notable examples are MOSHITO, which is an industry-led and government supported initiative to support the South African music industry, and Business and Arts South Africa (BASA) which supports and links the arts with funding and sponsorship from the private sector. Further examples are the establishment of the South African Screen Federation (SASFED) which supports independent film, television and audio-visual content industries (Joffe & Newton, 2012; National Department of Labour, 2008).

In respect of national macro-economic policies, such as the Accelerated and Shared Growth Initiative for South Africa (ASGISA) (released in 2006), there occurred some recognition of creative industries (The Presidency, 2006). Although ASGISA (2006) did not identify creative industries as a priority sector (such as business process outsourcing or tourism) it did acknowledge creative industries - especially the craft and film sectors - as drivers of sustainable economic opportunities (The Presidency, 2006). The *National Development Plan* (NDP), released by the Presidency in 2013 highlights the long term goals of government to transform South Africa economically and socially by 2030. It is observed, however, that within the NDP there is no specific reference to creative industries but only to the importance of building the greater knowledge-economy of the country (The Presidency, 2013). For enhancing the policy status and environment for creative industries in South Africa the significance of the Department of Trade and Industry (DTI) has been critical. Of greatest significance is the *National Industrial Policy Framework* (NIPF) released in 2007 which highlights the long-term intensification of South Africa’s movement towards a knowledge-based economy (Department of Trade and Industry, 2007). The sixth iteration of the *Industrial Policy Action Plan* (IPAP), released in 2014, continues as an ongoing action plan set in place to implement the overarching goals of the NIPF (Department of Trade and Industry, 2014). The IPAP specifically recognises the importance of creative industries as one of the most dynamic sectors of the global economy and the imperative to tap its potential for job creation and economic advancement in South Africa (Department of Trade and Industry, 2014).

It is significant to note that IPAP recognises only the music, film and craft sectors in the economy of creative industries (Department of Trade and Industry, 2014). It identifies the South African music sector as the most developed in Africa and provides key action plans to grow the sector. These include initiatives to boost manufacturing in the music industry across the value chain through stimulating local production of musical instruments. Furthermore, IPAP projects development and increased share of domestic and international markets by the local music industry. In terms of the local film industry the DTI (2014) argues South Africa is unique in that it combines wonderful locations, weather and a first world infrastructure for

filming. According to the DTI (2014) the market for filmed entertainment in South Africa generated as much as R2.2 billion in 2012. Key actions isolated to assist in growing the South African film industry are expanded access to finance and infrastructure to improve the film industry value chain, and investment in production capacity to increase employment opportunities. Beyond music and film the DTI (2014) is focussed on the potential craft sector albeit arguing that it is difficult to measure due to its informality and often unorganised characteristics. Actions put forward by IPAP to support craft include the upscaling of handmade and manufactured craft, improving design and production capacity and assistance in providing access to domestic and foreign markets (Department of Trade and Industry, 2014). Several of the complex challenges facing policy initiatives for the craft sector in South Africa have been explored in post-2000 research by the country's economic geographers (Rogerson, 2000; Rogerson & Rogerson, 2010, 2011; Rogerson & Sithole, 2001).

Conclusion

This review paper tracked the evolution of scholarly research and the growth of the policy environment around creative industries in South Africa. It was argued that policy interest concerning creative industries can be interpreted as an example of a travelling concept of neo-liberal development. Within Africa the greatest enthusiasm for development of creative industries and most advanced debates about creative industries occurs in South Africa. The ongoing South African debates and research around creative industries can serve to inform wider international discussions around creativity support policies as a means of development policy in the global South (cf Sternberg, 2016). Economic and urban geographers in South Africa must take up the challenges and address the multiple knowledge gaps that currently exist around creative industries in this country. One starting point for empirical work is for geographers to pursue local audits to monitor the size, scope and organisation of creative industries in the country's leading cities as well as secondary centres.

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RESIDENTIAL MOBILITY PRACTICES: A REVOLVING DOOR SYNDROME FOR LOW- INCOME FAMILIES IN THE GLOBAL SOUTH?

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Abstract: Residential mobility practices have assumed a central role in low income housing strategies and debates in recent times. It is argued that such practices could potentially open up opportunities for the accumulation of socio-economic advantages for the low income population. However, housing mobility practices in the global South are exercised in a constrained choice context and conditioned largely by the kinds of opportunities on offer in the overall urban structure. Therefore, low-income residential mobility in Southern cities appears to be symptomatic of housing instability and insecurity with households making revolving movements based on constraints of the housing system. This paper surveys the existing literature on low income residential mobility practices and argues that understanding the structural constraints under which mobility practices are exercised and integrating same into the overall urban development agenda could potentially unlock the low income housing policy dilemmas of the South.

Introduction

The literature on households' residential mobility practices assumed a major perspectival shift following the ground breaking evidence from Rossi's (1982) study of Philadelphia. Rossi, suggests that rather than being labelled as chaotic, and linked to social disorder and breakdown of community ties, as the Chicago school sociologists have maintained, residential mobility practices enabled households to adjust their housing needs in tandem with life-cycle changes. Major social transitions such as household formation, birth of children and the eventual leaving of home by grown up children are accompanied by the need for households to continually adjust housing requirements to fit the changing phases of their experiences through the life course (Clark & Onaka, 1983; Clark, 2013). Based on this perspective, residential mobility is best described as a housing adjustment strategy for households in the face of frequent changes in family structure and composition within the life course. Since this perspectival shift, the majority of residential mobility studies, especially in the context of the global North, have been framed around the ideals of universal home ownership. In this sense, mobility practices are conceptualised as mechanisms through which households transition towards this ideal state (Clark, Deurloo, & Dieleman, 2003; Morrow-Jones & Wenning, 2005). Equally important, in this framing, is the notion of housing careers and housing hierarchies which jointly evolved to further elaborate the argument that residential movements are progressive in nature and are usually oriented towards improving the housing outcomes of households in terms of tenure prototypes, house prices and quality (Clark *et al.*, 2003). Within the framework of housing hierarchy, households ability to transition from tenancy to homeownership has been very instructive and housing price has been used as proxy indicator of quality (Clark *et al.*, 2003). Conversely, immobility has been perceived as a symptom of housing distress and the concept of housing trap has been used to describe conditions of poor households who, acting within housing constraints, remained confined to locations with concentrated poverty (Wiesel, 2014).

The conceptualisation of residential mobility practices as symbolic progression towards the ideals of universal homeownership has probably masked the large volume of non-yielding residential movements that characterise urban housing systems the world over. For most poor families, securing any form of housing rather than improving housing outcomes is a lived reality underlying housing mobility decisions. Skobba (2016) notes that, when faced with resource constraints, low income families resort to a range of strategies including perching with friends and relatives, accepting deteriorated and unsafe housing and engaging in frequent mobility between series of cheap housing as a way of adjusting to their precarious housing conditions. For the poor, therefore, housing mobility is symptomatic of instability and insecurity and results largely from the constraints of tenure relations, market conditions and environmental concerns (Coulton, Theodos, & Turner, 2009). Thus, residential mobility can either be privileged (when movement is associated with a luxury of choice for the household) or disadvantaged (when mobility is characterised by stigma and limited choice, forced movement or deteriorated housing), the latter only predisposes households to poorer or fixated housing outcomes (Skobba, 2016; Wiesel, 2014). Baker, Bentley, Lester and Beer, (2016) argue that as much as 25 per cent of households' movements in Australian cities end up in housing that are typically within the same range as their old residential places. Such mobility practices are short distance in nature and households are likely to remain in such a revolving movement for a longer duration due to the joint impact of poverty and housing affordability (Clark & Maas, 2016; Coulton *et al.*, 2009; Schwartz, 2016).

Low-income residential mobility practices have received very limited scholarly attention in Southern urban studies. Existing literature tend to frame the phenomena around the theoretical assumptions concerning the housing practices of low income

migrants in the context of housing and land markets constraints in Southern cities (see for example: Afolayan, 1982; Gilbert & Ward, 1982; Gilbert & Crankshaw, 1999; Gyimah, 2001; Ardayfio-schandorf, 2012; Andreasen & Agergaard, 2016). This is probably because rural-to-urban migration constitutes a major component of urban population growth in the South and the housing question centres on the capacity of city systems to accommodate the growing numbers of poor and unskilled immigrants (Brueckner & Lall, 2015; Buckley, Kallergis, & Wainer, 2016; Davis, 2006; Jenkins & Smith, 2001; Jenkins, Smith, & Wang, 2007). Invariably, most of these studies suggest that urban contexts and their inherent constraints significantly shape housing mobility practices for low-income families in the global South. Based on a survey of relevant literature, this paper contributes to the conceptual debates on low income residential mobility practices in the global South. It argues that contrary to the notion of housing mobility practices opening up vistas of socio-economic advantages for low income families, the phenomenon is short distance in nature in cities of the global South and evinces very limited potential for improved residential outcomes. To this extent, residential mobility practices of the poor can serve as major signposts towards appreciating the extent of turbulence and instability characterising downstream housing markets in Southern cities. The paper is structured in three sections. The first section presents a summary of theoretical insights into the residential location choices of low income migrants and the housing market structure of Southern cities. The next section discusses existing empirical studies on low income residential mobility practices in Southern cities and their revolving and non-yielding outcomes. Finally, the article concludes with suggestions on lessons that could potentially inform the low-income housing policy dilemmas of cities in the global South.

Theorising low-income housing mobility in the global South

The work of Turner (1968) although, predicated on the assumptions about universal home ownership ideals, provides the conceptual building blocks for understanding low income residential mobility practices in the South. Turner developed a two-stage model that broadly explores the residential location choices of poor migrants when they first arrive in the city and the spaces they eventually move to inhabit when they become familiar with the urban terrain and desire to establish themselves as long-term urban residents. Turner (1968) shows that residential choices of low income migrants in Southern cities were shaped largely by three factors namely; tenure security, proximity to unskilled job locations, and dwelling types. He argues that newly arrived migrants in Southern cities will typically opt for tenancies in rundown housing facilities proximal to the city centre where unskilled employment opportunities could easily be accessed. However, as they become fully integrated into the urban space, and are more familiar with the terrain, their housing and residential needs become more complex, and households may choose to consolidate their stay by moving to become owners at the urban suburbia where land values are low and where self-help housing opportunities abound (Turner, 1968). Drawing on the experiences of Hong Kong, Turner concedes that his model will fall short of providing adequate explanatory power in cities where very strong urban policy and administration systems exist. Very effective urban policy regimes in the South could potentially dry up inner city low income housing opportunities through urban regeneration programmes, as well as prevent self-help housing opportunities in the peri-urban enclaves. The work of Gilbert & Crankshaw (1999) and Wu (2006) respectively demonstrate how government policy restricted and shaped the residential mobility practices and choice for low income migrants in Johannesburg and Beijing.

According to Gilbert & Ward (1982) findings of many earlier studies in Southern cities, especially in Latin America, supported Turner's position and his two stage model was widely accepted as offering adequate explanatory power for low income residential mobility practices in the South. But further evidence questioned the validity of Turner's model by positing that it was the socio economic status of low-income households rather than their housing priorities that determined housing choices and residential mobility practices of the poor (see for example: Gilbert & Crankshaw, 1999; Wu, 2006). For example, low income homeownership opportunities in many Southern cities are tied to the possibility of households being able to own land. The ease with which land ownership is possible in turn is dependent on the permissibility or otherwise of land invasion in cities and urban land values more generally. Again, contrary to the two stage model postulated by Turner, evidence in Mexico City suggests that inner city areas were rather more attractive to relatively better-off households and that the pattern of residential movement exhibited was more towards intermediate locations than urban peripheries (Gilbert & Ward, 1982).

Most importantly, Gilbert & Ward (1982) cautioned Turner and his critics for basing their arguments on the residential priorities of low income households without recourse to whether or not the poor has the requisite ability to access housing. They argue that low income migrants do not exercise their residential choices as independent actors in the urban scene, their preferences and choices often conflict with those of powerful commercial and public actors whose interests and priorities structure the overall contexts within which the poor exercises their residential choices (Gilbert & Ward, 1982). Structural factors such as land and infrastructure development policies, the changing land values; density thresholds in low income residential areas; and the effects of urban diseconomies jointly exert tremendous influences on the residential mobility practices of the poor. Based on evidence from Bogota, Valencia and Mexico City, Gilbert & Ward, (1982) conclude that low income housing mobility in the global South is best explained in the context of land and housing market dynamics whereby market forces effectively

condition the choice context available to the poor irrespective of their housing preferences. In other words, it is the constrained choice context rather than the housing priorities that shapes the residential mobility practices of low income households.

Housing markets structure and mobility practices in the global South

Conceptual problems inevitably arise when an attempt is made to construct a typical housing market structure with the capacity to reflect the diverse and confounding socioeconomic contexts of Southern cities. Nonetheless, Lim, (1987) provides three basic features of housing markets in Southern cities that are strikingly similar across the board although differences may exist in terms of institutional and structural constraints (Malpezzi, 1999). These similarities are derived from the fact that the majority of urban low income households lack the requisite resources to appropriate adequate housing through the market mechanism and are compelled to resort to non-conventional solutions to house themselves albeit at the margins of the law (Brueckner & Lall, 2015; Marx, Stoker, & Suri, 2013). The most common features of urban housing markets in the global South, that are markedly different from experiences elsewhere, include the fact that low income households occupy land outside established procedures of planning and development permitting; they also use substandard materials and physical structures to house themselves and finally, tenancy and multi habitation are among the most important housing practices of the poor (Lim, 1987; UN-Habitat, 2008; Marx et al., 2013; Huchzermeyer & Misselwitz, 2016). These are unique housing practices in Southern cities that may not correspond to conventional understanding of housing or housing occupancy in the context of the global North. Therefore, discussions on urban housing markets in cities of the global South cannot be comprehensive if it is reduced to the demand and supply of the formal and more regular housing sector. Instead, informal processes of housing production and consumption must be recognised and acknowledged as important component of urban housing systems. Based on this recognition, Lim (1987) defined the structure of housing markets in Southern cities as comprising four basic sub-market structures including; squatter housing, slums, invaded housing and regular/formal housing. A twofold criterion was used, namely: legality or otherwise of land occupancy and legality or otherwise of the physical structure in terms of material composition. Table 1 presents the housing market structure.

Beyond the delimitation of submarket structure, this classification also provides good grounds for a broader theoretical insight into the residential mobility practices of low income households. Lim (1987) argues that households are not stuck to specific submarkets, they frequently move within the market structure based on their peculiar circumstances (Lall, Suri, & Deichmann, 2006). Therefore, low income households could possibly transition through the rungs of the market to improve their housing outcomes. This notion clearly resonates with the slum modernisation view which holds, that poor housing conditions and urban poverty in general are inversely related to the development of market forces and the processes of socio-economic transformation. In this regard, it is expected that as societies experience rapid urban growth, low income families are able to improve their living standards by moving into better housing or improving existing units (Marx et al., 2013). Housing mobility is expected to correlate positively with better housing outcomes for low income households in the South.

Table 1: Structure of housing markets (Lim 1987)

Land occupancy Physical attributes of Land & Buildings	Legal	Illegal
Legal	Formal housing market	Invaded Housing market
Illegal	Slums Housing market	Squatter Housing market

Revolving and non-progressive residential mobility: A survey of empirical literature

The notion of progressive transition through the housing market with the aim of achieving better residential outcomes may not necessarily hold for the majority of low income households in the global South (Marx *et al.*, 2013). The ability of the poor to transition from informal to regular housing markets is severely undermined by such structural factors as urban poverty, land use regulations and land market dynamics. Gilbert & Crankshaw (1999) show how government policy prescribed and constrained the residential choices of poor households in Johannesburg. In slums of Nairobi, poor residents frequently moved between housing units due to rent hikes (Gulyani & Bassett, 2007; Gulyani, Bassett, & Talukdar, 2012; Gulyani & Talukdar,

2008). Indeed, housing mobility practices in Nairobi slums are considerably high although the majority of such moves have been found to have no associated welfare gains. For example, based on data from the Nairobi Urban Health and Demographic Surveillance Site (NUHDSS), Marx *et al.* (2013) show that between 2003 and 2007 alone, about a third of household residential mobility practices in Nairobi slum communities either revolved within the same slums or between slums of different locations in Nairobi. Most of these movements are not associated with any improvement in terms of housing quality or amenity values and many had moved into rural Kenya following years of accumulated poverty.

Lall *et al.* (2006) conducted an empirical investigation into the residential mobility practices of slum residents in Bhopal and established that, only 13 per cent of sampled households maintained regular savings practices that propelled their transition out of slums into formal housing areas in the city. Based on this finding, the authors proceeded to make a case for the extension of flexible financial instruments and credit mechanisms to slum residents as a way of promoting savings culture and enabling their outward residential mobility (Lall *et al.*, 2006). Although such flexible credit systems are believed to have significantly opened up new frontiers of entrepreneurial opportunities for low income families in India and Bangladesh, Harvey (2012) and Roy (2010) maintained that it does so by instituting systems of collective debt amortisation that can potentially lock up poor households rather than liberate them from cycles of poverty. Moreover, Lall *et al.* (2006) admit, that a vast majority of poor households moved in between houses in the same slum. Households could be dissatisfied with their current housing units, but they would most probably prefer to change residence within rather than move out of slum neighbourhoods. Those who succeed in moving out are only able to secure tenancies at the lower margins of formal housing markets (Lall *et al.*, 2006) and thus, may not be able to sustain their tenancies in the event of major changes in house prices or household income. Such households stand the risk of slipping back into slums given the volatility of housing markets in the global South. In Beijing, Wu (2006) finds high level of residential mobility amongst low income migrant households and mobility rate was subject to decline as migrants consolidated their stays and became long-term city residents. However, the majority of low income residents are unable to access ownership of affordable housing opportunities through frequent housing mobility practices. A few are also able to move to public rental housing which provides relative housing stability whilst the majority remain trapped in substandard private rental housing where repeat moves become the hallmark of daily experiences. Wu (2006) notes that homeownership of all forms was unattainable to poor migrants in Beijing and at the same time, self-help housing opportunities are non-existent due to repressive measures maintained by urban gatekeepers.

Studies in some Sub Saharan African cities indicate how residential mobility practices of city residents result in uncontrolled physical development with severe consequences for urban governance and service delivery (Andreasen, Agergaard & Møller-Jensen, 2016; Ardayfio-schandorf, 2012; Bertrand & Delaunay, 2005). Andreasen *et al.* (2016) explained how residential mobility practices, driven largely by the homeownership aspirations of urban residents, lead to rapid physical expansion of Dar e Salam. Although these studies did not primarily seek to establish the differential housing mobility practices for low and high income city residents, their results clearly show that the majority of movers who became homeowners in surveyed and informal settlements were primarily in stable employment and income sources. Therefore, their ability to successfully build housing by their own resources implies that they could not be classified as among the low income segment of the urban population of Dar e Salam (Andreasen *et al.*, 2016; Andreasen & Agergaard, 2016). Instead, the high and middle class residential mobility practices motivated by homeownership aspirations, offered an expanded stock of low-cost tenancy and rent-free housing opportunities for the poor. Some self-builders provided far less cheaper rental spaces in their compounds which became very attractive to low income families in search of low cost housing opportunities (Andreasen *et al.*, 2016). Other poor families were motivated by the opportunity to access non-paying housing opportunities by becoming caretakers in ongoing construction sites at the peri-urban zones. Andreasen *et al.* (2016) note that it is common practice in Dar e Salam to have self-builders arrange for poor families to live temporarily in their ongoing housing projects to protect it against encroachment or thievery (see Gough & Yankson, 2011, for a detailed discussion of the nature and scale of the practice in peri-urban Accra, Ghana). Caretaking is usually a short-lived tenure arrangement that terminates as soon as the owner and his family are ready to move in, and the caretaker will have to seek accommodation elsewhere. As owners move in to newly built housing units, another window of opportunity is opened for low income residential mobility in the sense that less privileged extended family relatives become attracted by the possibility of accessing rent free housing (Andreasen *et al.*, 2016; Andreasen & Agergaard, 2016). However, since rent free tenancies are mere privileges extended to the poor, security of tenure depends on the space needs of the benefactor as well as the attitude and conduct of the beneficiary household (Amole, Korboe, & Tipple, 1993). In the event of relationship breakdown between the parties, the poor will be required to relocate. Indeed, rent free housing consumers constitute a significant component of tenure mix in urban west Africa (Amole *et al.*, 1993) and their frequent mobility only reflects insecurity following the growing trend of housing commodification in the South.

Households residential mobility is identified among the key variables shaping the socio-spatial configuration of the Greater Accra Metropolitan Area and the rate of mobility vary considerably between peri-urban and central locations (Ardayfio-

schandorf, 2012; Bertrand & Delaunay, 2005; Gyimah, 2001). Bertrand & Delaunay (2005) argue that low income residents in indigenous sections of Accra appear to be less mobile than their counterparts in outlying areas and their mobility practices could arguably be based on needs and choices rather than residential strategies (see also, Ardayfio-schandorf, 2012). They observe however, that short distance movements, mainly between nearby accommodations and involving rent free housing consumers were pervasive across indigenous neighbourhoods. For a few tenant households with more definite residential status, residential mobility rate was as high as neighbourhood averages (Bertrand & Delaunay, 2005). Mobility rates among low income households in indigenous residential areas is increasing steadily in the face of increased commodification of residential spaces within compound housing and the general trend of several years advance rental payment often demanded by landlords (Arku, Luginaah, & Mkandawire, 2012). However, these emerging mobility practices are short distance in nature, often restricted to limited geographical spaces and hold very limited potential for improving the residential and social outcomes for households. Structural constraints of the land and housing markets conjoin with urban diseconomies to limit the spatial extent of these residential moves by restricting it within the same social spaces and often within shorter time frame (Bertrand & Delaunay, 2005). Indeed, the residential outcomes of short distance moves could be judged as better or worse based on an assessment of how and why households move rather than where they eventually get to settle. For low income households, the most attractive residential zones in the peri-urban interface are those that offered low cost housing opportunities of about an hour commuting time to the city centre where informal jobs could easily be accessed (Gyimah, 2001; Bertrand & Delaunay 2005; Ardayfio-schandorf, 2012).

Gough (2008) reports a high level of residential mobility among low and middle class youth in Lusaka in the face of declining national economic fortunes. Young people in Lusaka frequently move to stay with better-off family members or friends who proved capable and willing to look after them in school whilst others move to seek the care and social support of relatives after losing their parents to the HIV /AIDS pandemic (Gough, 2008). These form of residential mobility practices are made possible by the flexible nature of the extended family systems so common in most African societies and cultures. Gough (2008) explains that following years of worsening economic conditions, residential mobility practices in Lusaka manifest in changing neighbourhood profiles wherein, high income city residents move back into low income residential areas to access cheaper accommodation. This downward mobility trend intensifies densification within compound housing units and reproduces residential crowding in low income communities. In turn, low income households who could not honour their rent obligations have had to slip back to share rooms with family members (Gough, 2008). Obviously, this circular and revolving pattern of residential mobility will do nothing to improve the residential outcomes of poor households beyond reinforcing their stay within crowded and disadvantaged urban spaces.

South African cities present a unique case of residential stability for low income households in the South. This follows the commitments by post-apartheid governments to address asset poverty and ensure restorative justice through the provision of fully built housing assets for low income urban residents (Marais, 2014). Government policy emphasised home ownership for the poor as a major first step towards enabling their participation in the property market and ensure their upward movement on the housing ladder. Despite the good intentions, recent evaluation reports indicate that less than 5 per cent of all subsidised units are linked to transactions in the formal property markets and their net contribution to wealth creation for beneficiary households have been rather negligible (Marais, 2014). Only a small proportion of poor households have managed to climb the housing ladder, by taking advantage of mortgage credits to maximise financial returns from their units (Marais, 2014). The rest are said to harbour considerable scepticism towards mortgage finance. Assets based subsidy programme has place-attachment effects on low income households in the sense that beneficiaries of subsidised units will not relocate even if it becomes apparent that their present location may be contributing to a worsening poverty situation. The provision of subsidised housing in mining communities in particular, and the promotion of homeownership therein tend to inhibit low income residential mobility by locking in beneficiary households in mining communities whose socioeconomic fortunes are on the decline. The locked-in effects is likely to affect future residential mobility as children of beneficiary households stand to inherit the properties (Marais, 2014).

In Latin American cities, 'innerburb' revitalisation programmes are the most common low income housing policies (Sullivan & Ward, 2012). 'Innerburbs' are consolidated informal settlements that have been mainstreamed into cities corporate limits through rapid urbanisation. Their incorporation into the city compelled the authorities to provide urban infrastructure and services and measures are now being instituted to retrofit them into modern urban complexes (Sullivan & Ward, 2012). Sanfelici (2016) notes that the most immediate effect of 'innerburbs' revitalisation is the residential mobility inertia it creates amongst low income households. In Mexico City, for example, densification is said to be the defining feature of housing occupancy in the 'innerburb' and residential mobility is rather on a limited scale. This is because several generations of families prefer to live in proximal locations and therefore lots have to be subdivided to cater for a growing need for space. (Sanfelici, 2016). Indeed, Perlman's (2010) longitudinal study of low income families in the favelas of Rio de Janeiro also confirm the

impacts of innerburb revitalisation on low income housing improvement in Latin American cities. Her results indicate that the majority of families interviewed in 1969 (63 per cent) had moved out of the favelas by 2001 and those who remained in the favelas also experienced improved access to social amenities.

Conclusions

The review shows quite clearly that contrary to the view that housing mobility correlates positively with improved residential outcomes, mobility practices for low income families in the global South are shaped by a complex set of socio-economic and political contexts that tend to reproduce similar housing outcomes in terms of origin and destination characteristics. Low income residential mobility practices are not necessarily tied to socioeconomic choices of households. Instead, they are shrouded in financial constraints and driven largely by the quest to adapt to the turbulence and insecurity inherent in the housing system. Occasionally, some households, if any at all, would experience transition towards housing improvement, but such mobility practices are hard to sustain in the face of increased income and housing market volatility in the global South. Therefore, households face the greatest likelihood of slipping back into their original state of housing. The bulk of residential movements were not progressive and occurred largely for negative reasons including rent hikes, loss of relatives, and relationship breakdown among others. This calls for a more critical look at the regulatory regimes and social safety nets at the lower end of the housing market. Undoubtedly, household residential mobility practices are associated with a great deal of inconveniences, and for this reason, most popular housing policy efforts tend to favour housing stability even amongst the very poor. However, in cities of the global South where overt evictions and structural disadvantages for the poor are a common place, and where central governments and city authorities lack the requisite motivation and capacity to invest in low income housing assistance programmes, understanding the structural constraints under which mobility practices are exercised and integrating same into the overall urban development agenda could potentially unlock the low income housing policy dilemmas of the South. Most importantly, it will serve as the second best, non-exclusionary policy alternative towards realising the rights of the low income population to the city's resources.

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THE DEVELOPMENT OF THE URBAN POLICY AGENDA IN SOUTH AFRICA: THE ROLE OF THE SOUTH AFRICAN CITIES NETWORK

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Abstract: The urban policy agenda in South Africa has gained in prominence in recent years with organisations such as the South African Cities Network assuming an increasingly influential role in its definition and framing. This paper examines the changing role and activities of the South African Cities Network (SACN) in directing research and interest around urban agenda. Issues of concern relate to shifting research foci in relation to the new Integrated Urban Development Strategy in South Africa, current and future research directions, and the influence of the upcoming Habitat III meeting will have on the new emerging urban agenda. The discussion draws from key stakeholder interviews as well as documentary sources.

Introduction

Africa's rate of urbanisation is widely recognised as the most rapid in the world. By 2020, it is predicted Africa will host 11 mega-cities with 5 million inhabitants or more and almost 3000 cities with populations of more than 20,000 (United Nations, 2012). The critical agenda of sustainability challenges for Africa requires policy attention to several questions around building resilient cities, local economic development, service delivery, food security, informal livelihoods and environmental change (Beall et al., 2010; Grant, 2015; Parnell & Pieterse, 2014; Rogerson & Rogerson, 2010). The urban policy agenda in South Africa has gained in prominence in recent years with organisations such as the South African Cities Network assuming an increasingly influential role in its definition and framing. This paper examines the changing role and activities of the South African Cities Network (SACN) in directing research and interest around the urban agenda. The discussion draws from key stakeholder interviews conducted with the leadership of SACN as well as an analysis of the policy reports and outputs generated by the organisation.

International policy development on urban issues

The United Nations Development Programme (UNDP, 2012) recently released the Sustainable Development Goals which came into effect in January 2016. The 17 Sustainable Development Goals (SDGs) recognise Sustainable Cities and Communities as a key focus area (UNDP, 2012). The 17 SDGs are all interconnected and represent a bold commitment to pick up on the achievements of the Millennium Development Goals (UNDP, 2012). The SDGs are as follows:

1. No Poverty
2. Zero Hunger
3. Good Health & Wellbeing
4. Quality Education
5. Gender Equality
6. Clean Water & Sanitation
7. Affordable & Clean Energy
8. Decent Work and Economic Growth
9. Industry Innovation and Infrastructure
10. Reduced Inequality
- 11. Sustainable Cities & Communities**
12. Responsible Consumption & Production
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace, Justice and Strong Institutions
17. Partnerships for the Goals.

Arguably, cities and urbanisation are viewed now as a priority and SDG 11 directly focusses on cities (Parnell, 2016). At the upcoming Habitat III Cities conference in Quito, Ecuador in October 2016, the New Urban Agenda document will be finalised. The New Urban Agenda guides the efforts around urbanisation by various actors (e.g. national government, cities, funders etc.) for the next 20 years. The "Zero draft" New Urban Agenda was released in May 2016. The previous urban agenda was determined from the 1996 Habitat II Istanbul Declaration on Human Settlements, where the prime focus was on sustainable

settlements in an urbanising world (UNDP 2012). Since then there was the World Summit on Sustainable Development in 2002 that was followed Rio+20 in 2012, which re-affirmed the Habitat Agenda.

The emerging New Urban Agenda seeks to re-inforce and galvanise this relationship between urbanisation and sustainable development (UNDP, 2012). Emerging in the ‘Zero Draft’ of the New Urban Agenda document are the following themes: including *inter alia* that Cities should be:

- People-centred;
- Strong focus on quality of life;
- Empowering for women (decision-making, equal employment opportunities and pay);
- Participatory and inclusive;
- Productive urban economies;
- Urban mobility (link people, places and economic opportunities);
- Fulfil beyond their administrative boundaries, promoting urban-rural linkages, cross sectoral resource management, co-operation among different size cities (Habitat III, 2016).

In summary, the New Urban Agenda, as described in the “Zero draft document”, calls for the transformation of urban policies. Three drivers for the new urban agenda are:

- I. Renewed Local and National partnership
- II. Strategic and Integrated Urban planning and management
- III. Innovative and effective financing frameworks.

In the New Urban Agenda zero draft document there is recognition of the key role of cities as drivers for sustainable development. The following are the three Transformative Commitments in the New Urban Agenda:

- I. Leave No One Behind
- II. Urban Equity,
- III. Ecological & Resilient Cities

(Habitat III, 2016).

Urban policy issues in South Africa

South Africa’s urban challenges sometimes are considered as distinctive and separate to those of rest of Africa because of apartheid and its legacy of a fragmented and racially splintered urban landscape (Rogerson *et al.* 2014). This said, the issues that confront urban policy-makers include sustainability challenges akin to those of other fast-growing African cities (Parnell & Pieterse, 2014). South Africa is already among the most urbanized countries in Africa and the share of the national population living in cities is 62 percent and expected to reach 71 percent by 2020 (Turok, 2013). The United Nations estimates this urban share will expand to nearly 80% by 2050 (CSP, 2014). The country’s cities are engines for national economic development as well as major hubs for enterprise development which necessarily situates urban development and management firmly on the agenda of policy makers and practitioners (CDE, 2014; Rogerson, 2014). Nevertheless, South Africa’s cities are highly visible inequitable environments that exclude poor people from social and economic participation (CSP, 2014) and continue to face significant development challenges. Turok (2013: 170) maintains that until recently the underlying approach of national government to the space economy was broadly neutral albeit with rural development a stated priority. This ambivalence towards the role of cities appears to be shifting. The new urban emphasis in the budget vote by National Treasury in February 2015 signals government’s explicit support for the urban agenda and for supporting metropolitan areas (Turok, 2016).

With rapid rates of urbanisation and an imperative to address the challenges of urban South Africa the need was fuelled to gather policy-relevant information, experiences, and knowledge resources on urban development in general and more specifically with an African focus. This context underpins the emergence and activities of the South African Cities Network (SACN) which is an organisation that since 2002 has functioned to play an important role in defining and framing the urban agenda in South Africa (Abrahams, 2016).

The origins and directions of South African Cities Network

The South African Cities Network (SACN) represents a grouping of South African cities which was established in 2002 by the Minister for Provincial and Local Government (now called the Department of Co-operative Governance and Traditional Affairs), in collaboration with the mayors of the country’s nine largest cities and the South African Local Government Association (SALGA). The SACN is an independent Section 21 company with the mandate to promote good governance and management in South African cities; analyse strategic challenges facing South African cities, particularly in the context of global economic integration and national development challenges; collect, collate, analyse, assess, disseminate and apply the

experience of large city governments in a South African context; and, to promote shared-learning partnerships between different spheres of government (SACN, 2012). Overall, the SACN vision is to be “an established network of South African cities and partners that encourages the exchange of information, experience and best practices on urban development and city management” (SACN, 2012: 5).

The SACN was birthed largely out of a need for policy guidance to newly-formed local government structures in the early 2000s and the growing need for peer-based learning between the various municipalities (Mbanga, 2014). The White Paper on Local Government (1999) had indicated that knowledge-sharing would be an essential ingredient for conscious growth and the studying of failures and successes of the local government system (Mbanga, 2014). The SACN encourages the exchange of information, experience and best practices in urban development and city management. Over time the SACN has evolved from being driven out of the political need and technical administrative input required by cities during the early days of the new local government system to a network that now has lobbying and strong knowledge management capabilities. Since its inception the SACN has worked toward establishing platforms for knowledge sharing to assist cities in learning from their own experience and peer experiences. They have done this through interpersonal engagements and the codification of knowledge and producing knowledge products (Black Earth Consulting, 2014). Arguably, the production of the State of the Cities Report (SOCR) – a knowledge management and benchmarking tool - has been one of the core outputs for the SACN over the years and used to inform their strategic planning and focus areas.

In the 2011-2016 strategic plan, the SACN identified their role as of enabling South African cities’ understanding of, preparedness for, and performance in playing their respective roles in driving local and national development (SACN, 2012). The overarching goal is to have South African cities as effective drivers of local and national development, enabled by SACN activities through its activist board, focused programme, and strong secretariat by 2016 (SACN, 2012). This kind of visioning and goal-setting makes the SACN a key role player and champion in driving South Africa’s urban agenda (Abrahams, 2016).

The City Managers, Mayors, Councilors and local government officials, who form the core membership of the SACN, vocalise the organisations’ role to drive their interests, not least because they pay membership fees to the organization (Mbanga, 2014). This said, the SACN needed to look at how it functions as the local municipalities that constitute its network are markedly different in size and the types of challenges that they experience differ. Accordingly, the SACN necessarily had to consider all these factors in its organisational design and in articulating an urban agenda. The making of an urban agenda became the common denominator for the local municipalities working together under the SACN umbrella (Mbanga, 2014). The SACN urban agenda was structured initially around five key programme areas viz., the Productive City; the Inclusive City; the Well Governed City; the Sustainable City and City Development Strategy. These programme areas are well aligned to the type of urban language used by the various international agencies and relevant for the new SDGs and the New Urban Agenda. The SACN differs from international agencies particularly in their approach to implementation. One of the main differences is because SACN was initiated from a political context rather than from an educational context as was the case in several international cases (Mbanga, 2014). An important strength of SACN is its ability to assist cities to frame important questions about the challenges that they face as well as serving as an important vehicle to debate various urban matters

The SACN introduced the State of the Cities Report (SOCR) as a tool within which “to tell its story” and of the work undertaken by the network. The SOCR came about due to the need to reflect on the “hindsight, insight and foresight” in thinking about the progress of South African cities and municipalities (Mbanga, 2014). The first report appearing in 2004 was mainly a descriptive narrative around the state and problems of the country’s cities. Subsequent SOCR outputs are more technical and illustrative. Key SACN stakeholders report this change in style was influenced by the UN Habitat’s State of Cities Reports and to reflect also the local political context (Mbanga, 2014). The SOCR of 2004 was a powerful knowledge management resource that highlighted the important albeit little acknowledged role of cities and local government in South Africa. In this way the SACN assured the acknowledgement of cities and their role as well as the significance of evolving an appropriate national urban agenda. The recent release of the 2016 SOCR shows a strong alignment with what is unfolding in the international arena with regards to the SDGs and the New Urban Agenda (SACN, 2016). Arguably the SOCR has become established as the franchise product of the network with its influence extending to other parts of sub-Saharan Africa where several African countries now compile parallel ‘State of Cities Reports’ (Abrahams, 2016).

The SACN serves as a source of information for leadership of South Africa’s largest cities, a role which in turn enhances the decision-making ability of city leaders. Further, the SACN served also as an occasional vehicle for debate on urban matters through hosting various conferences and through its commissioning of independent research (SACN, 2012). In South Africa’s

dynamic political and legislative environment multiple influences impact on the administration of cities. The SACN has been able to identify these critical issues and to disseminate information to inform cities in learning from the experience of others and thereby to efficiently use resources for building sustainable cities (SACN, 2012). Since its inception the SACN has accumulated experience and considerable knowledge on how best to share and manage this information. In addition, SACN functions as a leader in facilitating the kinds of discussions that cities have been having over the years. The organization has initiated fora around which different thinking around cities can evolve (SACN, 2007). According to Singh (2012), the SACN's focus mostly has been around the issues of 'city administration' which was attributed to the fact that its membership is the large metropolitan cities. This said, SACN has also played a significant role in terms of engaging a range of stakeholders involved in the development of cities, including, national and provincial government departments and the private sector. Stakeholder management and engagement is important to the urban agenda as the different groupings involved in a city often have very specific expertise and specialisations, Singh (2012) describes this as not being part of the 'core business' of municipalities and cities but there is a benefit that pooling these resources, their information and knowledge that will improve the ways of doing within cities. Singh (2012) argues that this would free up city administrations to focus on the core business for which they exist.

The relationship between SACN and the South African Local Government Association (SALGA) is critical. The SACN assumes a markedly different role to that of SALGA. As an autonomous association of municipalities SALGA's mandate derives from the national Constitution and the organisation interfaces with parliament, the National Council of Provinces, cabinet as well as provincial legislatures. It defines the organisation's role as SALGA as inter alia: to provide advice and support through policy analysis, research and monitoring, knowledge exchange and support to their members; representation and stakeholder engagement; lobbying on behalf of local government in relation to national policies and legislation; to act as an employer body in collective bargaining on behalf of our members, capacity building and municipal human resources; strategic profiling of the image of local government locally and internationally. Over the years there has been improved harmonisation of the activities of SACN and SALGA with both lending greater support to the urban agenda. Singh (2012) points out that in some quarters there is still confusion about the difference of the roles to be played by the two organisations with calls for the SACN to take a more 'lobbying' approach to urban issues. However, while it is important to acknowledge some of the challenges that SALGA has experienced in the past, Singh (2012) contends it would be wise for the SACN - given its mandate - to 'stick to its knitting' and stay the course with regard to its vital knowledge support role to South African cities. It is stressed that SACN would face distinct challenges if decided to play a lobbyist role which might 'muddy the waters' with regards to the mandated role of SALGA - which the SACN is advised to try and avoid at all costs (Singh, 2012).

Overall, SACN continues at the forefront of issues around sustainable development and what this translates into for cities considering that cities will have a significant role to play in implementing national government's strategies for sustainable development. Greater importance is attached now to urban issues and an urban agenda by several national departments. Prominent examples include the Department of Co-operative Governance and Traditional Affairs (DCOGTA) (2009, 2012) Local Government turnaround strategy and 'Back to Basics' Programme as well as the establishment of several units at national government level to deal with urban matters, most notably by National Treasury (Karuri-Sebina, 2015). The DCOGTA leads the policy discussions in national government on the development of Integrated Urban Development Framework. The Integrated Urban Development Framework (IUDF) was approved in 2014 and currently is out for public consultation. The IUDF addresses the need outlined in the President's State of the Nation Address in 2012 in which it was noted that national and provincial governments need to work with cities around spatial transformation and interrogate the linkages between the 'rural' and the 'urban'. It has become increasingly important to understand the nuances of rural-urban interdependences because in this way, South African cities can also become a (part of the) solution to rural development (SACN, 2007). Once again SACN has been at the forefront of leading discussions and knowledge development around such issues. The SACN leadership through its political astuteness, and in understanding the political landscape and the growing urban debates, was able to successfully lobby key players to a point where the IUDF is now out for public consultation and serve shortly at the Cabinet level as an official urban policy with an implementation plan (Karuri-Sebina, 2015). The IUDF deals with issues of inclusive cities, good governance, spatial transformation and economic growth which closely mirrors the programme areas that the SACN has been working on for the past decade. The SACN facilitated critical discussions with stakeholders around the IUDF at its recent conference held in March 2015. These issues link well with what is emerging in the new urban agenda around Integrated Urban and Territorial Development. The 2016 SOCR produced by the SACN shows that there is already great alignment with its work and thinking with the emerging new global urban agenda (SACN, 2016).

SACN future focus

Looking forward the SACN has recently defined the following 5 outcomes for itself for period 2016-2021:

1. Cities have to transform: spatially and economically;
2. They have to have the resources to do so (finances, skilled people);
3. The necessary capability and accountability must be ensured (integrated built environment governance; strategy and action; innovation, learning, dynamics; systems & intelligence);
4. Institutions and arrangements should be supporting city performance;
5. Power and governance structures should reconfigure to enhance the voice and role of local actors (particularly of local government, civil society organisations, business, and knowledge institutions).

The SOCR in 2021 will be a key output which should reflect these outcomes (SACN, 2015)

The following are the focus areas for the SACN for 2016-2021 in terms of knowledge generation and knowledge application. In terms of Knowledge generation the focus will be in Metropolitan finances, urban economies, urban land, urban mobility, urban infrastructure and resources use and urban governance and social accountability (SACN, 2015). In terms of Knowledge application the focus areas will be on the built environment integration, urban indicators, city development strategies, metro financing- special purpose vehicle, climate change (SACN, 2015). Overall, the organization has evolved in function and is no longer only responding to issues in the local government sphere. The SACN is definitely influencing the urban policy agenda in South Africa. However, having said this, it is noted in its new strategic plan that:

- The SACN has not exclusively or explicitly focused its future work on SDGs and the NUA but have ensured a degree of alignment
- Although there is some degree of alignment between SACN programme areas and research with the SDGs, which is often by default and not but explicit design, they have decided to “Keep to their own knitting”.
- The SACN should however, consider the key themes and drivers in the New Urban Agenda such as gender empowerment, urban equity, economic transformation and ecological resilience, providing input into relevant action plans and for South African cities.
- The SACN works indirectly with a number of ‘think tanks’ on urban issues, most notably the African Centre for Cities and Gauteng City Region Observatory. The SACN can however, improve its international linkages albeit they do work with a few international partners and are often consulted by UN Habitat. Although the Cities Alliance was core to the establishment of the SACN they currently do not have a formal agreement at this stage (Karuri-Sebina, 2016).
- Among key recommendation to the SACN from its recent review are the need to be more focused and to improve the communication around some of their outputs and products (Karuri-Sebina, 2016). SACN needs to continue to be a ‘connector’ for cities and a knowledge sharing platform that shows the importance of cities and champions the urban agenda in South Africa

Overall, as an important driver of the urban agenda in South Africa the SACN needs to use the upcoming opportunity through HABITAT III, the New Urban Agenda and the Sustainable Development Goal 11 to further drive the importance of cities for sustainable development in South Africa. SACN have provided input via the national Department of Human Settlements for the upcoming HABITAT III meeting (Karuri-Sebina, 2016). In addition, they have provided input on specific tracks such as municipal finance, intermediary cities, and the African Agenda when invited to do so by UN Habitat or United Cities and Local Governments (UCLG). SACN will be attending the Habitat III Conference in Quito in October 2016 albeit they take note that often these international initiatives can become bureaucratic with the result that often inputs from smaller constituencies are lost (Karuri-Sebina, 2016). The SACN will however, seek to utilize its research and knowledge management expertise to influence the NUA especially around action plans and the implementation frameworks.

In final analysis whilst SACN has achieved much in keeping cities informed on emerging urban trends and policy it is acknowledged that its impact on action within cities is not yet clear (SACN, 2009). This said, it can be argued the organisation has grown in influence to the extent that it is no longer only responding to issues simply in the local government sphere, rather it is now influencing and setting the urban policy agenda in South Africa and aligning itself well with the new global urban agenda, through its programme areas.

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A NEW LEASE OF LIFE, OR NOT? LIVING CONDITION CHANGES OF SOUTHERN AFRICAN DEVELOPMENT COMMUNITY (SADC) MIGRANTS IN THE METROPOLITAN MUNICIPALITIES OF SOUTH AFRICA FROM 2001 TO 2011

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Abstract: This article extends on the research published by Chikowore & Willemse (2016) in the *South African Geographical Journal* (doi:10.1080/03736245.2016.1208577) entitled “Identifying the changes in the quality of life of Southern African Development Community (SADC) migrants in South Africa from 2001 to 2011”. Various push and pull factors contribute to people’s migration patterns worldwide; with the reoccurring slogan being “searching for a better life”. This is no different in the SADC region; with their numbers increasing steadily in the metropolitan municipalities of South Africa. This study thus determines the changes in the living conditions of SADC migrants in the metropolitan municipalities of South Africa (the City of Tshwane [CoT], City of Johannesburg [CoJ], eThekweni [eThek] and the City of Cape Town [CoCT]) from 2001 to 2011. Census 2001 and 2011 data is used for this analysis. Results indicate that certain dynamics work in favour of the SADC migrants’ ability to improve their living conditions, while other dynamics result in a deterioration of living conditions, and a third set of dynamics either positively or negatively influence the SADC migrants’ living conditions. The CoCT and eThek generally appear to have better living conditions than the CoT and CoJ.

Background

Migration can be defined as the voluntary or forceful relocation of people from one place to another; thus allowing for a permanent or temporal change of residence across administrative or political boundaries. At a basic level, migration can only occur when places offer different standards of living; i.e. several push factors obligate migrants to leave their old residences, while many pull factors persuade them to relocate to new residences (Gelderblom, 2006; Lee, 1966). The main push factors associated with migration lay in the unstable and dire political, social and economic conditions in the countries of origin. Political instability occurs as a result of oppressive governance and widespread civil disorders, violence and wars. Social instability occurs as a result of increased population growth placing more pressure on resources and service delivery, and religious and ethnic conflicts resulting in human rights violations. Economic instability occurs as a result of extended periods of drought and famine, structural adjustment policies, increased poverty, unemployment, and a lack of job opportunities, which together negatively impact people’s access to services and facilities. In most instances the pull factors are considered the exact opposite of the push factors. Migrants typically migrate along established networks in search of better living conditions, employment opportunities, access to services and facilities, and political and social stability and freedom (Gelderblom, 2006; Stanojaska & Blagojce, 2012). Established migrant and support networks is important in the sharing of knowledge, information, skills and resources, and it simplifies the flow of remittances to families back home (Hagen-Zanker, 2008).

Some factors may simultaneously be pushing people out of an area and attracting them to stay in a different area. Consequently, both the origin and destination locations have push (negative) and pull (positive) factors present, and this manifests differently for people. Migration typically only occurs when people perceive that the destination offers more positives than negatives, but this can only be experienced fully when actually living there; resulting in the origin always being more familiar than the destination. Personal factors associated with the migrants’ life cycles and the distances and costs associated with the migration process also function as intervening obstacles in the migration process (Lee, 1966).

These push, pull and intervening factors are also at play in the Southern African Development Community (SADC) region. The SADC geopolitical region was established in 1992 and includes Angola; Botswana; the Democratic Republic of Congo; Lesotho; Madagascar; Malawi; Mauritius; Mozambique; Namibia; Seychelles; South Africa; Swaziland; Tanzania; Zambia and Zimbabwe. The SADC was preceded by the Southern African Development Cooperation Conference (SADCC) that was established in 1980 in Lusaka. The SADCC’s purpose was to reduce its members’ reliance on the apartheid government, establish regional integration and policies, and secure economic liberation for all the member countries (SADC, 2012a).

Likewise, the SADC focused on: 1) increasing economic cooperation and integration, improving the region’s global economic competitiveness, alleviating poverty, and establishing cross-border investments, trade, and the free movement of produced goods and services; 2) establishing a common value system based on democratic principles, good governance, and the guarantee of human rights for all; and 3) strengthening regional solidarity, peace and security. This should be achieved through the

establishment of common strategies to develop and enhance food security, land and agriculture, infrastructure and services; industry, trade, investment and finance; human resource development; science and technology; natural resources and the environment; social welfare; information and culture; and politics, diplomacy, international relations, peace and security (SADC, 1993; SADC, 2012b).

Africa and Asia are urbanising faster than other world regions; it is projected that 56% of Africa's population will reside in urban areas by 2050, in comparison to 74% in Southern Africa and 77% in South Africa (United Nations, 2014). The SADC migrants increased significantly in South Africa from 2001 to 2011, with most of them migrating to the provinces where the metropolitan municipalities are located in search of better employment opportunities and living conditions (Crush, Williams, & Peberdy, 2005; Poswa & Levy, 2006; South Africa, 2013; Van Huyssteen, Botha, Meiklejohn, Whisken, Busgeeth, Naude, & Robinson, 2008). Gauteng had almost 50% of all the SADC migrants in the country in 2001 and 2011, and experienced a 4.4-fold increase in the number of migrants over the same period (150,319 in 2001 to 663,876 in 2011). The Western Cape experienced a 9.8-fold increase in SADC migrants (9815 in 2001 to 96,006 in 2011), while KwaZulu-Natal had a 4.5-fold increase (16,612 in 2001 to 74,787 in 2011) (Chikowore & Willemse, 2016). Once in South Africa SADC migrants are subjected to various immigration policies and regulations. Many of them also face considerable hardships and limited livelihood opportunities including difficulties with obtaining citizenship or work permits, lack of service delivery and education, lack of formal employment opportunities, and steady increases in instances of xenophobic and Afrophobic attacks (International Organisation for Migration [IOM], 2013; Khan, 2007; Palmarty, 2002).

In studies of this changing pattern of demographics, two frequent questions arise: are the migrants satisfied with their decisions to have migrated, and have these moves resulted in improved living conditions? (Olgati, Calvo, & Berkman, 2012). This study thus determines the changes in the living conditions of SADC migrants in the metropolitan municipalities of South Africa (the City of Tshwane [CoT], City of Johannesburg [CoJ], eThekweni [eThek] and the City of Cape Town [CoCT]) from 2001 to 2011. This article thus extends on the research published by Chikowore & Willemse (2016) in the *South African Geographical Journal* (doi:10.1080/03736245.2016.1208577) entitled "Identifying the changes in the quality of life of Southern African Development Community (SADC) migrants in South Africa from 2001 to 2011", implying that the literature used in that article is also applicable in this article. Data was extracted from the 2001 and 2011 Census unit records from Super-Cross and variables were grouped into socio-demographic and socio-economic characteristics, housing conditions, and the service-delivery situation.

The characteristics and living conditions of the SADC migrants in the metropolitan municipalities of South Africa

This section discusses the SADC migrants' socio-demographic and socio-economic characteristics, housing conditions, and service-delivery situation, while the literature in this section provides the context to explain how the findings influence the SADC migrants' living conditions.

Socio-demographic characteristics

The socio-demographic profile of SADC migrants includes the total population distribution, citizenship status, gender, population group, age, marital status, and household size (Table 1).

The number of SADC migrants increased in all four municipalities, especially in the CoCT, from 2001 to 2011, but the CoJ still had the most migrants in total; illustrating that they are attracted to metropolitan municipalities in search of better economic opportunities, services and improved living conditions (Crush et al., 2005; Poswa & Levy, 2006; South Africa, 2013; Van Huyssteen et al., 2008). Roughly 70% of SADC migrants in eThek and the CoCT and 80% in the CoT and CoJ did not have South African citizenship in 2011¹. This negatively influences their living conditions because it is difficult to find formal employment and access services and facilities without South African citizenship, and it also subjects them to ongoing discrimination, xenophobic and Afrophobic attacks, criminalisation, and deportation if caught illegally in the country (Palmarty, 2002; Peberdy, 2000).

SADC men were more likely to migrate in 2001 and 2011, but their percentages decreased in the CoT, CoJ and CoCT, and increased in eThek, most probably because they are employed as labourers on KwaZulu-Natal's farms (South Africa, 2013). Conversely, the female migration shows exactly the opposite pattern in the municipalities. The results confirm the literature's findings that men are more likely to migrate and have better living conditions. While female migration increases steadily over time, their living conditions remain poor due to ongoing gender abuse (Adepoju, 2008; IOM, 2013).

¹ Since the data was extracted from the Census unit records from Super-Cross, issues were detected with the citizenship variable for 2001.

The SADC migrants were mostly black in the municipalities in 2001 and 2011, while white migrants were more inclined to settle in the coastal municipalities. The SADC migrant population appears skewed towards the younger working age group (22-35 year olds). This group was more inclined to settle in the municipalities with the strongest economies (the CoT and CoJ) in 2001 and 2011. The older working age group (36-64 year olds) is the second largest SADC group to migrate to the municipalities. They were more inclined to reside in eThek in 2001 and 2011. The elderly (65 years and older) preferred to settle in the coastal municipalities (eThek and the CoCT) in 2001 and 2011. The results support the migration theories that working aged people are more prone to migrate in search of better employment opportunities (Anderson, Mikulic, Vermeylen, Lily-Yrjanainen, & Zigante, 2009; Crush et al., 2005), while the white and retired SADC migrants were probably looking for an attractive and leisure-filled “retiree-lifestyle” near the ocean, thus signalling improved living conditions (Walters, 2000).

Table 1: Socio-demographic profile of SADC migrants

Municipality	Total number of SADC migrants	Male	Female	Do not have South African citizenship*	Black	Coloured	Indian/Asian	White
CoT 2001	12981	67.2%	32.8%		90.2%	1.9%	0.8%	7.1%
CoT 2011	109319	58.1%	41.9%	78.0%	86.4%	0.7%	0.4%	8.3%
CoJ 2001	55980	65.6%	34.4%		94.4%	1.0%	0.6%	4.0%
CoJ 2011	330546	55.8%	44.2%	79.5%	91.2%	0.6%	0.4%	5.5%
eThek 2001	5495	60.4%	39.6%		69.0%	2.0%	2.4%	26.6%
eThek 2011	36457	63.1%	36.9%	64.9%	70.4%	0.7%	1.1%	22.3%
CoCT 2001	7775	62.9%	37.1%		59.4%	11.3%	2.6%	26.6%
CoCT 2011	74685	58.2%	41.8%	71.0%	62.9%	2.5%	0.7%	20.7%
Municipality	0-14 years old	15-21 years old	22-35 years old	36-64 years old	65 years and older	Married	Single	Widowed / Divorced
CoT 2001	9.9%	16.6%	48.6%	22.1%	2.8%	41.6%	54.8%	3.4%
CoT 2011	9.3%	10.5%	55.1%	23.1%	2%	55.5%	41.1%	3.3%
CoJ 2001	8.3%	14.6%	54.3%	21.1%	1.6%	46.5%	50.6%	2.8%
CoJ 2011	8.6%	9.7%	55.2%	24.8%	1.6%	54.5%	42.4%	3.2%
eThek 2001	12.2%	15.3%	40.6%	27.1%	4.8%	41.2%	53.5%	5.2%
eThek 2011	8.0%	8.1%	50.4%	28.8%	4.7%	54.9%	40.6%	4.5%
CoCT 2001	12.4%	18.2%	45.1%	21.0%	3.2%	31.9%	63.9%	4.1%
CoCT 2011	9.9%	7.4%	52.7%	26.5%	3.5%	55.7%	39.5%	4.8%
Municipality	1 Household member	2 Household members	3-4 Household members	5-9 Household members	10+ Household members			
CoT 2001	17.2%	13.0%	16.6%	10.5%	1.1%			
CoT 2011	15.9%	26.0%	40.2%	16.9%	1.1%			
CoJ 2001	15.9%	16.9%	18.9%	9.0%	0.7%			
CoJ 2011	14.7%	26.9%	40.2%	17.4%	0.8%			
eThek 2001	15.8%	15.2%	19.7%	11.1%	1.9%			
eThek 2011	13.5%	28.7%	40.4%	16.4%	1.0%			
CoCT 2001	11.3%	15.2%	18.8%	12.0%	1.3%			
CoCT 2011	11.4%	26.2%	42.3%	19.3%	0.8%			

Table 1: Socio-demographic profile of SADC migrants *Note: Since the data was extracted from the Census unit records from Super-Cross, issues were detected with the citizenship variable for 2001.

The percentage of single SADC migrants outweighed the percentage of married migrants in all four municipalities in 2001, but the opposite applied in 2011. In 2001, the SADC households mostly had 3-4 members in all of the municipalities, but a substantial increase of roughly 20% was experienced in the 3-4 member households in 2011. Similarly, households with 2 and 5-9 members increased in all of the municipalities from 2001 to 2011, but the 1 member households decreased or remained relatively unchanged over the same period. Southern African households often select and invest in the family members who have the greatest potential for achieving higher migrant earnings. The migrants then have to remit money back home as a coping mechanism to secure the family's survival. This could explain why the SADC migrants either migrated alone or in larger kinship or friend groups in 2001 in search of better livelihood opportunities (Adepoju, 2008; Landau & Wa Kabwe Segatti, 2009). The increased household sizes in 2011 could be explained by the fact that the SADC migrants got married and had children after they settled in South Africa, or it is more likely that they saved enough money to allow their whole family to migrate to South Africa. Married migrants and migrants residing together in kinship or friend groups are able to combine their resources and incomes together to survive, thus improving their living conditions. Conversely, an increase in household sizes results in the resources having to be distributed between more migrants, thus negatively influencing their living conditions (Anderson et al., 2009; De Jong, Chamratrithirong, & Tran, 2002).

Socio-economic characteristics

The socio-economic profile of SADC migrants includes the level and field of education, employment status, household income and the ownership of household goods.

The SADC migrants are reasonably well-educated because between roughly 44% and 54% have completed their secondary education in 2001, with slight decreases being observed in 2011 (Figure 1). The percentage of SADC migrants with no and primary schooling also declined in all of the municipalities from 2001 to 2011, while those with a tertiary education remained relatively constant around 4% in the CoT and CoJ, but decreased slightly in eThek and the CoCT. Despite this the CoCT still had the highest percentage of SADC migrants with a tertiary education in 2001 and 2011. Business management and engineering were the two most popular fields of study in all four municipalities in 2001 and 2011.

Most SADC migrants were employed in the four municipalities in 2001 and 2011 (Figure 2). Additionally, the SADC migrants residing in eThek and the CoCT experienced the biggest improvements in their employment prospects (7.7% more migrants were employed in eThek and 11.7% in the CoCT). A very slight decrease is observed in the percentage of employed SADC migrants in the CoJ from 2001 to 2011, but this is most probably attributed to a decrease in the availability of formal employment opportunities (it is more difficult for foreigners to obtain formal employment). The percentage of unemployed migrants declined in all of the municipalities from 2001 to 2011, possibly suggesting increases in the informal employment opportunities. Despite improved employment prospects, the SADC migrants' annual household income remained extremely poor (Figure 3). Approximately a third of SADC migrants earned low-incomes in all of the municipalities in 2001 and 2011, but these percentages declined between 2.7% and 7.3% in the CoT, CoJ and eThek from 2001 to 2011, with only a slight increase of 1.7% being observed in the CoCT. Additionally, all of the municipalities indicate an increase in the percentage of SADC migrants who earn no income, a decline in those earning a middle-income, and a relatively unchanged trend in terms of the high-income and super-rich earners.

Radios were the most popular household item amongst roughly 40% of SADC migrants in the CoT and CoJ and approximately 50% in eThek and the CoCT in 2001 (Figure 4). Cell phones grew in popularity in 2011, especially in the CoT and CoJ where about 20% additional SADC migrants had cell phones. Likewise, the usage of computers and televisions increased mostly in the CoT and CoJ in 2011.

The literature indicates a ripple effect whereby well-educated migrants are able to find more formal employment with better working conditions and higher incomes, resulting in improved access to housing, services and facilities, and the ability to purchase more household goods, which ultimately results in improved living conditions (Adepoju, 2003; Anderson et al., 2009; Mawadza, 2008; Misago, Gindrey, Duponchel, Landau, & Polzer, 2010; Olgiati et al., 2012). This could explain why the SADC migrants are relatively well-educated and employed, and are able to afford certain household goods like cell phones and computers. Owning more household goods and goods that are more technologically advanced (e.g. cell phones and computers) results in improved living conditions, because the migrants are able to look for job opportunities and general information on the internet (Oldewage-Theron et al., 2005; Western Cape Government, 2016). Conversely, in some instances migrants are seen as being more productive and less militant than native employees, thus making it easier for them to fall victim to low-paying jobs with harsher working conditions that the locals are not prepared to do, which negatively impacts their living conditions (Adepoju, 2003; Anderson et al., 2009; Mawadza, 2008; Misago et al., 2010; Olgiati et al., 2012). This could be a possible explanation for the relatively low annual household incomes of the SADC migrants in this study.

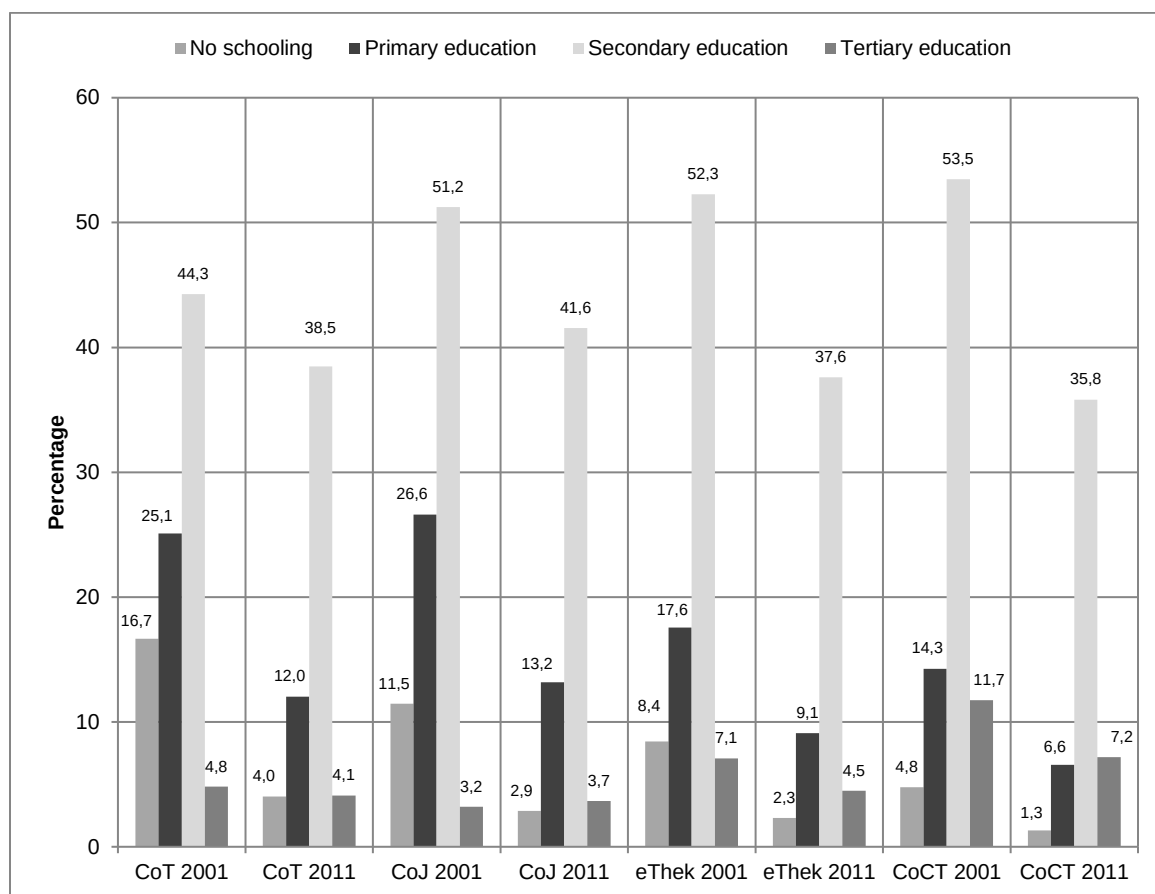


Figure 1: Educational profile of SADC migrants

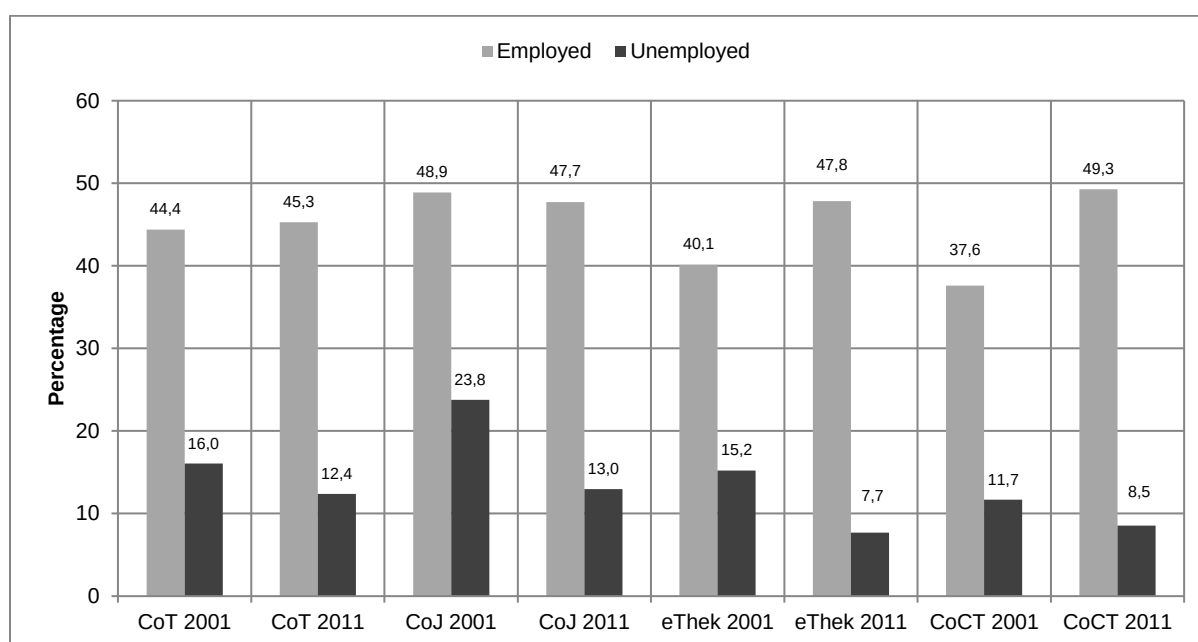
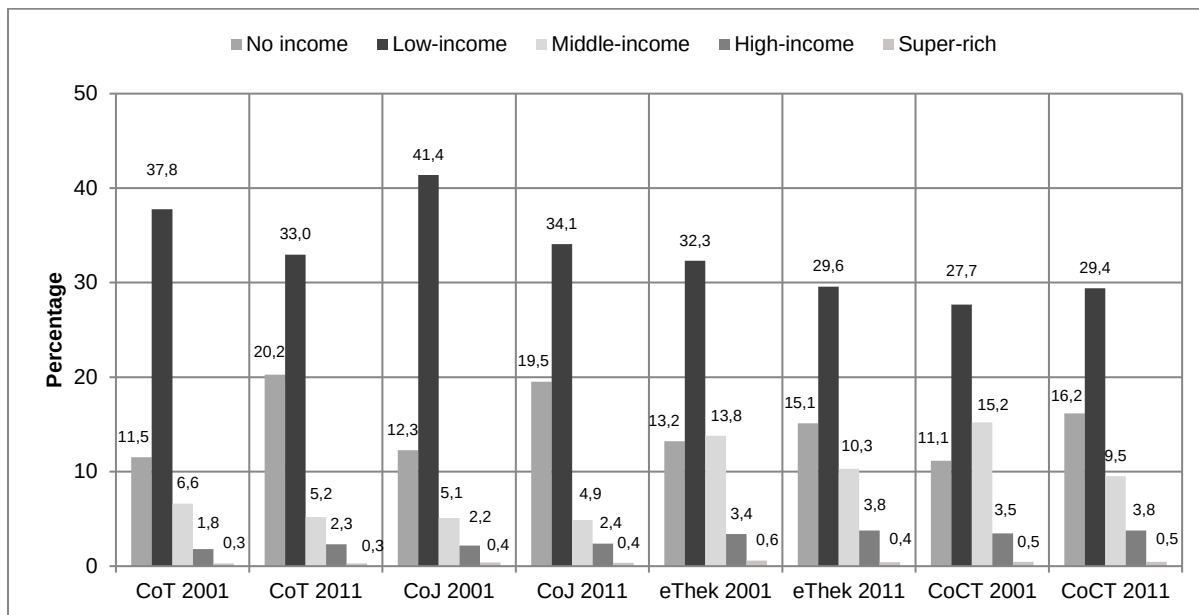


Figure 2: Employment status of SADC migrants



Notes: The closest approximation of the Census income categories for 2001 and 2011 were as follows: Low-income: R1-R76,800 (2001) and R1-R76,400 (2011), middle-income: R76,800-R307,200 (2001) and R76,400-R307,600 (2011), high-income: R307,201-R1,228,800 (2001) and R307,601-R1,228,800 (2011), the super-rich: R1,228,800 and higher (2001 and 2011).

Figure 3: Annual household income of SADC migrants

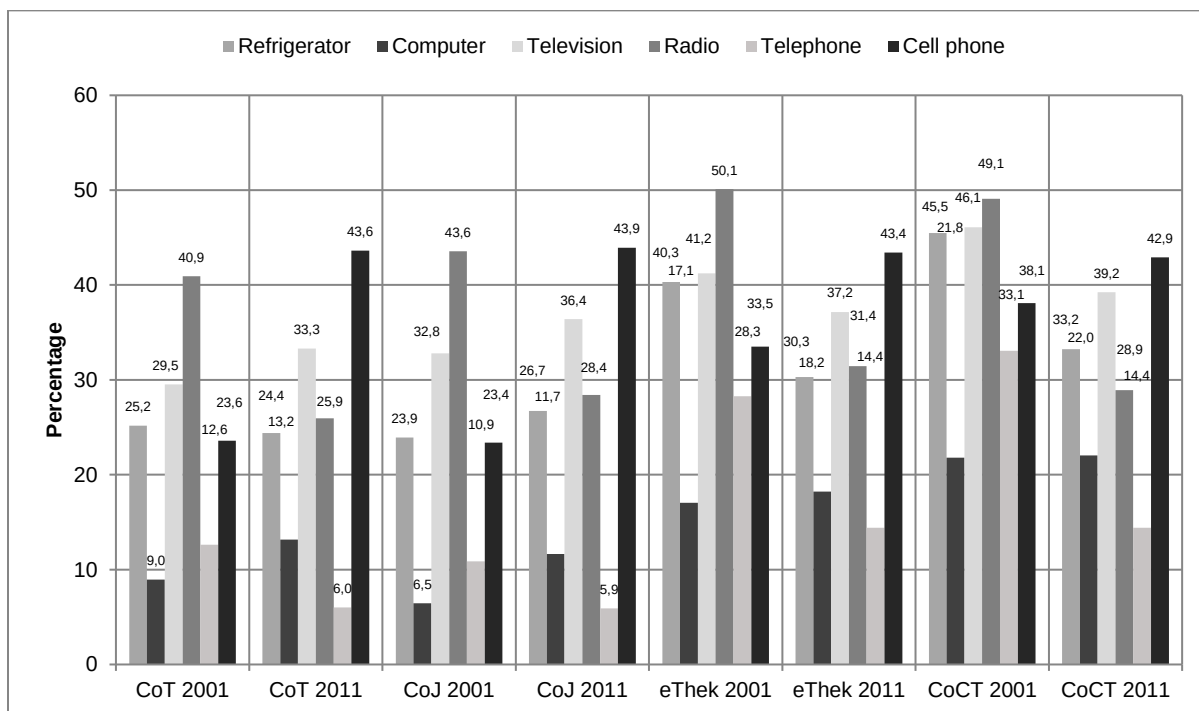


Figure 4: Household goods of SADC migrants

Dwelling structures and tenure status

The SADC migrants in the four municipalities mostly had relatively good-quality housing in the form of detached dwellings in 2001 and 2011, the only exception was in the CoJ in 2001 where most SADC migrants resided in informal dwellings (Figure 5). Semi-detached dwellings were the second most preferred housing type in eThek and the CoCT in 2001 and 2011, while the informal dwellings were more prevalent in the CoT and CoJ. Detached dwellings are built from permanent materials and are classified as formal housing, thus positively influencing the migrants' living conditions, while the reverse is the case for the informal housing built from temporary materials (Govender, Barnes, & Pieper, 2011; Gulyani & Bassett, 2010; Oldewage-Theron et al., 2005).

The percentage of SADC migrants who rent their dwellings increased by approximately 25% in all of the municipalities from 2001 to 2011, while those who own their dwellings remained relatively unchanged in the CoT and CoJ, but decreased slightly in eThek and the CoCT (Figure 6). The literature offers two somewhat opposing perspectives as to whether owning or renting dwellings result in improved living conditions. Owning the dwelling could function as collateral in difficult economic times, and it also offers the ability to earn additional income through renting out rooms; all of which positively impacts the SADC migrants' living conditions. Conversely, if SADC migrants rent the dwellings they do not have the additional financial burden of upgrading and maintaining it, implying an improvement in their living conditions. However, renting can be seen as an insecure form of tenure, because the SADC migrants have a greater chance of being evicted by the landlords (Govender et al., 2011, Gulyani & Bassett, 2010, Gwebu, 2003, Winayanti & Lang, 2004).

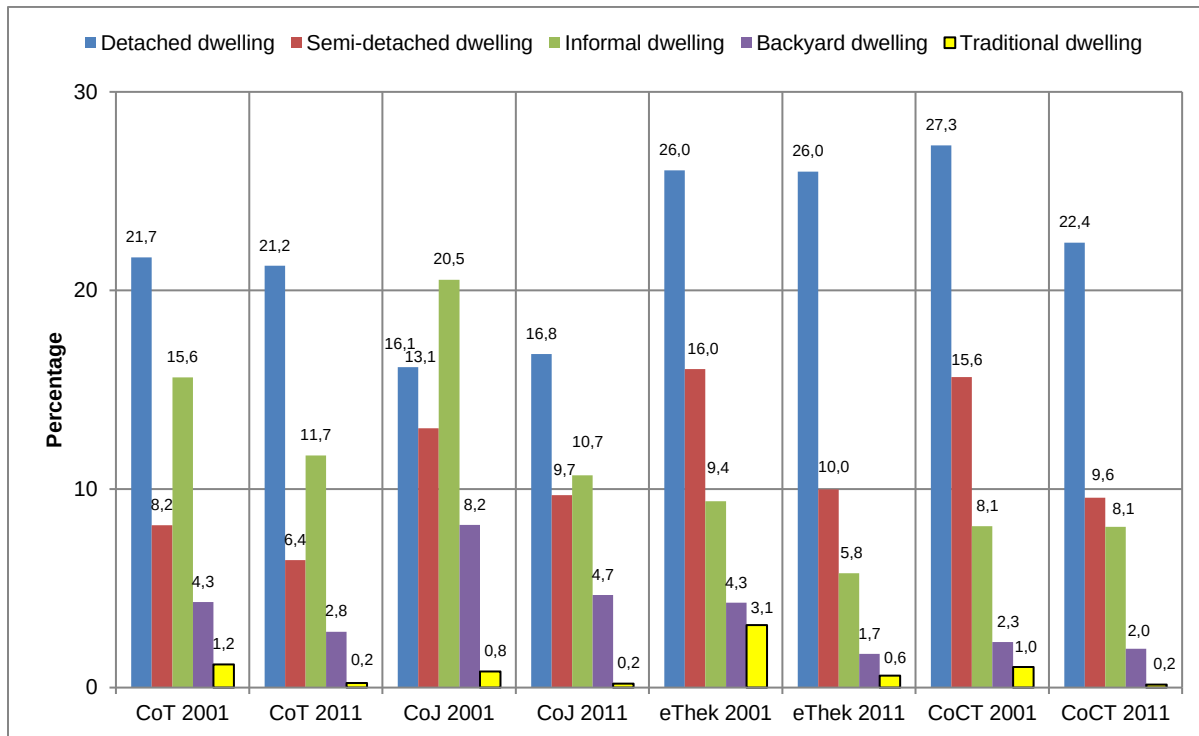


Figure 5: Dwelling types of SADC migrants

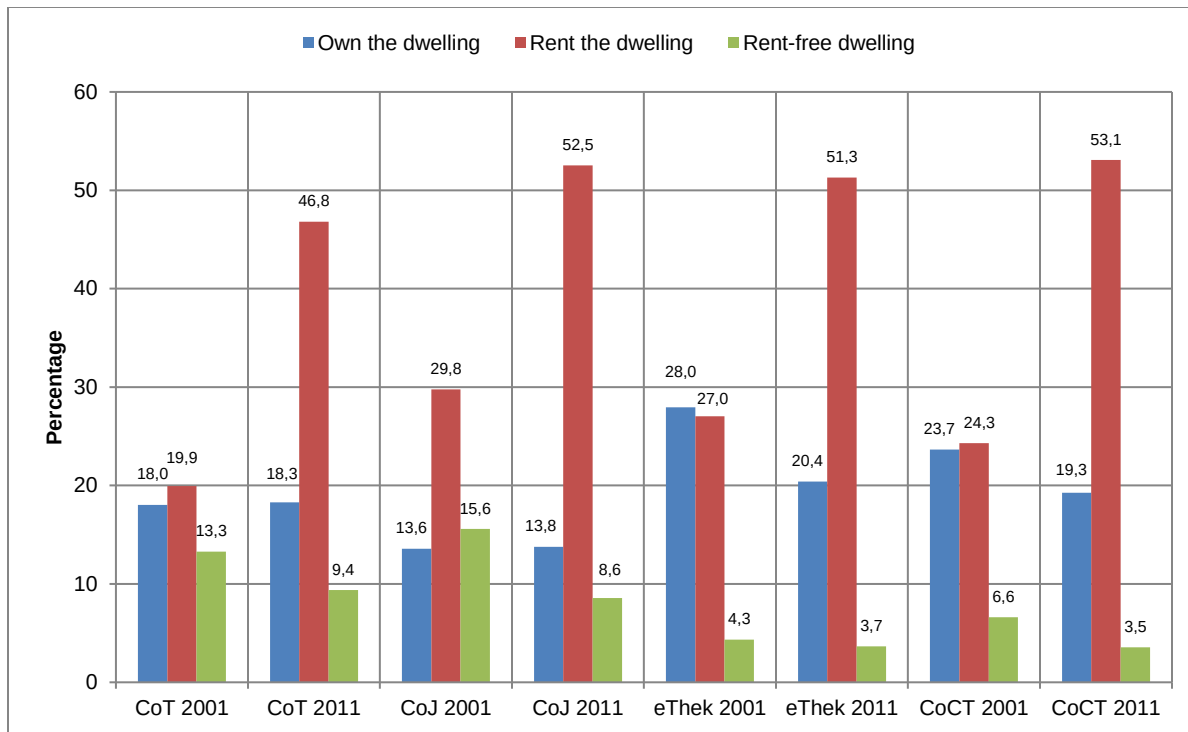


Figure 6: Tenure status of SADC migrants

Service-delivery situation

In 2001, 37.1% and 45.2% of SADC migrants in eThek and the CoCT, respectively, had access to water inside their dwellings, with the percentages decreasing to 30.2% and 32.2% in 2011 for eThek and the CoCT, respectively. Despite these decreases, eThek and the CoCT still had better access to water inside the dwelling, and had the lowest percentages of SADC migrants who do not have access to any water. Conversely the SADC migrants residing in the CoT and CoJ were more likely to source water from the site or community stand. Electricity, followed by paraffin, were the most and second most important sources of energy to cook, heat and light the home in all of the municipalities in 2001 and 2011. Wood and coal were also popular energy sources to heat homes in the CoT and CoJ in 2001, but the percentage of SADC migrants doing this remained below 8%, while candles were also used to light homes in all four municipalities in 2001 and 2011.

Most SADC migrants (percentages vary between 34.3% and 54.8%) had access to flushed toilets in all four municipalities in 2001 and 2011, but these percentages declined by between 8.8% and 12% in the CoJ, CoCT and eThek, but remained relatively unchanged in the CoT. Pit latrines were fairly common in the CoT (18.3% in 2001 and 9.3% in 2011), eThek (12.9% in 2001 and 5.2% in 2011) and to a lesser extent in the CoJ (5.5% in 2001 and 3.8% in 2011); but it was virtually non-existent in the CoCT over the same period. The refuse of SADC migrants was mostly removed by the local authority in all four municipalities in 2001 and 2011, but fewer SADC migrants had access to this service in 2011. At 37% and 35.4%, the SADC migrants of the CoT had the worst access to local authority refuse removal in 2001 and 2011, respectively. Overall, 18.2% and 9% of SADC migrants in the CoT were more likely to use their own or communal refuse dumps or have no refuse dumps at all in 2001 and 2011, respectively, while far fewer SADC migrants in the CoCT experienced the same situation.

Various post-apartheid policies emphasise the importance of the same service-delivery standards for migrants as ordinary citizens (Landau & Wa Kabwe Segatti, 2009). Migrants experience better living conditions if they have access to municipal services that are delivered regularly and are properly maintained. It is typically those who are well-educated and earn higher incomes that are able to afford better services (Adepoju, 2003; Mawadza, 2008; Misago et al., 2010). However, if water and electricity is sourced through illegal connections it increases the demand and reduces the quality of the services, resulting in an accumulation of hidden costs for services, which ultimately negatively influences the migrants' living conditions (Landau & Wa Kabwe Segatti, 2009).

Discussion

Dynamics that work in favour of the SADC migrants' ability to improve their living conditions include age, education, employment prospects, technological capabilities and migrant and support networks. Well-educated young working aged migrants have better employment prospects resulting in improved living conditions (Anderson et al., 2009; Mawadza, 2008). Most of the SADC migrants are of the working age; with most of the young working aged group settling in the economically stronger municipalities. Most of the SADC migrants had a secondary education in 2001 and 2011, while those with no or primary schooling decreased in all four municipalities. The CoCT had the highest percentage of SADC migrants with a tertiary education; implying better access to employment prospects. Increased access to cell phones and computers provides an opportunity to access job prospects via the internet, which positively influences living conditions (Oldewage-Theron, 2005; Western Cape Government, 2016). Cell phones increased significantly in popularity, and computers were used more often in the CoT and CoJ from 2001 to 2011. Established migrant and support networks is important in the sharing of knowledge, information, skills and resources, and it simplifies the flow of remittances to families back home (Adepoju, 2008; Landau & Wa Kabwe Segatti, 2009). Although not explicitly indicated in the study, migrant networks could have played a role in the increased number of SADC migrants that entered all of the municipalities from 2001 to 2011, and it could have contributed to the significant increases in the percentage of households with 3-4 members over the same period.

Dynamics that deteriorate the living conditions of SADC migrants include the number of migrants and the family and household sizes, gender, citizenship status, and income. An increase in the number of migrants and the family and household sizes, result in the resources having to be shared amongst more people, thus decreasing the living conditions (Anderson et al., 2009; De Jong, Chamrathirong, & Tran, 2002). The total number of SADC migrants increased significantly in the CoCT, but the CoJ still had the most migrants in total. Likewise, the percentage of households with 3-4 members increased significantly from 2001 to 2011. These results could negatively impact access to job opportunities and services in all of the municipalities, and in turn result in a deterioration of living conditions, because more resources have to be distributed between more migrants. The SADC migrants are mostly male, but the female migration increased in the CoT, CoJ and CoCT, thus possible indicating that these women faced dismal living conditions in their home countries if they were willing to partake in a "gender-role reversal" migration pattern. The literature does however indicate that female migrants still suffer disproportionately in terms of their living conditions in the destination locations compared to men (Adepoju, 2008; IOM, 2013). The majority of SADC migrants

in the four municipalities do not have South African citizenship, suggesting that they struggle to access employment opportunities and services, and experience increased risks of being subjected to harassment, criminalisation, xenophobia and Afrophobia, and deportation (Palmary, 2002; Peberdy, 2000). The natives often feel that the migrants are taking their income-generating and service-delivery opportunities. Consequently, many illegal migrants may end up working for low-paying jobs under appalling conditions which negatively influences their living conditions (Adepoju, 2003; IOM, 2013; Mawadza, 2008). Despite improvements in the employment prospects of SADC migrants, especially in eThek and the CoCT, their annual household income remained extremely poor with most of them earning between R1-R76,800 (2001) and R1-R76,400 (2011).

Dynamics that either positively or negatively influence the SADC migrants' living conditions include the tenure status, type of dwelling and service-delivery situation. Most of the SADC migrants in the four municipalities rent their dwellings, with an approximate 25% increase in the migrants that rent in 2011. This could either positively or negatively influence their living conditions seeing as they do not have to pay to upgrade and maintain the dwellings, while renting is considered an insecure form of tenure due to greater chances of being evicted by the landlords (Govender et al., 2011, Gulyani & Bassett, 2010). The SADC migrants experience better living conditions if they reside in formal detached or semi-detached dwellings that are made of permanent materials, and if these dwellings are properly serviced with water inside the dwelling, electricity for cooking, heating and lighting, flushed toilets and refuse removal by the local authority (Govender, Barnes, & Pieper, 2011; Gulyani & Bassett, 2010; Oldewage-Theron et al., 2005). The SADC migrants in the CoCT and eThek mostly resided in detached and semi-detached dwellings, and had better access to water, electricity, flushed toilets and local authority refuse removal. Conversely, SADC migrants experience a deterioration in their living conditions if they reside in informal settlements made of non-permanent materials, and if the services are either delivered at greater distances from homes, more informally or less regularly (e.g. water sources located on the site or the community stand, alternative energy sources for cooking, heating and lighting, inferior or no sanitation services, and using a community or own refuse dump, or not having a refuse dump at all). More SADC migrants in the CoT and CoJ resided in informal dwellings and struggled to access the aforementioned services.

Conclusion

This study determined the living condition changes of SADC migrants in the metropolitan municipalities of South Africa from 2001 to 2011. The number of SADC migrants increased in all of the municipalities, but the majority of them do not have South African citizenship. They are mostly men between the ages of 22 and 35 years old in all of the municipalities. The male SADC migrants declined in the CoT, CoJ and CoCT, but increased in eThek, while the female migration shows the opposite picture. Most of the SADC migrants were black in all of the municipalities, but the white migrants mostly settled in the coastal municipalities. The percentage of single SADC migrants outweighed the percentage of married migrants in all four municipalities in 2001, but the opposite applied in 2011. Likewise the percentage of households with 3-4 members increased substantially in 2011 in all of the municipalities, possibly suggesting that the single migrants managed to move their families to South Africa as well.

The SADC migrants in all of the municipalities are well-educated with a secondary education in 2001 and 2011, while the CoCT had the highest percentage of tertiary educated migrants over the same period. Having a higher education improved the employment opportunities available to them in 2011, but their incomes remained relatively poor in all of the municipalities in both years. Increased access to cell phones and computers provides an opportunity to access job prospects via the internet, which positively influences living conditions especially in the CoT and CoJ in 2011.

The SADC migrants in eThek and the CoCT mostly resided in detached and semi-detached rented dwellings with better access to a variety of municipal services including water, electricity, flushed toilets and local authority refuse removal in 2001 and 2011. Conversely, more SADC migrants resided in informal dwellings in the CoT and CoJ with poorer access to aforementioned services.

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CAPE TOWN AND ITS EMPLOYMENT CENTRES: MONOCENTRIC, POLYCENTRIC OR SOMEWHERE IN-BETWEEN?

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Abstract: The paper explores the monocentric as opposed to possible polycentric structure of Cape Town using a disaggregate database of population and employment combined with additional data. Using various approaches to identify metropolitan sub-centres, particular from the United States and Mexico, three main conclusions can be drawn from the methodology and data: Firstly, the gravity points of employment and population have already moved substantially away from the old port oriented Central Business District. The application of the Glaeser Rings, however, reveals that Cape Town is also not a typical decentralised metropolitan area. Secondly, based on Suarez and Delgado, the data indicates large local mismatches between demand for and supply of employment, especially in low income neighbourhoods. Finally, using the Aguilar and Alvarado (2004) threshold criteria (jobs > 10 000 and Job Density > 50 jobs / ha) it was possible to identify fourteen employment centres. Nine of the fourteen are manufacturing clusters, as opposed to the more regular observed service centre clusters. Overall it can be concluded that Cape Town is neither a typical monocentric city nor a decentralised city. Polycentric nodes however, as distinguished and defined in the international literature, are definitely present in Cape Town. These nodes seem to follow the historical railway lines and are imbedded within the old spatial urban footprint of Cape Town.

Introduction

By the early 1980's, students of American metropolitan structures realised that the Monocentric City Model was gradually losing its sole relevance to the urban form debate. Under the momentum of the constant suburbanisation of population and employment, growing car ownership and associated car mobility and the emergence of post-industrialism, the United States metropolitan spaces changed rapidly. This resulted in, among other, newly developing sub-centres in the inner, and even outer, suburban spaces. In today's Global North, it is now widely accepted that polycentric metropolitan areas exist as demonstrated by an impressive number of academic publications (see e.g. Giuliano & Small, 1991; McDonald & Prather, 1994; Gordon & Richardson, 1996; Clark, 2000; Champion, 2001; Phelps & Ozawa, 2003; Sarsynski, A. et. al., 2005; Romein et.al., 2009; Shearmur et. al., 2007; Vasanen, 2012; or Sweet et. al, 2016).

Remarkably, even after several decades of research the polycentric concept remains rather ill-defined covering different levels of spatial scale, criteria, and measuring approaches ranging from simple "cut-off" methods to advanced statistical analysis (see e.g. Clark, 2000; Davoudi, 2003, or Romein et. al., 2009). Indeed, as Sarzynsky et. al. (2005) put it, the concept is (still) searching for a definition². As Sarzynsky et. al. (2005) state rather appropriately '*... although there is widespread agreement that polycentrism involves multiple centers of employment, there is no consensus on how significant (either in absolute terms, or relative to the employment of either the metropolitan area or the CBD) a nucleus or node must be to qualify as such...*'. A general accepted definition, however, states that an area is polycentric if its population or employment is not concentrated to a substantial extent in one single centre (Riguelle et al., 2007: 195).

As of the 1990's, the major Latin American metropolitan areas also came under scrutiny regarding the presence of polycentric developments. Although recent outlying employment centres were indeed identified, the differences between Latin American metropolitan polycentricism and its Northern corollary also became visible. These differences were associated with the large contextual differences between the subcontinents as to economic development, infrastructural amenities, income levels, private

² In the prominent international academic literature on the topic two major currents come to the fore: In the North American context, polycentric structures are usually studied on the *level of single metropolitan areas* (with ongoing sprawl of population and employment as a driving force and outlying employment centers as an important result). In Europe the concept is often related however to the so-called *Polycentric Urban Regions (PURs)*, i.e. a set of urban centers (in different size-brackets), at close proximity of each other which maintain important functional relations (and often a firm degree of interdependency). In this respect, Sarzynski et. al. (2005) emphasize, that polycentrism within metropolitan areas should be clearly distinguished from the PURs, which generally cover quite a different level of scale. In this contribution we are following the American train of thought and consider Cape Town as a single metropolitan area.

car ownership versus dependency on public transportation, etc. (see e.g. Becerril-Padua, M., 2000; Borsdorf 2003; Fernández-Maldonado et al. 2013).

This paper focus on the Cape Metropolitan Area as defined after the unification of the 6 functionally independent municipalities in 2000. The research will explore signs which might indicate the presence of outlying employment centres, and hence a polycentric metropolis (or its emergence in the near future). The urban policy debate in South Africa has only recently attended to polycentric metropolitan developments, perhaps a consequence of the unavailability of suitable, disaggregated, spatial data. This study uses a relatively new dataset of the Municipality of Cape Town, based on the fine-grained metropolitan transport zones, that cover the current and planned built-up area of metropolitan Cape Town.

The next section of this paper offers a cursory look at the North- and Latin American literature on polycentric metropolitan areas and the identification of the outlying sub-centres i.e. the employment centres. This is followed by a brief review of the spatial development trends which shaped metropolitan Cape Town and its current spatial structure. Using the data of residents' home and employment collected for the transport models and at the transport zone level, metropolitan Cape Town's urban form will be analysed in terms of:

- Does metropolitan Cape Town match the American polycentric scale?
 - To what extent are American models and parameters applicable to identify employment centres in Cape Town?
- The paper concludes with a closer look at metropolitan Cape Town's employment centres in terms of location and employment type.

Metropolitan polycentricism in North-/Latin America: A cursory look at the literature

Regarding the presence of polycentric urban forms, only a handful of studies focused on South Africa. In one of the few studies on monocentric urban form, Sinclair-Smith and Turok (2012), using business tax paid on company turnover and employee payroll, conclude that Cape Town is still a monocentric city but with some de-concentration of activities taking place (Sinclair-Smith & Turok, 2012). They found that Cape Town's city center still accounts for about a quarter to a third of the city's formal economy when measured on the turnover tax. This does imply that a significant employment percentage is located elsewhere in the metropolitan area. In a subsequent paper, Sinclair-Smith used commuting flows in greater Cape Town region which included towns of up to 140 kilometers away. He concludes that the Cape Town region is monocentric, in morphological as well as in functional terms (Sinclair-Smith 2015). Finally, Wilkinson, in presenting a qualitative city profile of Cape Town argued that while Cape Town experienced some decentralization of office and retail employment activities, the City has not experienced the same level of employment decentralization in comparison with other South Africa cities (Wilkinson 2000). Cape Town, according to these authors remain mostly monocentric but with underlying decentralization trends. In one of the few studies that endeavored to clarify the various terms such as such as metropolis, metropolitan region and polycentric cities, Geyer et. al (2015) argues that polycentricity denotes more than one functionally linked monocentric urban centers with significant employment and labour interactions between the centers. Multimodality, according to the authors is associated with a monocentric city, in which a single dominating primary node exists (Geyer et al, 2015). In this context, Cape Town can be classified as a monocentric city with various nodes.

Polycentric metropolitan structures are not a recent phenomenon. On the contrary, in the 1930's when the Monocentric City Model was developed, American urban researchers (e.g. Colby, 1933; Proudfoot, 1937, 1938) called attention to urban spatial structures which did not fit the widely accepted Monocentric Model. A few years later, Harris and Ullman (1945) presented their Multiple Nuclei Model of the American city. Nevertheless, monocentricity was still for quite some period perceived the standard for urban spatial structures, even after Berry (1963) convincingly showed the role of Chicago's non-CBD retail nuclei, their differences in size and composition, as well as their place in the functional commercial hierarchy.

At the beginning of the 1980's it emerged that many metropolitan city centres in the U.S.A. no longer were the focal point for jobs and economic activities a result of the continuing decentralisation of residential population and jobs and the subsequent rise of employment centres in the suburban rings. Peter Muller's (1981) "Contemporary Suburban America" linked the ongoing processes of metropolitan change with spatial metropolitan form. Eventually, John Borchert, well-known author about the evolution of American metropolitan areas, added polycentrism and its sub-centres as a new phase to his descriptive model (Borchert, 1972, 1991).

For quite some time, polycentrism-oriented research was based on studies of separate American metropolitan areas, the generalizability of which was unclear. The gradual availability of highly disaggregated census data (census tracts) at the urban/metropolitan level proved a breakthrough which boosted empirical and theoretical research (McDonald 1987; Giuliano & Small 1991; McDonald & Prather 1994; Song 1994; Gordon & Richardson 1996; Phelps & Ozawa 2003). In due course it

also became clear that the US metropolitan area did reveal some impressive differences in their polycentric forms (Glaeser & Kahn 2001; Glaeser 2001; Lang 2003; Lee 2007). It finally emerged that the rise of polycentric metropolitan urban form did not bring an end to monocentric urban forms and neither to the relevance of the Monocentric City Model. On the contrary, while monocentric spatial structures proved to be prevalent in the middle and bottom segment of the urban settlement hierarchy, polycentrism was increasingly perceived as a characteristic of the (very) large metropolitan areas (Arribas-Bel & Sanz-Gracia 2014).

With regard to Latin America, Harris (Harris 1971) was one of the first researchers who noted the presence of sub-centres in Latin America's metropolitan peripheries, a phenomenon that was soon appearing in descriptive city-models (Bähr & Mertins 1976; Bähr & Mertins 1995; Borsdorf et al. 2002; Stewig 1983). After 1990, thanks to the availability of new disaggregated databases, empirical evidence of polycentric city models gradually underpinned the already existing qualitative images (Aguilar & Alvarado 2005; Ciccolella & Mignaqui 2009; Garcia-Lopez & Muñiz 2005; de Olarte & Segura 2012; Romein et al. 2009; Fernández-Maldonado et al. 2013). On the one hand, these studies showed that the Latin American metropolises might indeed be labelled polycentric characterised with quite some outlying employment sub-centres. However, it also became clear that the Latin American metropolitan CBD's remained very strong and that the number of registered employment centres was fairly limited and that these appeared to be located close to the C.B.D. Indeed, outside a radius of 15 km from the city centre, both the number and size of the Latin American employment centres are insignificant. Furthermore, while North-American employment centres clearly radiate the characteristics of a post-industrial tertiary sector, the encountered employment centres in Latin America are often characterized by manufacturing industry activity. It is only logical that the outcomes of Latin America metropolitan polycentrism are intimately related to the very different political and socio-economic context including much higher levels of poverty, lower levels of private car ownership and car mobility, as well as a much greater dependence on the means of public transportation. In this respect it would not be surprising if the findings of the Cape Town study and its employment centres be closer related to the Latin American polycentricism than to the North American structure.

There still is no one single methodology to identify sub-centres to illustrate polycentric urban areas. The literature reveals quite a few different approaches which vary from straightforward techniques such as the use of a threshold level as to the required minimum number of jobs and/or job density to more elegant and complex methods of spatial econometrics such as Moran Indexes. When official, standardized, disaggregated socio-economic data became available in the U.S.A, Canada, European countries and in some Latin American countries, it rapidly became the standard approach to use employment data in identifying employment clusters.

In their highly interesting contribution, Garcia-Lopez & Muñiz (2005) distinguished a number of different approaches used to identify sub-centres, namely: 1) thresholds (or cut-off points), 2) mobility, 3) density peaks, 4) residues and 5) spatial economics. Table 1, which is a modification from Garcia-Lopez and Muñiz, lists some approaches to identify metropolitan sub-centres.

In North American studies, frequently relatively high thresholds are applied to define employment centres, which generally results in a break in the number of identified sub-centres. In the Latin American studies one often finds that lower thresholds are used, in order to get a better fit with the different socio-economic conditions. This, in combination with the limitation and quality of the available data, has led us to focus in this paper on the threshold based approaches with emphasis on Latin American and in specific Mexican, applications. But first we will present a brief overview of historic spatial developments in Cape Town.

Table 1: Approaches to identify metropolitan sub-centres: some examples

Approach	References	Criteria
Sprawl Measurement	Gleaser, Kahn & Chu (2001)	5km and 15 km employment rings
Density Peaks	McDonald & McMillen (1990)	Density of jobs/population
Thresholds	Suarez & Delgado (2009)	Jobs/resident workers ratio's in employment centres
	Giuliano & Small, (1991)	Jobs >10.000; Job-density >25 jobs/ha (10/acre)
	Aguilar & Alvarado (2004)	Jobs >10.000; Job-density >50 jobs/ha (20/acre)
	Shearmur & Coffey (2002)	Jobs:> 5000; Jobs/population: >1
Mobility	Bourne (1989)	Commuting flows
	Gordon & Richardson (1996)	Density trip generations > 0.8 standard deviation
	Szabó et al. (2014)	Reciprocal commuter connections
Residues	McDonald & Prather, 1994	Exponential job densities
	McMillen, 2001	Flexible Fourier with distance to sub-centres; locally weighed regression
Spatial econometrics	Guillain et. al (2004)	Total and local Moran Index (jobs/population)
	Riguelle et. al (2007)	Local Index of spatial autocorrelation to detect employment centres; shift and share analysis to trace developmental trends.

Modified after Garcia-Lopez & Muniz (2005) and Fernandez-Maldonado et. al. (2014)

Cape Town: Historical spatial development

Cape Town has experienced extensive spatial, economic, social and transport change since European settlers arrived in the 16th century. Originating as a small trading settlement founded by the Dutch East Indies Company in 1652, the colony proved to be a prosperous trading outpost due to fertile land and the particular location on the main maritime trading routes between the east and west (Brice n.d.). Over the following three and a half centuries, Cape Town's built-up area developed steadily to the south and east, well beyond the boundaries of the original village nucleus near the Castle of Good Hope (Dewar, 1990). Urban development also accelerated during the second half for the 19th century with various satellite villages forming on the outskirts of the formal port settlement. Some of these villages were established as a result of formal planning policies while others followed transport (road, rail and port) connections.

Urban expansion and development in Cape Town have been structured by the extent of local water supplies, food production, geographical features, transport networks and spatial planning policies (Floor, 1968; Dewar, 1990). In particular, five factors seemed to shape the spatial development of Cape Town. *Firstly*, the original port of Cape Town and direct hinterland form today's Central Business District. *Secondly* the city is bound by the Atlantic Ocean to the west and a sandstone mountain range which limited early growth to the east and south making available space for urban expansion limited. *Thirdly*, transport networks were initially constructed to support to carriage of trade between the hinterland and the port of Cape Town. The first rail line was constructed to Wellington (1863) in the east and much later that a passenger line was constructed to the south linking Cape Town to Simons Town (Burman, 1984). During 1950–1970 Cape Town adopted the freeway construction technology popular in the United States and several ring roads were planned and partially constructed. *Fourthly*, Cape Town never experienced mining boom associated with Johannesburg or some of the other in-land cities. The economy was initially mainly structured around agriculture, trade (export of commodities) and small scale manufacturing. These economic sectors

had a distinct mercantile, agricultural and light industry footprint. *Finally*, the formal establishment of segregated residential areas started as early as 1890's with alleged emergency measures implemented to check the spread of bubonic plague and continued with Natives (Urban Areas) act of 1923 and the subsequent formal adopted of the Group Areas Acts (1950) all lead to the entrenched racial segregated housing policies (Bickford-Smith, 1995; Wilkinson, 2000).

The combination of these factors led to a spatial urban form which is somewhat unique in South Africa. Early development centred on an historic core, the port, with some urban expansion along main transport corridors. Ribbon development extended development along these corridors and some smaller scale economic activities was scattered along the eastern road and rail and long the southern axis. Between these axis public housing estates was established for so-called Coloured and African people on the Cape Flats. Mostly private sector development sprawled outwards from these axes to the North and to the South. Informal settlements formed, on the outskirts of the city and between the main corridors. While many of these settlements was the result of uncontrolled informal squatting (Dewar, 1990) some was in fact guided by formal policies; formal segregated planning placed lower and middle income categories in the wedge between these two axes.

Identification of Cape Town City structure: Unpacking the data

To assess whether Cape Town Metropolitan Area reflects any polycentric development pattern and to apply any of the approaches listed in Table 1 requires access to rather detailed, disaggregated data. In fact, data availability and quality determines the spatial exploration techniques that can be used to assess the emergence of polycentric development. Employment Statistics, contrary to population data, is less readily available in South Africa. The main source of statistical data in South Africa is Statistics South Africa (STATSA). The 2011 Census (STATSA) contains various relevant datasets at various levels of spatial aggregation. For example, main land use categories are available at Enumerative Area (EA) level. This is, however, only indicative of the main land use category and does not reflect actual employment intensity or employment numbers. The 2001 Census contained information on the 'Place of Work' for the population, aggregated to main place, but this question was dropped from the 2011 census. Main place is a too coarse spatial unit for any urban form examination as the City of Cape Town is divided in only 20 spatial units. The National Household Travel Survey (NHTS) also contains information on place of employment but this information is similarly only available at a too coarse zone level for Cape Town.

The City of Cape Town, as part of its metropolitan transport plan, undertook a Household Survey in (2013) which contained origin - destination data (or place of residence and place of employment) of a representative sample of the population. The data is available at transport zone level (average size of 4 - 5 km²) and Cape Town metropolitan area contains roughly 1650 zones covering mostly build up areas of the city region. Additional information was collected including residential income group, employment income and employment type. The combined dataset is spatially sufficiently disaggregated to analyse spatial trends in the Cape Town Metropolitan area. The following sections presents some selected approaches from Table 1, using this dataset.

How does the Glaeser classification fit Cape Town?

As illustrated, the spatial footprint of Cape Town has continuously expanded from the original port nucleus and 18th century town boundaries. The transport network, and specific the rail links provide the impetus of much of this spread. Plotting the current population and employment gravity points, Figure 1, illustrate that these have moved respectively 10 and 16km to the east of the Central Business District, which is remains largely in its historical location. This does elude to some serious changes in employment, and indeed population, distribution over time. Just how much, can be demonstrated with the Glaeser rings.

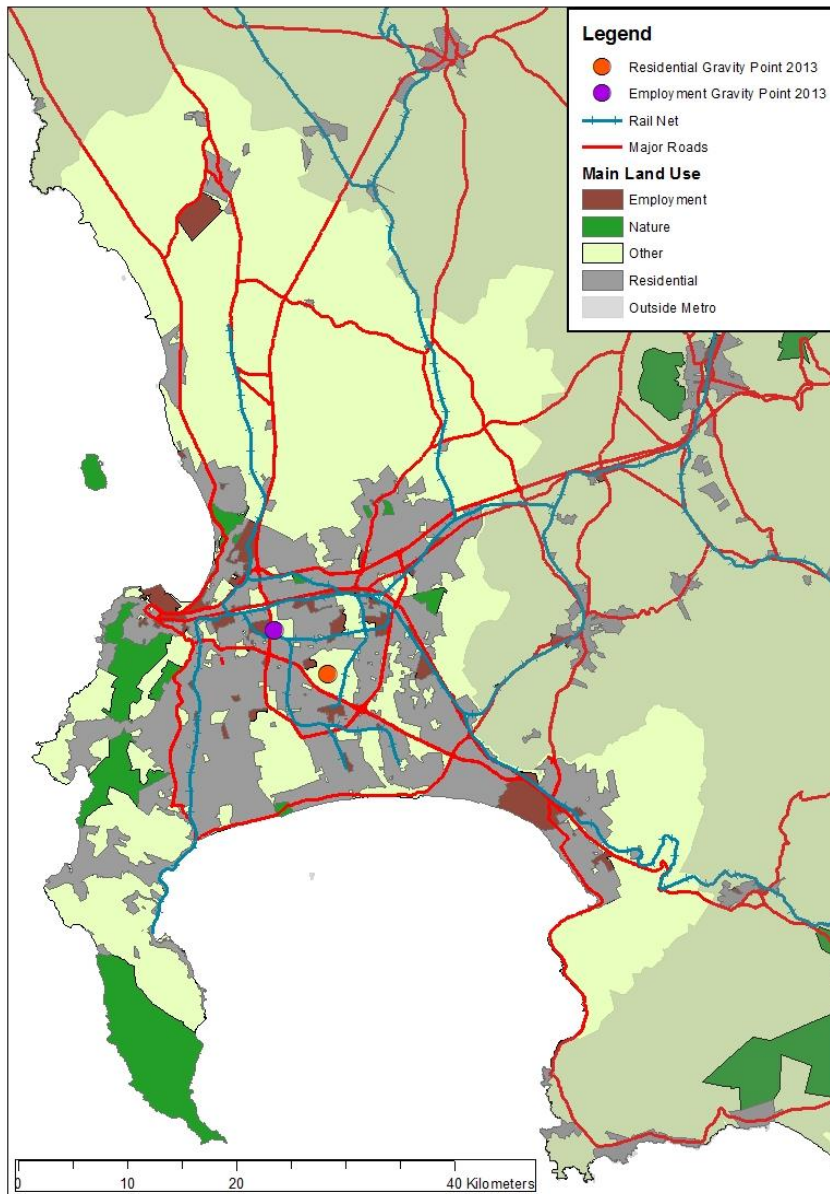


Figure 1: Population and employment gravity points (2013)

To come to grips with the concentration and dispersion (or sprawl) in the United States metropolitan areas, Gleaser et.al. (Gleaser, Kahn & Chu, 2001) have come up with a classification to characterize the employment structure of metropolitan cities. This classification, termed Glaeser Rings, is based on employment counts in two rings around the original CBD; an inner ring of 5 km / 3 mile and a second ring of 15 km / 10 mile (Figure 2) resulting in four types metros:

- Type A: Dense employment metro's with at least 25% of all employment in the inner ring. Examples include New York and San Francisco.
- Type B: Centralized employment metro's with 10-25% of employment in the inner ring and at least 60% in the two rings combined. Examples include Minneapolis, Denver and Miami
- Type C: Decentralized employment metro's with 10-25% of employment in the inner ring and less than 60% in the two rings combined. Examples include Chicago, Seattle and Baltimore.
- Type D: Extremely decentralized metro's with less than 10% of all employment in the inner ring. Examples include Los Angeles and St Louis.

In 2014, Fernandez-Maldonado et. al also resorted to the use of Glaeser Rings in their polycentricity study of Latin American metropolises. With 20.4% of employment in the inner ring and 58.8% in the two rings combined Cape Town is a borderline case of a decentralized employment metro. In case 10 miles, roughly 16 km as opposed to 15 km had been used to define the outer ring, it may very well had fallen in the next category. Nevertheless, the application of the Glaeser Ring model shows that Cape Town, in terms of employment size and concentration, is comparable with North American cities somewhere in between Minneapolis and Atlanta. The results also show that Cape Town is definitely no longer a monocentric and predominantly centralised city.

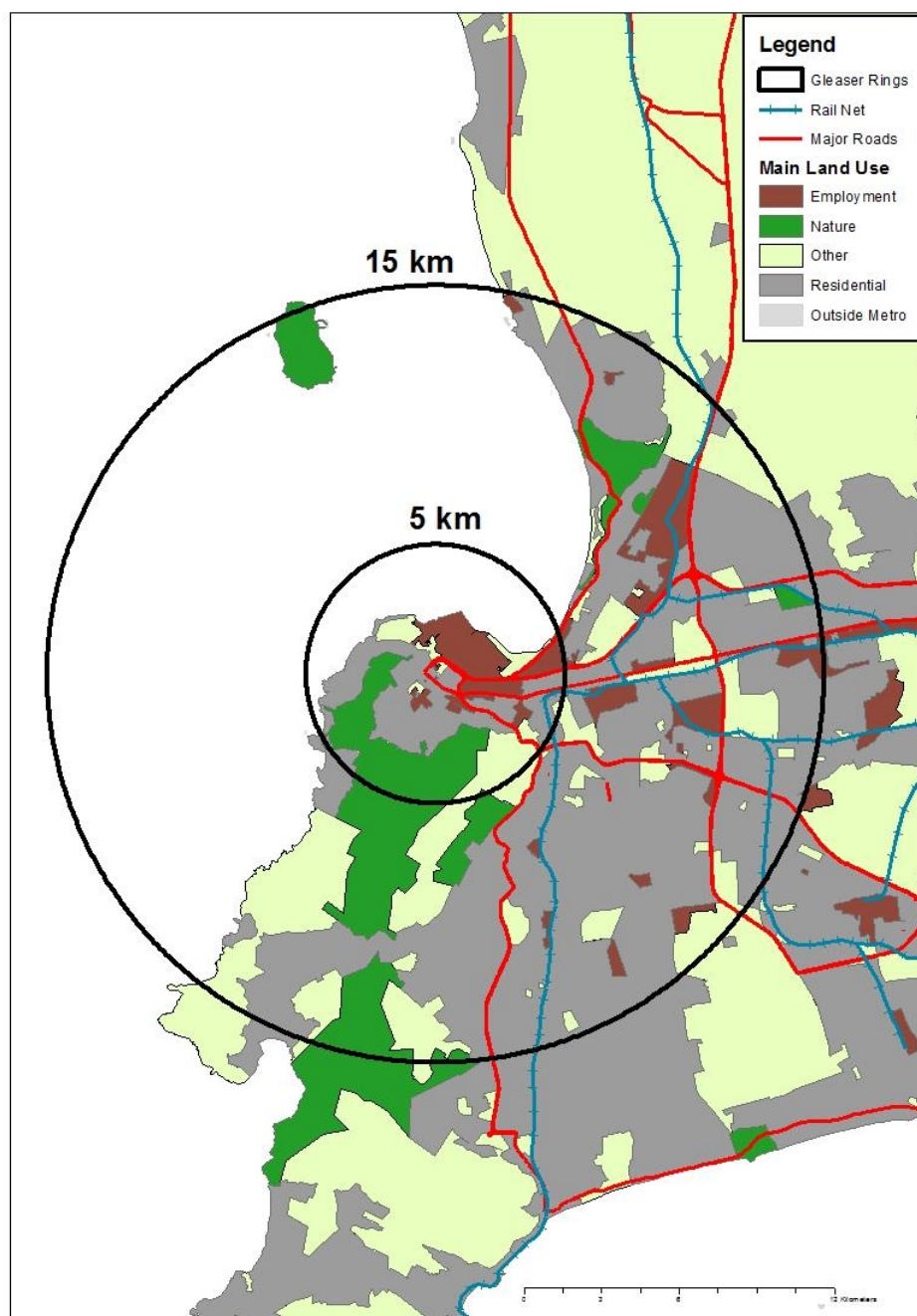


Figure 2: Application of the Glaeser Rings in Cape Town

A general classification or a single scalar variable, like the Glaeser Rings does not look at specific spatial patterns. To examine more detail patterns, some threshold based approaches were applied.

The Suarez and Delgado demand and supply balance for employment

The variation of employment opportunities and residential workers in transport zones in the available data set make it difficult to apply approaches based on ratios. Quite a few transport zones have no or only a few employment opportunities and residents which result in ratios comparable to zones that count thousands of employment opportunities and residents and hence are in a totally different league. Also differences in the physical size of transport zones may lead to misleading results when only densities are taken into account. With a slight modification of the methodology, that is by not dividing but subtracting employment demand from employment supply in individual transport zones, the authors came up with an approach that is in essence very close to the work of Suarez and Delgado (2009). The resulting map, Figure 3, shows large areas with a substantial lack of employment. These areas also coincide with the formally planned, segregated lower income residential areas, wedged between higher income development axis. Figure 3 also shows a nice local mix of employment supply and demand around Bellville and Somerset West nodes. While informative, Figure 3 does not clearly identify any specific employment concentrations or clusters outside the historic CBD.

Identifying employment centres based on Aguilar and Alvarado

To identify specific employment centres or clusters often a threshold approach based on two criteria is used. One criterion is a simple count of employment to ensure that resulting centres have sufficient mass and the second criterion is employment a density measure to ensure that employment is sufficiently concentrated. This latter criterion also corrects for size inequalities which in this case are the transport zones. Giuliano and Small in their 1991 Los Angeles study used as thresholds an employment count of 10,000 and an employment density of 2,500 jobs per square kilometre. Aguilar and Alvarado in their 2004 study of Mexico City used the same employment count threshold but lifted the density requirement to 5,000 jobs per square kilometre. As employment centres may consist of clusters of adjacent transport zones the correct identification procedure is as follows: first select all zones with sufficient employment density, secondly cluster the selected zones if spatially adjacent and finally count the employment opportunities per cluster. Applying the Mexican thresholds to the 2013 Cape Town Transport Zones resulted in the identification of 14 different employment centres all, except Atlantis, shown in Figure 4.

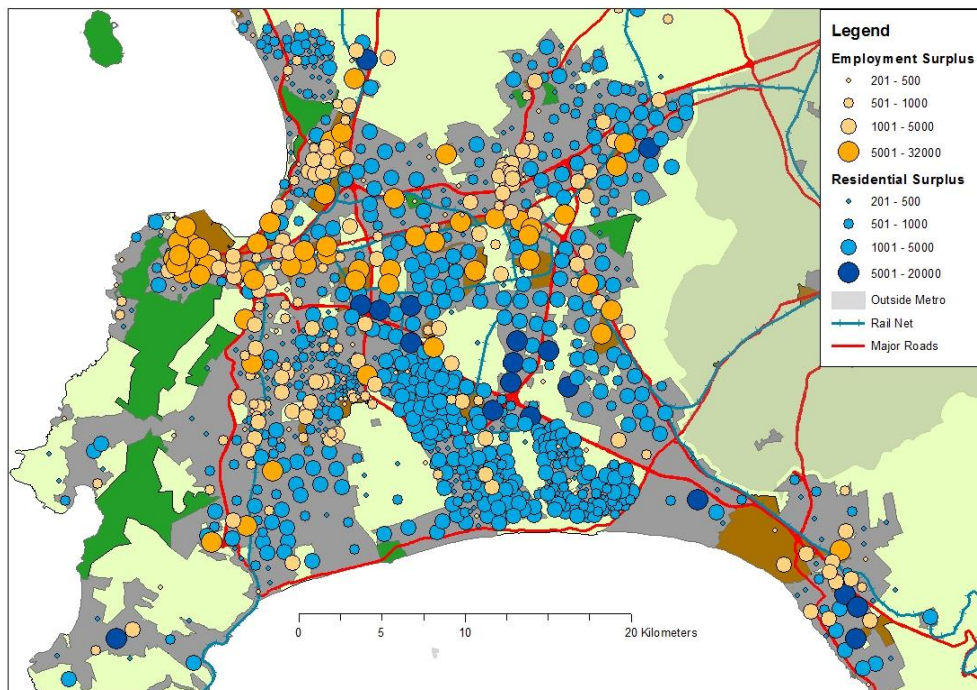


Figure 3: Application of modified Suarez and Delgado ratio for Cape Town

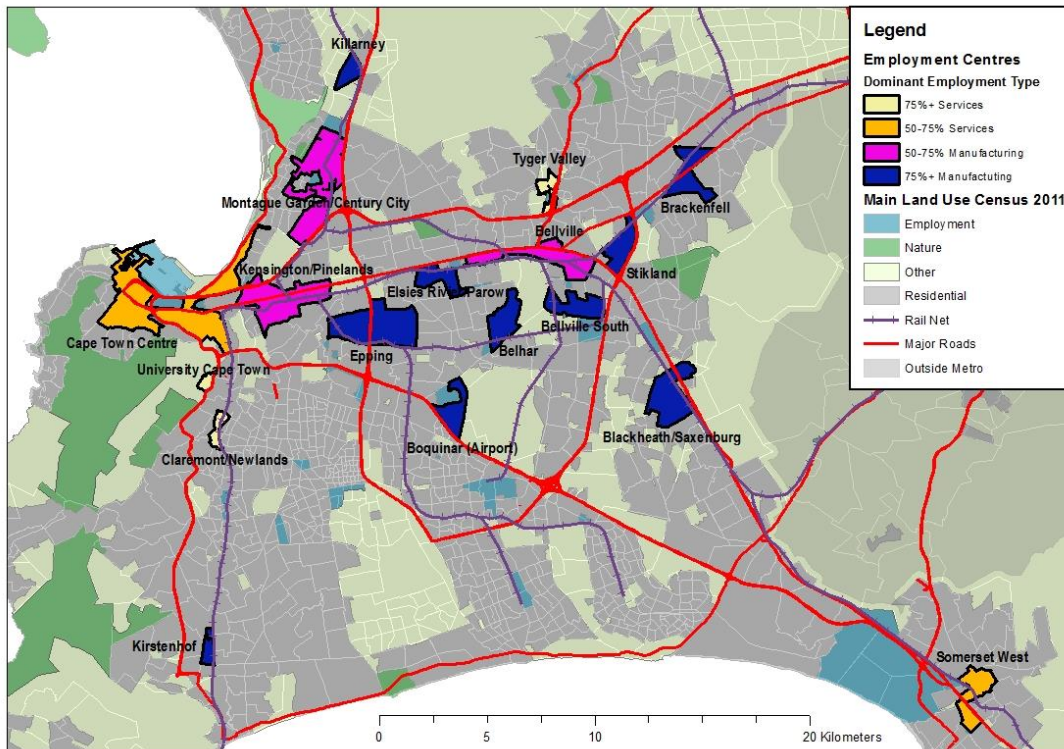


Figure 4: Cape Town employment centres (2013) identified using Mexican criteria

The Mexican criteria seem to work for Cape Town as the outcome is very acceptable. In the 2010 draft “Analysis of the Cape Town Spatial Economy”³ most of these centres were already identified as commercial centres. There is also no dramatic effect of dropping the employment density requirement to the level used for Los Angeles (2,500 jobs per square kilometre), the same centres are identified although they are slightly larger and in some cases nearby centres have merged.

As to the locations of the employment centres, Figure 4, the importance of the central city and its immediately adjacent areas still stands out. Few employment centres were identified near the metropolitan periphery. This spatial distribution confirms that Cape Town is in terms of Glaeser & Kahn (2001) definitely not an extremely decentralized employment metro, unlike Los Angeles or St. Louis in the U.S.A. In addition, many of the identified employment centres are located along major historic traffic arteries, like the railroads and the major urban roads. They are not associated with the recent major highways leading from the city. Also the employment structure of the identified employment centres does not point towards newly developing tertiary employment centres but rather to traditional centres still dominated by manufacturing. Of the fourteen centres, nine are dominated by secondary employment (Figure 4). In comparing the employment centres there is a high positive correlation (0.971) between percentage of workers in manufacturing and percentage workers with low income. All this seems to suggest that the majority of employment centres in Cape Town can be characterised as manufacturing based with a relatively low skilled workforce, spatially located in the prime locations of a century ago. Unlike American cities, Cape Town did not experience the same impact of car mobility and free-market decentralization which led to the massive suburbanization of the residential population and economic activities.

Conclusion and findings

This paper attempted to analyse the current urban form and structure of Cape Town building the earlier international definitions and findings of polycentric urban form in the USA followed by the more recent Latin American experiences. There are various, sometimes ambiguous, definitions of polycentric urban forms, covering different conceptual, functional and morphological perspectives and spatial scales. This paper defined polycentric urban areas as any single metropolitan area with two or more

³<https://www.capetown.gov.za/en/sdf/Documents/Nov2010/AnalysisOfSpatialEconomyS.pdf>

employment (or population) centres, with a threshold exceeding 10 000 employment opportunities and where the employment (or population) is not predominately concentrated in one centre.

A spatially disaggregated employment dataset, based on transport zones, was used to explore some of the approaches discussed in Table 1. Three main conclusions can be drawn from the methodology and data; First the gravity points of employment and population have already moved substantially away from the old port oriented CBD, indicating that employment and population is definitely not concentrated in the CBD. Cape Town is, however, not a monocentric city by international comparison and criteria. Application of the Glaeser Rings, however, reveals that Cape Town is also not a typical decentralised metro. Second, based on Suarez and Delgado the data indicates big local mismatches between demand and supply of employment, especially in low income neighbourhoods. There is a clear lack of employment (be it concentrated or dispersed) which undoubtable will have some significant transport demand implications. Thirdly, using the Aguilar and Alvarado threshold criteria it was possible to identify fourteen employment centres. Nine of the fourteen are manufacturing clusters, as opposed to the more regular observed service centres. These manufacturing centres seem to cater for lower income and hence lower skilled employment.

Overall it can be concluded, that Cape Town is neither a typical monocentric city nor a decentralised city. Polycentric nodes, as defined and distinguished internationally are definitely present in Cape Town. These nodes seem to follow the historical railway lines and are imbedded within the historic spatial urban footprint. The new planned townships, housing the greater part of the population, does not reveal any clusters. Future research may do well to consider the impact of this polycentric structure on spatial equity of the city or the implication for public transport in terms of financial viability and level of service.

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GROUNDING ARCHITECTURAL PRACTICE: EXPLORING SPATIAL CAPACITY BUILDING IN INFORMAL SETTLEMENT UPGRADING

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Abstract: Architectural professionals have the potential to contribute to informal settlement upgrading. However, this potential is negated by the extremely limited realm of professional architectural discourse. Drawing on the work of Lefebvre, grounded architectural practice (GAP) will be developed as a conceptual framework to explore spatial capacity building in the context of *in situ* informal settlement upgrading projects. By participating in live projects in informal settlements, the authors will explore the highly improvising and generative everyday practices of the urban majority. Architectural practice in such a context requires a multi-disciplinary approach which extends beyond conventional professional boundaries, and attention must be paid to building the spatial capacity of all participants to function in such uncharted territory.

Introduction

UN-Habitat (2009, 6) predicts that future urban development will be characterised by inequality. In spatial terms, Santanicchia (2014, 44) describes inequality as fractures created by buildings and infrastructure, separating residents from opportunities. Against this context, Lafferty (1996, 185) sees sustainable development as an explicitly political and normative project. Agyeman, Bullard, and Evans concur, stating that a truly sustainable society is one where wider questions of social needs and welfare, and economic opportunity are integrally related to environmental limits imposed by the supporting ecosystem (2002, 78).

Swilling, Musango, and Wakefield (2015, 6) posit that a just transition towards sustainable urbanism – achieving both social and environmental sustainability – is “only possible if the overall goal is human well-being in a sustainable world”, stating that “game changers emerging out of niche innovations should be coalescing around viable alternatives”. In this paper, we understand *in situ* upgrading of informal settlements to be a viable alternative, and architectural professionals who engage with residents to support *in situ* upgrading, as game changers. Sverrisdóttir (2014, 104-106) describes the central role of architectural professionals in society, as people with specialised abstract knowledge, and trained in strategic fields which contribute to the greater good of society. However, Marschall and Kearney (2000, 2) state that architectural professionals must acknowledge that South Africa is a developing country, with specific financial, material and labour constraints. Cognisant of this reality, architectural professionals can contribute to urban developments which promote socio-spatial justice.

However, despite meaningful contributions by individual architectural professionals, Combrinck (2015, 3) notes the sustained marginal position which the architectural profession maintains towards *in situ* upgrading. In order to achieve meaningful transformation within their profession, architectural professionals need to embed themselves in the continually changing, complex and dynamic systems of informal urbanism, and explore the “highly improvising and generative everyday practices of the urban majority” (Pieterse 2008, 2-3). Mayet (1995, 49) urges the architectural profession to “change course from a history of entrenched exclusivity” and to confront the needs of a changing society, not only to regain its relevance, but to ensure its survival. To do so, the city – both formal and informal – must be approached as a fundamentally emergent and therefore open-ended reality, and the artificial boundary between the formal and the informal undone (Pieterse 2008, 4; Schoon and Altröck 2014, 215). According to Pieterse (2008, 14) the architectural profession has an ethical obligation to look beyond this boundary, and to support informal settlement residents in their stubborn appropriation of the city. For Combrinck (2015, 3-4), this entails overcoming the “inability to engage meaningfully in a context that fundamentally challenges the construct of professional architectural service”.

Meadowcroft (2011, 73) calls for explorations of innovative conceptions of living – such as the practices of informal settlement residents – and how they can unsettle established practice in order to move beyond the “frontiers of the possible”. Heeding this call and drawing on the South African tradition of applied intellectual engagement described by Oldfield *et al.* (2004, 287), we will explore how spatial capacity building occurs when architectural professionals engage with informal settlement residents during *in situ* upgrading projects, thereby grounding architectural practice in an informal settlement context. In the paper we observe architectural professionals who claim a different – often independent and subsequently unexplored – position, requiring a range of different skills, attitudes and roles (Lofvers and Devos 2015, 3). This approach draws on both phenomenology and

action research; the latter described as being subjective, collaborative, reflective and experiential, transforming all participants into researchers whose capacities are enhanced in the process (Abdel-Fattah 2015, 311). In this paper we will discuss two *in situ* upgrading interventions in Cape Town. Our engagement with these interventions was through the Design Build Research Studio (DBRS), which facilitates live projects in the Department of Architectural Technology and Interior Design at the Cape Peninsula University of Technology (CPUT).

Grounded in reality?

Kipfer, Goonewardena, Schmid, and Milgrom (2008, 6) describe the city as a contradictory mediation between everyday life and the social order. In South Africa, one could argue that “everyday life” equates informality and “the social order” formality. Huchzermeyer (2011, 75) problematises this mediation, stating that our knowledge of informal settlements will always be incomplete and out of date. Thus, from the perspective of architectural practice – “a distinct, superior, specialised, structured activity” as described by Lefebvre ([1961] 2002, 210) – fully comprehending everyday life is challenging. Lefebvre further argues that the capitalist-industrial rationality’s “will to abstract” has resulted in innumerable human beings having been tortured by innumerable conflicts ... since abstract rational social processes became detached from the realm of immediate and direct relations between individual people (*ibid.*, 214).

However, according to Goonewardena (2008, 128) no specialised activity is ever fully removed from everyday life, and that this alienation is a result of the “relative autonomy and incomplete detachment of elevated activities from everyday life”. Thus, our conceptual framework of grounded architectural practice (GAP) derives from Goonewardena, who encourages architectural professionals to be *grounded in reality* ... overcoming existing relations – separations – between abstract processes and concrete life (2008, 118) as well as from Oldfield, Parnell and Mabin, who call for “morally engaged work that is constructive through critiquing existing ideas and reconstructing alternatives ... processes of conceptual deconstruction and reconstruction that build from *grounded engagement* with empirical realities and political imperatives” (2004, 295).

Boonstra, Vogel, and Slob (2014, 258) note a shift of power away from governments, providing opportunities for GAP where architectural professionals engage in with informal settlement residents in local partnerships and practices (such as enumeration and reblocking) as equals rather than experts. In doing so, they must remain aware that *in situ* upgrading is a team effort, with leadership continually shifting between different disciplines and stakeholders (Cooke 2014, 27), in essence a multi-disciplinary practice that extends beyond conventional professional boundaries. Archipovaite (2015, 7) suggests working in teams consisting of people with different ideas and skills, thereby encouraging residents to recognise their own capacities (Jack 2014, 28) and to take part in a collaborative design process as co-designers.

Operating in this manner requires spatial capacity building by all stakeholders, to improve their ability to reflect collectively on the spatial transformation processes taking place in their environment and to act collectively on these processes (Constantinescu, Devisch, and Huybrechts 2015, 3). The technical and theoretical skills associated with the architectural profession – the “defaulting into design” when confronted with complex issues (Huchzermeyer 2013, in Combrinck 2015, 2) – must yield to a deeper appreciation and openness towards different ways of seeing and responding to problems, as well as cultural identities and dynamics of informal settlement residents (Pieterse 2008, 129).

Live projects

Our engagement with the two *in situ* upgrading interventions was by means of live projects where we, together with fourth year Architectural Technology students from CPUT, collaborated with residents to contribute to their upgrading trajectory. In both cases this engagement was facilitated by local NGOs, to ensure that our involvement did not compromise the continuity and sustainability of the upgrading interventions. The NGOs are the Community Organisation Resource Centre (CORC, a mid-size NGO affiliated to the Informal Settlements Network - ISN), through whom we engaged with residents of Lwazi Park in Gugulethu, to develop new incremental housing typologies; and Violence Prevention through Urban Upgrading (VPUU NPO, formerly a programme of the Western Cape Provincial Government - WCPG), through whom we engaged with residents of Lotus Park, also in Gugulethu, to design and build a small public space intervention.

Live project 1: Lwazi Park

Lwazi Park is an informal settlement of forty households located next to the Lotus River canal, between Gugulethu and the Barcelona informal settlement. The first residents of Lwazi Park built shacks along the canal in the mid-1990s, adjacent to the Lwazi Park Primary School. The City of Cape Town (CoCT) initiated a canal widening project in early 2011, which would involve the relocation of the settlement to a portion of land further along the canal. Without consulting residents, an external consultant employed by the CoCT prepared a conventional, uniform settlement layout based on standardised erf sizes (seven by eight metres) and allowed for eight shared free-standing toilet enclosures and two water points (CORC, Lwazi Park

Community and South African SDI Alliance 2011). However, the layout could only accommodate twenty-six households, meaning that some households would have to be relocated elsewhere, and as a result the residents rejected the proposed layout (ISN, Lwazi Park Community Leadership and CORC 2011, 5). At this time, the CoCT had already been engaging with CORC regarding informal settlement upgrading, and they called on CORC to assist with the situation. CORC facilitated an introductory meeting between CoCT officials, Lwazi Park representatives and the external consultant, where the problematic nature of the proposed layout was discussed. The representatives saw the impending relocation as an opportunity to upgrade their settlement, and indicated that they wanted CORC to assist them with planning and negotiations (CORC *et al.* 2011). The CoCT agreed to this and allowed time for a participatory design process, which included resident-based mapping (measuring of erven and shacks), enumeration (socio-demographic survey of every household) and the layout of the relocated settlement (ISN *et al.*, 2011:5). Many informal discussions occurred, during which residents were able to express their real concerns around the CoCT consultant's proposed layout: wide streets would be a thoroughfare to Barcelona informal settlement, insufficient perimeter security, and a lack of space for communal services such as washing and laundry areas (CORC *et al.* 2011). The representatives, assisted by CORC, prepared a report describing their current living conditions, enabling them to engage the CoCT constructively with regard to their real and most pressing needs.

An architectural professional from CORC then facilitated the collaborative design of a settlement layout reflecting the needs and priorities of residents, using the same portion of land indicated by the CoCT (ISN *et al.* 2011, 5). Shacks were organised along the settlement perimeter, with different erf sizes provided according to household needs, and arranged to form courtyards where women could gather and children play. Adequate space was allowed for toilets and communal services, as well as for a small central play area and a future community hall or crèche (CORC *et al.* 2011). CORC and the CoCT mediated between the residents and the external consultant, and they agreed on the co-designed layout, minimally revised in order to satisfy fire safety regulations. Within a week of this agreement, residents moved their shacks over to the relocation site with the help of a CoCT truck, where the layout had been marked out and toilets and electricity poles were being installed. Some households applied to the ISN Community Upgrading Finance Facility (CUFF) to build new, upgraded shacks, contributing twenty percent of the cost of their upgraded shack, which however was still only fifteen square metres in size (CORC *et al.* 2011).

The relocation set in motion a process where residents began to imagine the next phase of settlement upgrading. CORC and DBRS undertook a live project during April 2015 to contribute towards this process by developing alternative settlement layouts and housing typologies suited to incremental upgrading. Together with the CPUT students, we were introduced to the project by representatives from CORC, Lwazi Park and the CoCT. This was followed by a site visit to Lwazi Park where students met with residents and discussed their needs and priorities. The collaborative design process between the students and Lwazi Park representatives took place in the CPUT design studio, with lecturers and the architectural professional from CORC providing guidance when necessary. The design process started with a site analysis based on information provided by CORC and the CoCT, as well as interviews conducted on site. The analysis facilitated an understanding of the physical context and spatial planning issues, most of which pertained to the relationship with neighbouring settlements, the challenges of everyday life, and community needs. Students became aware that many things which they take for granted were absent: heating, piped water, toilets and showers.

The students then started negotiating the difficulties of planning, urban design and landscape architecture in an unfamiliar context. Settlement layouts were developed in an interactive and fluid collaborative design process punctuated by real-time input from residents and CORC. Having to adjust their design based on the input received made clear the complexity of balancing residents' needs with the students' own design intent. Conceptual settlement layout diagrams were developed individually and then discussed in groups, with the best ideas combined into a new iteration. This was a rich process due to the variety of voices, and different settlement layout options were tested as overlays over existing maps and aerial photography. Different strategies to allow for passive surveillance and sufficient access to shared facilities, while ensuring that residential areas are private and secure, were explored. The residents required each housing unit to have a direct relationship with ground, preferably with a small front yard, and that units should allow for incremental expansion so that each household can adapt their unit to their own evolving needs over time. In order to facilitate this, the students decided to design a core structure, to be funded from the housing subsidy which residents were planning to apply for. Appropriate materials and construction methods were explored in terms of cost, performance and availability. While this was within the realm of expert knowledge, which the students are used to applying in their design projects, the residents provided crucial information about the relation of spaces and functions, as well as the internal layout of housing units. After the completion of the collaborative design, it was agreed that the alternative settlement layouts and housing typologies would be presented to all Lwazi Park residents on site, in order to contribute to the ongoing negotiations with the CoCT with regards to the upgrading of Lwazi Park.

Live project 2: Lotus Park

Lotus Park is an informal settlement situated at the Nyanga Junction train station in Gugulethu, between the train line and the Lotus River canal. Originally a forested area with footpaths from the station to Gugulethu, the area had become deforested by the mid-1990s as a result of nearby residents collecting firewood. During the mid-2000s residents living along the canal who fell victim to flooding, as well as backyard dwellers from the nearby Khikhi hostel, were relocated to Lotus Park by the CoCT (VPUU 2011). In 2009, residents embarked on service delivery protests, with bucket system sanitation and the dangerous environment as key issues. In response to the protests, the CoCT asked VPUU to adapt their violence prevention methodology to an informal settlement context, using an *in situ* developmental approach. Lotus Park was one of three pilot sites identified (VPUU 2014b), and VPUU were introduced to residents as an agency that would facilitate the infrastructure development of their settlement by acting as an intermediary between residents, the CoCT, WCPG and other stakeholders.

Soon after this, a Community Facilitator (CF) was appointed to facilitate the development process, based on VPUU's methodology to reduce crime, increase safety and security, and improve living and social conditions in the settlement through urban improvements and social interventions (VPUU 2015). Subsequently, a Safe Node Action Committee (SNAC), representative of all residents, was established and a workshop held to develop a common vision for the development of Lotus Park. The findings of the workshop informed a Baseline Survey (VPUU 2011) as well as a Community Action Plan (CAP), a settlement development plan which identified projects and interventions. The CAP, consisting of both spatial layers and work streams, guided the development of a Spatial Reconfiguration Plan (SRP) during 2012. The SRP is a medium-term project which identifies the nature of interventions and priorities relative to strategies, programmes, timeframes and budgets in consultation with all stakeholders, including CoCT line departments.

The SRP included a Neighbourhood Centre (NHC), which was to function as a safety catalyst and provide community facilities, including offices for local organisations, meeting rooms, a hall, early childhood development (ECD) facilities, and an *emthonjeni*: a multifunctional space with a selection of utilities (e.g. water points), places for gathering, playing, washing and conducting business (VPUU 2014a; Ewing 2015). As Lotus Park is an informal settlement, the NHC had to be a temporary building in order to obtain CoCT Building Control approval, which resulted in initial resistance from residents. The project brief was developed in collaboration with the SNAC, and architectural professionals from VPUU used rough models throughout the collaborative design process. The building process – planned for six to nine months – took a year, with some residents employed as labourers. This involved a mentoring process by the contractor's skilled craftspeople, resulting in the sandbag wall construction of the hall having had to be rebuilt thrice. After practical completion, the architectural professionals remained involved in the process of the SNAC and residents settling into the building prior to the official opening. This extended involvement was crucial in addressing problems relating to the grey water recycling system, used in the absence of a municipal sewer connection. An existing play space next to the NHC was upgraded into a hard court in soon after completion of the building, and a walkway from the main road (NY3) to the NHC was completed in 2015.

VPUU and DBRS undertook a live project in April and May 2016 to design and build a public space intervention at the NHC, commencing with a site visit and guided walkabout. An architectural professional from VPUU described the history of their involvement in Lotus Park to the students, after which they worked on a site analysis in the NHC. Based on the site analysis and discussions with residents who volunteered to take part in the live project, possible spatial interventions were proposed. These were to be designed collaboratively in groups, consisting of students and residents, working at both the NHC and at the CPUT design studio. Concept designs were presented to residents at the NHC during the last week of April, after which a group of twelve students were identified to proceed with the technological design and construction of the proposed intervention. The architectural professional from VPUU, residents and ourselves reviewed the proposed interventions and to selected a design for implementation by means of a vote. The selected design was developed further developed by the students, in liaison with their Construction Technology lecturer and a structural engineer. The design of the steel brackets and reinforcement bars had to be finalised urgently to allow sufficient time for manufacturing.

However, a couple of days before construction was to commence, we received an email from VPUU reporting that the proposed intervention was discussed at the weekly meeting of the SNAC (of which only one member attended the concept design presentation). They felt that they had not been sufficiently consulted in the design process, and were concerned about the form and function of the intervention. This was in part due to a misinterpretation of computer renderings which were displayed at the NHC, and with the use of a cardboard model and revised renderings one of our isiXhosa-speaking students addressed the SNAC's concerns at their next weekly meeting. This had postponed the construction by one week (and only two weeks were set aside for construction due to the students' mid-year portfolio review). As the construction work was to take place in two groups – six students working on site under supervision of a local contractor, doing excavations and preparing for the concrete to be cast, and six students working in an off-site workshop to prepare and test assemble the timber structure – it was decided

to attempt to complete the entire project in one week. Progress was slower than expected due to the risk of theft on site and cumbersome procurement processes at both VPUU and CPUT, which resulted in a delay in delivery of material. However, the delays allowed more time for planning, which resulted in more efficient work once the material had been delivered. At the end of the week, the concrete work had been completed and the timber structure had been test assembled, but there was not sufficient time to erect the timber structure on site. As a result, the project has been put on hold until such time as student volunteers to take part in the completion of the intervention.

Discussion

GAP was developed as a conceptual framework to explore an emergent form of culturally appropriate and sustainable architectural practice in the context of *in situ* informal settlement upgrading projects. By drawing on the work of Lefebvre, it was determined that GAP has characteristics of pragmatic bottom-up and top-down policy-driven strategies, and occupies the conceptual space between the informal and the formal. By participating in two live projects, we were able to explore architectural practice premised on a multi-disciplinary approach which extends beyond conventional professional boundaries. By building connections between architectural professionals, researchers, NGOs, informal settlement residents and local government, situated knowledge can be unlocked and used in conjunction with the expert knowledge of the architectural professional. This enables informal settlement residents to articulate their own needs and become involved in the spatial processes which impact on their lives.

In both live projects, important issues were raised by residents in the collaborative design process, and their situated knowledge proved integral to the development of both the settlement layout and the housing typologies at Lwazi Park, as well as the spatial intervention at Lotus Park. Some students reflected that the project could have progressed faster if the community involvement had been more intense, and also found that interacting with the architectural professionals from CORC and VPUU was less challenging than engaging with the residents. It also became evident that the priorities of architectural professionals and residents are often different and that these differences can be surfaced and addressed in the collaborative design process. Unforeseen opportunities came to the fore when engaging with residents, both in the design studio and on site. The more direct relationship between designer and occupant fostered an empathy which contributed to the success of the design outcomes. In addition to becoming sensitised to the poverty and lack of opportunity which residents of informal settlements such as Lwazi Park and Lotus Park experience daily, we learnt to appreciate the complex problems faced by local government in addressing informal settlement upgrading.

The marginality of the architectural profession in informal settlement upgrading can be addressed by building the spatial capacity necessary to design context-specific and resident-centred interventions. This capacity includes developing an appreciation of the incremental and cumulative nature of informal settlement upgrading, as referred to by Hendler and Meke (2015) in their report on the Lwazi Park live project for CORC. The live projects presented in this paper offer a preliminary view into the capacities required to engage in culturally appropriate and sustainable architectural practice, and it is expected that deeper and more complete analysis of the two projects discussed will yield further insights as the principal author's doctoral research continues. It is envisaged that the findings of this research will assist in unsettling established architectural practice by embracing the contingency inherent in engagements with *in situ* informal settlement upgrading. In doing so, this research will contribute to the evolution of architectural practice in South Africa.

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THE IMPACT OF MINE CONSTRUCTION ON NOISE LEVELS IN CHANENG: A RURAL VILLAGE IN NORTHWEST PROVINCE

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Abstract: Any change in land-use in an area results in a change in the prevailing ambient conditions such as the prevailing noise and ground vibrations within that area. A rise in the noise and vibration levels could have an impact on the health and well-being of the people and also affect the infrastructure of the area. The level of exposure would depend on the type of activity, the distance from the source and the attitude of the people exposed to the land-change activities. The objective of this study was to identify, compare and determine the impact of establishing a mine on the inhabitants of Chaneng Village, 900 metres from the mine footprint area. The assessment took place over a 24-month period and the data were collected using recognised and appropriate instruments. The fieldwork was backed up by an environmental noise- and ground-vibration monitoring and management plan. It was found that there was an increase in the environmental noise and ground vibration levels along the boundaries of the mine footprint area and only a slight increase in these variables in the residential area - the latter being within the recommended parameters of the statutory regulations.

Introduction

Noise is a phenomenon that affects everyone since we are constantly exposed to noise in our daily lives (Muzet, 2007). In fact, noise pollution is steadily increasing in all countries of the world. However, this is often an unnoticed environmental problem (Mato & Mufuruki as cited by Van der Merwe & Von Holdt, 2006). There are different types of noise issuing from the environment such as sustained or unsustained noise, fluctuating noise and tonal noise (Botteldoorn, De Coensel & De Meur, 2006). Exposure to transportation noise, domestic noise, aircraft noise, industrial noise and ground vibration, for instance, depends on the location of the receptor in relation to the noise source (Muzet, 2007). Industrial activities could prove to be a source of excessive noise for the surrounding areas when they are in close proximity to noise-sensitive areas. However, the components of industrial noise could be complex owing to the wide variety of sources from which noise is generated - as in the case of mechanised equipment and machinery (Öhrström & Skandberg, 2004).

Universally, urbanisation and economic development often surge ahead, owing to unco-ordinated planning, putting the poor and the less fortunate in society ever closer to and in contact with the ever-proliferating commercial and industrial areas of the world (Van der Merwe & Von Holdt, 2006). As found in a study by Wong, Chau & Wong (2002), it seems that people are less concerned about noise pollution as a social concern. In fact, these researchers found that the population of Hong Kong did not object to noise pollution *per se*, although they ranked this category third after air pollution and security as a problem facing the city. In the case of South Africa, the term 'environment' underlies the National Management Act (Act 107 of 1998). "Environment" refers to the surroundings, made up of natural and human elements, in which people live. This term refers to the interrelationships between the artefacts, mentifacts and sociofacts that are intrinsic to human culture and that can affect human health and well-being (Van der Merwe & Von Holdt, 2006).

The aim of this paper was to investigate the possible impact of noise pollution caused by mine development on the inhabitants of Chaneng Village in Northwest Province, South Africa. This paper is divided into five sections. The first section presents a literature review on the impacts of noise pollution; the second provides a description of the study area and a statement of the research objectives. The third section deals with the research methodology used in this case study, while the fourth showcases the results of environmental noise and the possible impact on the inhabitants of the study area. The final section offers recommendations and concluding remarks.

Literature review

Sound is produced by a mechanical oscillation in a free field and is generated as a motion wave through the air or any other material. Sound is measured in decibels (dB) and has two characteristics, namely amplitude and frequency. Amplitude is the amount of pressure that is exerted by the air when a sound is made, and is measured in Pascals (Pa). However when reference is made to sound *per se*, the dB scale is used instead of the sound pressure scale (Muzet, 2007). The dB scale covers a wide range, varying between 0.0dBA and 140dBA's (Lercher & Schulte-Fortkam, 2003).

The audibility range of sound is not equally sensitive to all sound frequencies over the entire sound spectrum as some people might be sensitive to a high-pitched sound, whereas others might not be able to hear such a sound at all. When environmental

noise is measured, a weighting network is used to filter the frequency of sound to imitate the functioning of the human ear. Since the sound pressure level is expressed in dBA's, which is a logarithmic measure, an increase of 10 dBA's in the sound level is perceived by the human ear as a doubling up in the loudness of the sound (Sharland, 2005).

Environmental noise is defined by the intensity, frequency and periodicity of a specific sound that is introduced into an area, and is measured in A-weighted Decibels (dBA's) (Gilchrist & Allouche, 2005). The recommended ambient noise level for a rural area is between 35,0dBA's (night-time) and 45,0dBA's (day-time) (SANS 10103, 2008), while the recommended noise level for residential areas is 45.0dBA's at night and 55.0dBA's during the day. Day-time noise levels of 70.0dBA's are recommended for industrial areas (WHO, 2000).

Studies on the effects of noise on the quality of the urban living environment and the quality of human life previously focused on the negative impacts on human beings such as sleep disturbance, the annoyance factor, and medical conditions - all associated with interruptions in sleeping patterns. The current focus embodies a more holistic approach by taking the negative, positive and non-residential functions of the urban environment into consideration when quantifying the noise problem associated with regional development or a change in land-use from rural to urban functions.

The negative effects of noise are those detrimental impacts imposed upon the health and well-being of a person. Positive effects, on the other hand, such as the singing of birds or soft music, are ways in which sound can be used beneficially to mask a noise or to cause a person to relax. At the other end of the spectrum, in the category non-residential functions of noise, and of interest to researchers, are the raised noise levels generated by traffic and industry (Soederlund & Sikstroem, 2008).

When noise analysis studies are undertaken, the impact of a signal should be investigated in terms of not only the variations in the statistical noise level values, but also the spectrum of amplitude (and pitch) fluctuations (Botteldoorn et al., 2006). An increase in noise above the prevailing ambient levels would induce a reaction in a community or a group of people which could vary between no observed reactions to vigorous group reactions.

It is generally accepted that the health and well-being of a person exposed to higher noise and vibration levels through disruptive human activities could be severely compromised (European Parliament, 2002). Sound and/or unwanted sound (noise) can be evaluated by means of scientific methods whereby the intensity of the sound is measured through sound-measuring equipment and is analysed and evaluated in terms of South African legislation and standards. The level of interference can, therefore, be determined by comparing the prevailing ambient noise level to the projections made for the study area (Diaz & Pedrero, 2006).

The World Health Organisation defines health as a state of complete physical, mental and social well-being, so that any impact on this condition should be investigated, evaluated and controlled. Increased noise levels other than the prevailing ambient noise level should, therefore, be considered to be not only a cause of nuisance, but also a cause for concern for the health of the public and the environment (WHO, 2006).

The process of risk assessment of environmental noise requires knowledge of the following:

- the nature of the effects of noise and ground vibration on health;
- the levels of exposure to current noise and ground vibration levels at which negative health effects begin to occur;
- the number of people exposed to increased noise and ground vibration levels (WHO, 2011).

The WHO has identified health hazards and characterises the hazards in question, namely noise and vibration, as two of the factors pertinent to health risk assessment. Cardio-vascular disease, cognitive impairment, sleep disturbance, tinnitus and annoyance are amongst the more significant effects of excessive noise and vibration (WHO, 2011).

Some of the noise levels that people are exposed to on a daily basis and that contribute to the prevailing ambient noise level of a specific area are presented in Table 1. These noise levels range from a human breathing at 5 dBA's to jet engines at 140 dBA's. All of these categories could have an impact on the ambient noise in an area.

The South African perspective on noise

It is widely recognised that many aspects of mining operations lead to raised levels of environmental ambient noise and/or ground vibration. The impact of such high noise and vibration levels can be both physical and physiological, especially when they rise above the former prevailing ambient level (Garvin et al., 2009).

In terms of Regulation 66 of the Mineral Petroleum Resources Development Regulations GN R527, a holder of a permit or right must, in terms of the Mineral and Petroleum Resources Development Act (Act no. 28 of 2002), comply with the provision of the Mine Health and Safety Act (Act no. 29 of 1996), as well as with other applicable laws regarding noise management and control. Assessments relating to noise pollution management and control should form part of Environmental Impact Assessments, Environmental Management Programmes and Environmental Management Plans. Both the Environment Conservation Act (Act no. 73 of 1989) and the Air Pollution Management Act (Act 39 of 2004) make provision for the promulgation of Noise Control Regulations to control noise from industrial activities (GDACE, 2008).

Table 1: Typical sound levels in the environment to which people are exposed (AASHTO, 2013)

Examples of common, easily recognised outdoor sounds	Indoor Sounds	Decibels – dB's	evaluations	Subjective
A jet engine in close proximity, within a range of 15m			140	
	A rock band		120	
A motor cycle accelerating			110	Deafening
Noise in an urban street			90	
	A food blender within a range of 1m		90	
A noisy factory			85	Very loud
	A school cafeteria		80	
	A vacuum cleaner within a range of 1m		70	Loud
Noise in close proximity to a highway	Normal speech within a range of 1m		65	
			60	
	A quiet conversation within a range of 1m	55		Moderate
	Average office noise		50	
	A soft radio in an apartment		40	Faint
	A quiet bedroom at night		30	
An average whisper	An average whisper		20	
The rustling of leaves in the wind			20	Very Faint
	Human breathing		5	
The threshold of audibility			0	

The South African National Standards – SANS 10103 of 2008 – provides recommended noise levels and noise survey assessment methods for conducting noise assessments. However, each province has its own Noise Control Regulations, and provinces such as Northwest Province, Free State, Eastern Cape, Northern Cape, Mpumalanga and Limpopo allow for an increase of seven dB above the prevailing ambient noise level before a noise can be considered as a disturbance. On the other hand, the Gauteng Noise Control Regulation does not allow for an increase above the prevailing noise level at all (SANS, 2008).

In the case of this study, conducted in Northwest Province, the Corporate Social Responsibility Programme for the platinum mining industry in this province, under the Bench Mark Foundation (Africa), states that investments and business ventures are acceptable as long as they contribute towards sustainable development by empowering communities in the vicinity of the mines and by promoting the following principles:

- the enhancement of quality of life and of the environment;
- the generation of employment on a broad scale;
- the fulfilment of basic human needs;
- sensitivity to gender issues, particularly at leadership level;
- care for those infected and affected by the HIV/Aids pandemic; and
- pollution-free production (Bench Mark Foundation, 2009).

It is claimed that mining houses have adopted these principles on account of their interest in the health and well-being of their employees (Bench Mark Foundation, 2009).

Study area and research objectives

The mine development is in the vicinity of the Pilanesberg National Park and Sun City (Northwest Province), the latter located approximately five kilometres north of the new mine shaft complex. There are four villages in close proximity to the development, with Chaneng Village, 900 metres east of the development, being the closest. The new mine development will consist of a shaft complex with a main ventilation shaft and auxiliary ventilation shafts, a new waste-rock dump, a road for the transportation of mining materials and workers, and a gravel road accessing the present construction site. The ore will be transported to the existing concentrator by means of a conveyor system and/or heavy-duty trucks.

The exploitation of natural resources is regarded as a vital part of economic growth. However, the environmental consequences of such developments in South Africa have been neglected over a long period of time. The evaluation of mining activities and the controlling measures associated with them have become essential components in the steering of developmental processes in this country, and the negative environmental impacts of mining activities are now recognised as critical (Bridge, 1998).

Owing to the importance of development and mining in the South African context, much greater value is now being attached to the protection of the environment. For the Chaneng Village case study the following research objectives were formulated:

- to collect baseline information concerning the prevailing ambient noise levels before construction of the mine commenced;
- to ascertain/evaluate the impact of noise pollution during the construction phase of the project;
- to establish whether the increase in noise levels would perhaps contravene the Noise Control Regulations; and
- to quantify the alleged noise pollution impacts on the population of Chaneng Village.

The study area is a typical rural residential district which is exposed to increased noise levels caused by traffic, domestic activities and aircraft flying over the village. The residents have, therefore, already been and are still being exposed to increased noise levels associated with such activities on a limited to partially continuous basis. Some of the residents of the village have been exposed to noises and noise levels associated with mining activity as they are employed by the mines in the vicinity of Chaneng Village and also by the Styldrift Mine.

Research methodology

The noise survey was differentiated into a pre-construction phase and a construction phase. The pre-construction phase was conducted over a period of three months, namely over October and December of 2009 and February of 2010. The data collected during this period were considered to be the prevailing ambient noise levels for the study area before mining activities were commenced.

The noise survey conducted during the construction phase of the project extended over a period of 24 months, from September 2010 to August 2012. Although 22 measuring points were used in the study, only nine were selected for investigation. They included the following (see Figure 1):

- Measuring points 1, 2 and 3, along the boundary of the mine shaft complex (the mine footprint area);
- Measuring point 4, along the feeder road in Chaneng Village;

- Measuring points 5 and 6, along the proposed conveyor line (along the haul road at the time of the study); and
- Measuring points 7, 8 and 9, along the western boundary of Chaneng Village.

The measuring equipment used for the environmental noise survey included a Class 1 sound level meter that complies with the accuracy requirements specified in SANS 656, SANS 658 and SANS 61672-1. The instrument was calibrated at an approved calibration facility. Noise readings were taken on a monthly basis, while extraordinary noise events such as that associated with aircraft flying over Chaneng Village at the time, were ignored (the Sun City Airport is to the north-east of Chaneng Village). The noise survey was differentiated into a pre-construction and a construction phase.

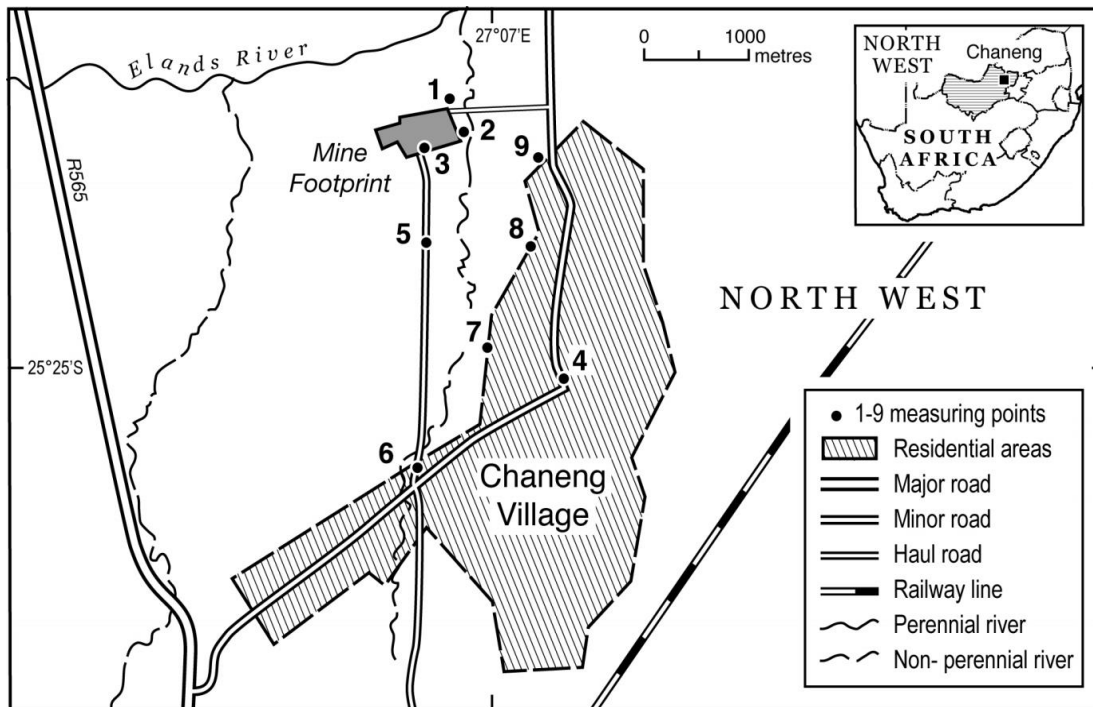


Figure 1: Location of the mine and measuring points

Environmental noise results for the study area

The ambient noise levels for the study area during the pre-construction period (October 2009 to February 2010) are indicated in Table 1. These values provide the baseline noise levels for the area. Averages were calculated from the three values obtained (for daytime and night-time readings) to calculate the average prevailing ambient noise levels for each respective measuring point. For this period, the values ranged from 31.2dBA's to 60.9dBA's during the day and from 30.1dBA's to 48.3dBA's at night. However, two measuring points registered much higher values. For instance, the prevailing ambient noise levels recorded at Measuring Point 4, located alongside the feeder road in Chaneng Village – were of the order of 60.9dBA's during the day and 48.3dBA's during the night. The second Measuring Point 6, next to the village and the proposed conveyor line, which was used as a haul road during the study period, recorded values of 56.5dBA's and 47.4dBA's for day and night respectively (see Table 2). At both these points, the higher ambient noise could be attributed to human activities in Chaneng Village. Calculations were made to determine the average prevailing ambient noise levels for the study area during the day (41.6dBA's) and at night (38.2dBA's). It was clear from the study undertaken during the pre-construction phase that these noise levels were in line with the recommended noise levels for residential areas in accordance with SANS 10103 of 2008.

It should be kept in mind that only averages were used for determining the noise levels in the vicinity of Channing Village for the construction phase of the mine. During 2010, the ambient noise levels were measured during the last four months of the year (September to December), each of the months of 2011, and during the first eight months of 2012, from January to August - in total, over a period of 24 months. Although high values were also recorded during the study period and the construction phase of the mine – namely 63dBA's in May 2011 and 61.6dBA's in February 2012 – both these values were measured within

the village and at some distance from the mine footprint area. As such, these ambient noise levels should be attributed to human activities. However, because only averages were used in this context, these peaks of higher values are not as clearly apparent.

Table 2: Prevailing ambient noise levels for the study area in the pre-construction phase

Measuring Points	Oct 2009		Dec 2009		Feb 2009		Average prevailing ambient noise level	
	Day Leg dBA's	Night Leg dBA's	Day Leg dBA's	Night Leg dBA's	Day Leg dBA's	Night Leg dBA's	Day Leg dBA's	Night Leg dBA's
1	42.9	32.4	31.8	30.2	41.0	41.9	38.6	34.8
2	38.1	35.2	31.2	30.2	37.5	37.5	35.6	34.3
3	42.6	34.8	33.3	30.1	37.2	38.6	37.7	34.5
4	60.1	40.1	59.0	45.4	60.9	48.3	60.0	44.6
5	32.1	39.1	34.8	36.7	39.1	35.0	35.3	36.9
6	56.5	44.7	52.7	47.7	52.9	44.4	54.0	45.6
7	36.8	36.9	35.5	36.6	41.2	34.1	37.8	35.9
8	34.6	34.6	36.8	37.3	38.9	35.7	36.8	35.9
9	38.9	36.3	33.2	39.7	42.9	48.3	38.3	41.4
Average prevailing ambient noise levels for the area							41.6	38.2

It is clear that an increase in ambient noise did occur in the vicinity of Channing Village during the construction phase of the mine (see Table 3). The highest average values for the study area were recorded for 2012 at Measuring Point 3, where the proposed conveyor line (the haul road at the time of the study) enters the footprint area of the mine. Average ambient noise levels of 58.3dBA's during the day and 51.0dBA's at night were recorded (the averages for the two-year period being 54.2dBA's (day) and 42.1dBA's (night) respectively) because construction work during the 2012 period was on a continuous basis (24 hours per day), thus accounting for the higher night-time ambient noise.

A second measuring point with extraordinarily high average values was Measuring Point 4, located alongside the feeder road within Chaneng Village but at some distance from the construction area. It recorded values of 54.8dBA's and 45.8dBA's for average ambient day-time and night-time noise respectively. For the study area, average ambient noise levels during the construction period were calculated at 45.9dBA's for the day and 40.9dBA's at night.

Table 3: Prevailing ambient noise levels for the study area during the construction phase

Measuring Point	2010 space arithmetic average		2011 space arithmetic average		2012 space arithmetic average		Total space arithmetic average	
	Leg dBA Day	Leg dBA Night	Leg dBA Day	Leg dBA Night	Leg dBA Day	Leg dBA Night	Leg dBA Day	Leg dBA Night
1	45.9	32.4	42.2	38.0	49.2	47.8	45.8	39.4
2	50.0	35.4	44.5	37.3	44.5	47.2	46.3	40.0
3	54.7	39.5	49.6	35.8	58.3	51.0	54.2	42.1
4	56.2	43.6	51.5	46.3	56.8	47.6	54.8	45.8
5	57.3	36.2	39.3	35.5	37.5	40.3	44.7	37.3
6	46.3	39.5	40.5	42.1	43.2	45.1	46.7	42.2
7	41.6	39.2	38.8	40.6	37.7	41.7	39.4	40.5
8	38.0	38.1	37.2	37.9	39.9	39.9	38.4	38.6
9	43.1	42.9	41.3	40.7	43.2	42.6	42.5	42.0
Average prevailing ambient noise levels for the area during the construction phase							45.9	40.9

According to SANS 10103 (SANS 2008), the recommended noise level for an industrial area is 70.0dBA during the daytime. It is clear from this study that the respective average prevailing ambient noise levels at the three measuring points in the mine footprint area (1, 2 and 3) are below this. The largest increase in noise (+16.5dBA's) was measured at Measuring Point 3, where the haul road enters the mine footprint area. The recommended noise level for areas that are categorised as having traffic and being occupied by, businesses and residential land are 60.0dBA's and 50.0dBA's for day and night respectively. Measuring Points 4 to 9 that are all located in the above-mentioned land-use areas are characterised by variables that influence their ambient noise levels. However, all of these measuring points have dBA's well below the recommended values.

From Table 4 it can be established that the average ambient noise in Chaneng Village has increased in that 4.3dBA's and 2.7dBA's were recorded for day and night respectively - a clear indication that the mine development has not had that great an impact on noise levels of this rural area (see Table 4).

It was found that at times the north-westerly wind carries noise from the mining construction operations towards Chaneng Village, which is situated south-east of the mine footprint area. Measuring Point 9, closest to the mine, measured the highest day-time average values and, amazingly enough, the lowest average night-time values (see Table 4).

Table 4: Increase in noise pollution in Chaneng Village during the development of the mine

Measuring point	Average prevailing ambient noise levels before construction		Average prevailing ambient noise levels during construction		Change in average prevailing ambient noise	
	Leg dBA's Day	Leg dBA's Night	Leg dBA's Day	Leg dBA's Night	Leg dBA's Day	Leg dBA's Night
1	38.6	34.8	45.8	39.4	+7.2	+4.6
2	35.6	34.3	46.3	40.0	+10.7	+5.5
3	37.7	34.5	54.2	42.1	+16.5	+7.6
4	60.0	44.6	54.8	45.8	-5.2	+1.2
5	35.3	36.9	44.7	37.3	+9.4	+0.4
6	54.0	45.6	46.7	42.2	-7.3	-3.4
7	37.8	35.9	39.4	40.5	+1.6	+4.6
8	36.8	35.9	38.4	38.6	+1.6	+2.7
9	38.3	41.4	42.5	42.0	+3.7	+0.6
Average increase	41.6	38.2	45.9	40.9	+4.3	+2.7

Concluding remarks and recommendations

This study found that there was an increase in environmental noise during the day along the mine footprint area from 2010 to 2011. However, 2012 marked the commencement of low-level construction at night, with a resultant relative increase in night-time ambient noise. It is clear that there was an increase in environmental noise along the boundary of the mine footprint area during the day. There was also a marked increase in environmental ambient noise along the haul road during the construction phase, accounted for in terms of the reasons above (see Measuring Point 5 in Table 4). This could be expected since industrial activities were introduced into an area which had previously been open veld. Nevertheless, this increase in noise pollution was well within the recommended values prescribed by the government.

There were a number of limitations that this study faced in addressing the topic of raised environmental noise levels during the construction phase of the mine. The availability of data pertaining to environmental noise was limited and the determination of the prevailing ambient noise levels values was based on a three-month period during the summer only. This is the time of year when insect activities close to the measuring instruments could heighten the ambient noise levels of an area.

Furthermore, because of the lack of relevant data considered during the pre-construction phase, the importance of developing a central data base on the national and local levels should not be under-estimated. It is recommended that future research should concentrate on investigating the noise pollution frontier and on ascertaining whether any development plans are envisaged or proposed for the rural area in question.

As proved by this study, when mining development is started up at a distance of 900 metres from a residential area, for instance, an increase in the environmental noise and ground vibration levels can be expected. This study found that the distance between the source and the receptor plays an important role in determining how people perceive the raised environmental noise and ground vibration levels.

The relatively higher environmental noise levels, as measured along the western side of Chaneng Village during the construction phase of the project are insignificant and are in compliance with the regulatory standards. Evidence of structural damage to properties should, however, be investigated, as well as possible deterioration in the health of the inhabitants owing to stress and raised noise pollution levels within Chaneng Village.

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THE CONTRIBUTION OF URBAN POULTRY FARMING TO FOOD SECURITY AND EMPLOYMENT IN JOS, NIGERIA

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Abstract: Rural and urban populations in developing countries have been increasing dramatically over recent decades. City dwellers in these countries are being overwhelmed by challenges such as food insecurity, unemployment and poor incomes that are unable to meet their daily needs. Urban agriculture is being looked at as one of the more important livelihood strategies for urban dwellers to adopt in their efforts to meet these challenges. Also, in Nigeria, the socio-economic potential of urban agriculture – even in big cities – is not disputed. Jos, in the Plateau State of Nigeria, is under pressure as a result of a fast-growing urban population and environmental degradation arising from unsustainable urban agricultural practices within the city. This study examines the contribution of urban poultry farming to food security, the generation of income and the creation of employment for the urban population of Jos. Data were collected by randomly selecting 89 households (40%) from the list of registered poultry farmers in Jos. A questionnaire was presented to these farmers to ascertain the contribution of their farming enterprises towards food security and employment in the study area. The farms are devoted mainly to chicken rearing, but there are also a few turkey farms. The size of the farms and the number of workers vary substantially. By-products from the poultry farms, such as manure, bring in additional income, but unfortunately also contribute to the problem of pollution in the city.

Introduction

Rapid urbanisation and demographic growth are regarded as global problems. The United Nations estimated that by 2050 the global population will have reached the 9.6 billion mark with most of that growth having taken place in the urban areas of the developing continents of Africa and Asia (United Nations, 2012, 2013). By that date, with an average growth rate of 2.3% per year between 2000 and 2030, the population of sub-Saharan Africa will have constituted the greater number of people to this total. In fact, it is predicted that it will increase at a faster rate than the population in any other area of the world, and will double between 2010 and 2030 (Food and Agricultural Organization (FAO), 2012),

Furthermore, the approximately 240 million people living in the developing countries of the world lack sufficient food to sustain satisfactory living conditions and a healthy lifestyle (FAO, 2004 & 2010). The rising problematical economic and social conditions in the urban areas of the Third World are leading to inequality and urban poverty. (Shapouri & Rosen, 2008). Furthermore, urban poverty is also a threat to food security in that it leads to significant inequality in terms of the purchasing power of urban dwellers (Shapouri & Rosen, 2008). Compounding the problem of rising levels of urban poverty is the fact that the cost of living in Third World cities is 30% higher than that in rural areas and that these populations urban have limited economic opportunities to escape their impoverished circumstances (United States Foreign Disaster Assistance (USFDA), 2009). Africa is the most insecure region in the world in terms of food supply, according to the 2016 figures, it accounts for an estimated 45% of the total number of food-insecure people in the world (Rosen, Thome & Meade, 2016).

Nigeria is one of African's most urbanised countries with over 35% of the country's population living in cities (Salau & Attah, 2012). However, the rapid growth in its urban population has not translated into employment opportunities and economic growth to absorb the people (Internal Food Policy Research Institute (IFPRI), 2003). Nigeria's fast-growing population reached the 111.6 million mark in 2000 with almost half living in its urban areas. By 2006, the Nigerian total population had grown to 140 million, and it is estimated that by the year 2020 the population will have reached 168.2 million with the urban population numbering 97.9 million (Salau & Attah, 2012). In the case of Jos, the study area, the population increased from 37 600 in 1953 to 736 016 people in 2006 (National Population Commission (NPC), 2012).

This paper on urban poultry farming is divided into six sections. The first section presents the introduction. The second covers a literature review on urban poultry farming. The third provides a description of the study area and a statement of the research objectives, while the fourth focuses on urban poultry farming in Jos, Nigeria. The final section offers recommendations and concluding remarks.

Literature review

Urban agriculture - the processing, production and selling of food and other products within and around cities - is an important source of food that offers wide-ranging benefits to urban dwellers in addressing food insecurity challenges. If geared towards increasing urban food production, income and employment, urban agriculture, is gaining ground as a means to mitigating

food shortages and poverty (Pasquini, 2006; Salome, Jacob & Pacifica, 2015). Urban farmers, for instance, are engaged in home-based gardens mainly to enable households to have access to increased food supplies (Galhena, Freed & Maredia, 2013). The contribution of fresh produce produced by urban dwellers to the total fresh produce output in developing countries varies from 70% in Vietnam to 10 % in Nicaragua and Indonesia (Smit, Nasr & Ratta, 2001), while in Cuba, 90% of Havana's fresh produce is from urban agriculture (Koont, 2009).

Figures for African countries in 2003 (Bryld, 2003) show that 30% of the city farmers in Maputo used the urban land at their disposal for farming. On the other hand, approximately 67% of the city dwellers in Dar es Salam engaged in urban farming as a source of employment. In fact, according to Bryld (2003), urban agriculture serves as the second-largest source of employed labour in Africa.

In Lusaka, Zambia, over 50% of the urban residents practise urban agriculture to supply their own food needs (Simatele & Binns, 2008). In cities in Cameroon and Uganda, many urban households raise livestock, including cattle, poultry and pigs, for home consumption (Lee-Smith, 2010). Ichima (2009) report that the city farmers in Bamako were meeting over 50% of the demand for chicken at the time that their research was being conducted.

In sub-Saharan Africa, the poultry meat industry has made an important contribution to the diets of consumers in terms of essential protein, minerals and vitamins (Muchenje, Manzini, Siyada & Makuze, 2001). Furthermore, David (2010) came to the conclusion that chicken meat and eggs are the best sources of quality protein for those who are under-nourished, and especially significant in benefiting people in African cities.

As noted by Ukwuaba and Inoni (2012), urban poultry farming saw its beginnings in Nigeria five decades ago, mainly as a backyard enterprise. Such enterprises focus on local (84%) and exotic (14%) breeds. Local species of birds are reared under free-range conditions while the exotic species are reared under a cage system (Adene & Oguntade, 2006). Recently, the Nigerian Ministry of Agriculture (NMOA, 2012) observed that poultry production is a fast-growing industry in the country, especially in and around Jos (Haruna, Jibril, Kalla & Suleiman, 2007). Poultry farmers in the country have been encouraged to commercialise in order to improve their livelihood in terms of food security, poverty alleviation and income generation, and to strive for self-sufficiency in poultry products (NMOA, 2012).

In Nigeria, urban poultry farming focuses on the rearing of turkeys, ducks, chickens, and other birds for egg and meat production in and around the cities (Hovorka, Zeeuw & Njenga, 2009). It represents approximately 94% of the total number of poultry farming enterprises and accounts for nearly four percent (4%) of the total estimated value of the livestock resources in the country (Tadelle, Alemu & Peters, 2000). Alabi, Aghimien, Daniel & Gladys (2004) concluded that chickens are the most important among the bird species in the tropics. Okoli *et al.*, (2007) and Adebayo and Adeola (2005) reported that about 10% of the Nigerian population is engaged in poultry production. Poultry production as an enterprise has the potential to rival crude oil production, which is currently the main source of foreign earnings in the country. However, despite the large number of poultry farms scattered all over the country, Nigeria is currently importing over 60% of its poultry meat for national consumption (Poultry Site News, 2009).

In Jos, urban poultry farming also has the potential for generating employment amongst urban dwellers. It provides employment to those engaged in the production of eggs and meat, to hatchery operators, feed dealers, egg case producers, the processors of poultry products, and all dealers engaged in the marketing of these products. From the afore-mentioned review of the relevant literature, it is clear that there is a paucity of information concerning the contribution of poultry farming to individual farmers' incomes; food security and employment in Jos, thus implying that little research has been conducted in this respect. Thus, this study has been conceived to fill this gap with the following objectives:

- to describe the socio-economic profile of urban poultry farmers in Jos, Nigeria;
- to assess the contributions of urban poultry farming to employment, food security and the generation of income;.
- to assess the attitudes of urban poultry farmers towards urban agriculture in Jos.

Study area and methodology

Jos city is the administrative capital of the Plateau State (Figure 1). It has a population of 736 016 people (NPC, 2012) and covers an area of 249,9 km². The study area has an altitude of around 1 290 meters above sea level (Vivian, Adesikuteb, Danjuma & Abdulrahman, 2015). The climate of the area is influenced by altitude and the situation of the area across the Inter-Tropical Discontinuity (ITD), which migrates seasonally. The study area falls within the Wet-and-Dry Tropical Rainy (AW) climate, as classified by Koppen (1923). It is characterised by a mean annual rainfall of 1260mm, peaking between July and August, while the mean annual temperature is around 22°C (Alfred, 2012).

Age of respondents:	< 50 years	53.9%
	≥ 50 years	46.1%
Educational level:	No formal education	3.4%
	Secondary education	14.6%
	Tertiary education	68.5%
Occupation of respondents:	Full-time farmers	55.1%
	Part-time famers	44.9%
Farming experience:	≤ 5 years	32.6%
	6 to 10 years	34.9%
	>10 years	32.5%
Income from farming activities:	< N20 000	14.6%
	> N20 000	85.4%

Most of the interviewees (73%) practise poultry production on their own land while 15.7% rent the land. Over 58% of the farmers practise poultry production where they live, with only three percent (3%) travelling five kilometres or more to their farms (see Table 2). Both these variables could have a positive impact on production costs. However, the odours emanating from this agricultural activity have contributed to pollution in Jos - especially in cases where the distance between the urban poultry farms and the houses is short.

The majority of the respondents (93.3%) operate their farming enterprises on premises smaller than 0.5ha in area, while almost seven percent (7%) practise poultry production on an area of land greater than or equal to 0.5 to 1ha. Only 3.4% of the respondents spend two or fewer days per week attending to their farming enterprises, nine percent (9%) spend three to four days, almost 26% spend five to six days, while most interviewees (61.8%) indicated that they spend seven days of the week working on their farms.

The majority of the respondents (73%) keep chickens for both egg and meat production. On the other hand, 16.9% house their poultry in a battery system with 83.1% keeping theirs in a cage-free system (free range). All of the respondents (100%) use poultry waste as manure (see Table 2). According to Gerber, Opio & Steinfeld (2007), poor management in the case of poultry farming leads to microbial build-up in the soil, and soil nutrient imbalances that could result in the pollution of the soil, water and air.

Table 2: Attributes of poultry farming in Jos

Land tenure:	Land owner	73%
	Family-owned land	11.2%
	Rented land	15.7%
Distance to site of agricultural enterprise	At home	58.4%
	1 to 4 km	38.2%
	≥ 5 km	3.3%
Size of farming area	< 0.5 ha	93.3%
	≥ 0.5 to 1 ha	6.7%
Number of days attending to farming activities	≤ 2 days	3.4%
	3 to 4 days	9.0%
	5 to 6 days	25.8%
	7 days	61.8%
Type of poultry farming	Meat	4.5%
	Eggs	22.5%
	Meat and eggs	73.0%
Housing of poultry	Cage system	6.9%
	Cage-free system	83.1%
Utilisation of poultry waste	Manure	100%

The majority of poultry farmers in Jos employ workers, while only 13.4% of the interviewees do the work themselves or are aided by relatives. Almost 60% of the farmers employ one to two persons, 18% employ three to four persons, with only nine percent (9%) employing more than five workers (see Table 3). Majority of the farmers (67.4%) employ their workers on a full-time basis, while 20.2% of the interviewees use family volunteers to work on their poultry farms. This finding confirms the assertion by Balamurugan & Manoharan (2014) in the case of the Tamil Nadu State, India, that poultry production reduces unemployment. The results further reveal that most of the interviewees (91%) pay their employees less than ₦10,000 a month with only nine percent (9%) of the employers paying more than ₦15,000 per month. Thus, the majority of the workers in Nigeria earn below the national approved minimum wage of ₦18,000 per month (NSIWC, 2015).

The majority of the interviewees in Jos affirm that they are practising urban poultry farming to improve their standard of living (78.7%); 78.7% believe that they are contributing to local economic development; 78.7% that they are enhancing food supply; and 75,3% that they are providing the large urban population with food (see Table 4). These findings agree with those of Pica-Ciamarra & Otto (2009), who found that poultry farming in Hyderabad, India, serves as an important source of livelihood to the urban farmers; it reduces their poverty levels; develops the economy; enhances nutrition; improves the health of the farmers; and generates incomes to cover expenses such as school fees and medical bills.

Table 3: Employment generated through poultry farming in Jos

Number of employees	None/family volunteers	13.4%
	1 or 2 workers	59.6%
	3 or 4 workers	18.0%
	≥ 5 workers	9.0%
Type of employment	Part-time	12.4%
	Full-time	67.4%
	Family volunteers	20.2%
Salaries of employees per month	Family volunteers	15.7%
	Less than ₦ 6 000	20.2%
	₦ 6 001 to ₦ 10 000	32.6%
	₦ 10 000 to ₦ 15 000	22.5%
	More than ₦ 15 000	9.0%

The majority of the interviewees (74.2%) perceive that security of land is a minor problem or not a problem at all (84% practise poultry farming on their own land or on family-owned land). In this study, 87.6% of the interviewees regard the regulatory role that government agencies play in poultry farming enterprises in Jos as unproblematical or only of minor significance (see Table 5). Almost 61% of the interviewees indicated that they regard government policy concerning poultry farming as ineffectual and classified it as a problem, the range varying from minor to serious.

The findings of this research corroborate the conclusion made by Aromolaran, Ademiluyi & Itebu (2013) in respect of Ibadan in Oyo State, Nigeria, that government policies do not promote poultry production. Seventy-six percent (76.4%) of the interviewees regard the feeding of poultry, and therefore the cost of inputs, as a moderate to serious problem. This concurred with the finding of Nurudeen (2012) in respect of Ilorin in Kwara State, Nigeria, where farmers generally experience serious problems in terms of the cost of feeds since the feeding of fowls constitutes 60 to 70% of the total costs involved in poultry production.

Most of the interviewees (91%) regard the seasonal variation in poultry production as a moderate to serious problem in that the productivity of their enterprise, and therefore their source of livelihood, could be impaired. This conclusion supports the findings of The Indian Council for Agricultural Research (ICAR, 2010) to the effect that in the case of poultry farming, high temperatures have a negative impact on egg and meat production. Credit facilities are also considered by 73% of the interviewees to be either a minor or a serious problem. This researcher's findings confirm those of Rehman, Hunjra & Pacifica (2012), whose study in Rawalpindi, Pakistan, showed that a lack of credit facilities poses a challenge to poultry farmers in developing countries.

Table 4: Respondents' opinions on their respective urban poultry farming enterprises

Attitudinal statement	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
Improves the standard of living	5(5.6%)	1(1.1%)	0(0.0%)	13(14.6%)	70 (78.7%)
Can be practised in one's free time	4(4.5%)	3(3.4%)	1(1.1%)	27(30.3%)	54(60.7%)
Contributes to local economic development	0(0.0%)	0(0.0%)	0(0.0%)	19(21.3%)	70(78.7%)
Is a source of income	0(0.0%)	0(0.0%)	1(1.1%)	30(33.7%)	58(65.2%)
Helps reduce poverty amongst the urban poor	1(1.1%)	0(0.0%)	0(0.0%)	29(32.6%)	59(66.3%)
Provides employment to a large number of people in Jos	1(1.1%)	0(0.0%)	0(0.0%)	26(29.2%)	62(69.7%)
Reduces unemployment	0(0.0%)	1(1.1%)	0(0.0%)	27(30.3%)	61(68.5%)
Provides food to the large population of urban dwellers	0(0.0%)	0(0.0%)	0(0.0%)	22(24.7%)	67(75.3%)
Enhances food supply	1(1.1%)	0(0.0%)	0(0.0%)	18(20.2%)	70(78.7%)

Table 5: Perception of problems faced by urban poultry farmers in Jos

Factors	No problem	Minor problem	Neutral	Moderate problem	Serious problem
Security of land	54 (60.7%)	12 (13.5)	1 (1.1%)	6 (6.7%)	16 (18.0%)
Government agencies	55 (61.8%)	23 (25.8%)	2 (2.2%)	4 (4.5%)	5 (5.7%)
Government policy	4 (4.5%)	21 (23.6%)	10 (11.2%)	8 (9.0%)	46 (51.7%)
Cost of feed	10 (11.2%)	10 (11.2%)	1 (1.1%)	19 (21.3%)	49 (55.1%)
Seasonal variation/Change	4 (4.5%)	3 (3.4%)	1 (1.1%)	23 (25.8%)	58 (65.2%)
Credit facility	19 (21.4%)	4 (4.5%)	1 (1.1%)	13 (14.6)	52 (58.4%)

Concluding remarks and recommendations

This study has revealed that urban poultry production serves as a source of income, employment and food security to urban poultry farmers in Jos, the capital city of the Plateau State, Nigeria. In this study, it was found that most of the farmers have a tertiary education and are farming on a full-time bases. More than 85% are generating an income larger than the minimum wage per month for Nigeria.

The farming activities are practised on areas of land smaller than 0.5 hectares, with the homes sited on the land that the farmers or their families own. Fifty-five percent (55%) of the interviewed poultry farmers are full-time farmers and, in line with this, almost 62% attend to their agricultural activities seven days per week. The majority of the farmers are producing meat and eggs on the basis of a cage-free system. The majority of the interviewees employ full-time workers, thus creating employment in Jos although they pay these workers less than the national minimum wage.

Thus, poultry farming in Jos should be regarded as an integral component in the urban agricultural system in generating income and employment. However, the constraints faced by the Jos urban poultry farmers should be adequately addressed by the authorities and be given the necessary consideration as a livelihood strategy and as a means to providing a stable

food source for the population of Jos. Farmers should be encouraged to join existing cooperative societies for ease of procurement of loans and to gain access to group marketing and to experience its benefits.

Notwithstanding all the positive contributions of poultry farming in Jos towards food security and work creation, there are, however, some environmental concerns, namely the close proximity of the poultry farms to the residential areas. Commercial enterprises of this nature could contribute to air and soil pollution within the city. As such, these aspects should be carefully monitored in the future by the Ministries of the Environment, as well as of Health, to ensure that the population of Jos can enjoy a healthy environment.

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AN EXPLORATIVE STUDY ON HOUSEHOLD RECYCLING BEHAVIOUR IN THE CITY OF JOHANNESBURG

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Abstract: Rapidly growing populations, economic growth and improvement in living standards have accelerated the rate of municipal waste generation. In South Africa, and the City of Johannesburg (CoJ), the preferred method of waste disposal is landfilling. The CoJ faces numerous issues in waste management, and a pressing issue is limited landfill airspace left. To address waste disposal and increase recycling, the CoJ is busy rolling out recycling programmes throughout the residential areas in the city. Only 17% of residents participated in the pilot recycling programme indicating very low participation in recycling activities. The objective of this explorative study is to investigate the relationship between socio-economic factors and recycling behaviour, as well as measures to increase recycling in the CoJ. The results of this study often do not correlate to results obtained in previous studies on recycling behaviour and that there is a need for residents to be educated on recycling.

Introduction

Rapidly growing populations, rapid economic growth and improvement or change in living standards have accelerated the rate of municipal waste generation, thereby adding significant pressure to existing landfills, causing its management to be a major worldwide challenge (Al-Khatib et al., 2010; DEA, 2016). Increased population growth has led to a greater demand on the existing landfills, as well as pressure for more landfills to be made available for domestic waste. The rise in waste generation has increased the pressure on natural resources, which can result in environmental degradation and pollution on global, regional and local scales. This in turn has possible detrimental effects on human health and associated economic implications. Over the last few decades, waste management has been prioritised within the environmental field, as well as within the various governmental departments regulating these functions (Fiehn & Ball, 2005). The accountability of local municipalities, for providing equitable services to communities, has increased due to the requirement for integrated waste management plans (DEA, 2016).

Background

In South Africa the majority of waste ends up at landfill sites. This statement is true as the DEA (2016), for instance, asserts that only 10% of all waste generated in South Africa was recycled in 2011. Waste disposal at landfill sites is generally considered as the most practical waste management method in South Africa. According to the DEA (2011) and Greben & Oelofse (2009), economic and population growth will inevitably result in an increase in the amount of waste generated in South Africa.

The Department of Environmental Affairs (DEA, 2011) stated that the use of landfill sites in South Africa can be reduced by the successful implementation of the waste management hierarchy (prevention, minimisation, recycling and treatment). The National Environmental Management: Waste Act (NEMWA) (South Africa No. 59 of 2008) encourages the separation of household wastes as this would in turn contribute to the improvement of recycling programmes throughout the country. However, some of the key issues of waste management in South Africa include the lack of available or current waste information, recycling not generally undertaken or encouraged by municipalities and waste minimisation which is almost exclusively industry driven (DEA, 2016). Over 50% of the general waste currently being disposed of in South Africa has the potential to be recovered for recycling or re-use; specifically paper, glass, beverage cans and metal (DEAT, 2005).

The City of Johannesburg (CoJ) is located in Gauteng - the smallest but most populous province in South Africa that generates 45% of waste in South Africa (DEA, 2016). Finding suitable land for new landfill sites is increasingly difficult as competition for land is high in Gauteng. It is therefore important to find ways of extending the life spans of existing landfill sites (GDARD, 2011). Any deviation of waste away from landfills will extend the life span of these sites from reaching full capacity. The simplest way of extending the lifespan of landfill sites is to divert waste away from the landfill, and for Gauteng, particularly to increase the amount of waste that is recycled and reused (GDARD, 2011).

One of the most pressing issues faced by CoJ is that an estimated 9.7 years of landfill space was left in 2013 (Pikitung, 2013). Furthermore, the amount of waste generated in the CoJ is expected to increase annually by 13% (Oelofse & Strydom, 2010) while only 7% of waste generated in the CoJ is diverted through recycling and composting (Pikitung, 2015). Waste management

in the CoJ is undertaken primarily by the City's waste utility, Pikitup (GDACE, 2008). Two services are provided by Pikitup, namely commercial and council services. The CoJ has mandated Pikitup to provide the council services exclusively (Pikitup, 2010). One of the commercial services provided by Pikitup includes recycling. To increase recycling rates, Pikitup implemented a pilot project for waste separation at source in October 2009 at the Waterval Depot. This involved the distributing of orange Mondi Ronnie bags for paper and cardboard and clear refuse bags for other recyclables to add to the existing black wheelie bins that are used for non-recyclables. The Separation@Source programme was extended and now covers about 490 000 households and six of the depots in CoJ (Pikitup, 2015).

Although all the areas covered by the programme are showing a gradual increase in the participation rate, the participation rate is very low and estimated at 17% (Pikitup, 2013). The Waterval Depot area reported a 25% participation rate while a mere 7% participation rate was recorded at the Zondi Depot area (Pikitup, 2013). From these low figures it is clear that very little recycling is taking place. The recycling of household waste is influenced by a number of factors such as the attitudes, behaviour and perceptions of waste management by the general population (Strydom, 2012). Knowing which personal or household attributes are associated with high/low recycling behaviours can assist in designing programmes to encourage higher participation (Anderson et al., 2013). This research paper therefore explores the recycling behaviour in selected areas of CoJ to give a better understanding about the recycling behaviour of residents and measures that can increase the participation rate in recycling. The structure of this paper is as follows: methodology, results and discussion of the findings and the way forward.

Methodology

Three high schools, Hoërskool Vorentoe, Trinity High School and Helpmekaar Kollege, agreed to participate in the study. Hoërskool Vorentoe is located in low to middle income area of CoJ. Trinity High School and Helpmekaar Kollege are private schools and learners from the middle to high income group attend these schools.

Primary data were gathered by distributing a total of 180 questionnaires at the schools. Learners took the questionnaires home to be completed by a parent/guardian. A total of 145 questionnaires were completed across the three schools of interest, with a response rate of 66% for Hoërskool Vorentoe, 100% for Trinity High School and 78% for Helpmekaar Kollege. The questionnaire made use of both closed and open ended questions. Questions were asked in various formats ranging from simple yes/no questions to multi-variate questions. Reasons or an elaboration on the choice of an answer were also asked for in certain questions. The questionnaire investigated the household's knowledge, awareness, attitudes, and practices regarding recycling.

Basic statistical analysis has been performed in order to determine the significance of the results obtained. The data from different schools were cross-tabulated and manipulated to provide statistical analysis in the form of percentages. These percentages were then used and developed into a graph format for comparative purposes, which provided a good indication of the current situation of the topic of study, as well as the area involved. Therefore, the data obtained from the strategically structured questionnaires will be graphically portrayed. Problems encountered are the lower response rate for the low/middle income area (Hoërskool Vorentoe), a low response rate on the question dealing with household income and that not all age groups were well represented.

Results and discussion

A total of 57.2% of respondents indicated that they do not participate in recycling, while 42.8% do recycle. The recycling rate for the study area is higher than the 17% for the Pikitup Separation@Source pilot project (Pikitup, 2013) and the Council for Scientific and Industrial Research 2010 survey that indicated some 27% of urban South Africans do some recycling (Oelofse, 2012).

Several studies revealed that higher income households tend to have higher recycling rates when compared to low income households (Koch & Domina, 2002; Jenkins et al., 2003; Kalinowski et al., 2006; Martin et al., 2006). In the study area this was not the case (Figure 1) as more people in the low/middle income group recycled (59.2%) compared to the middle/high income group (37%).

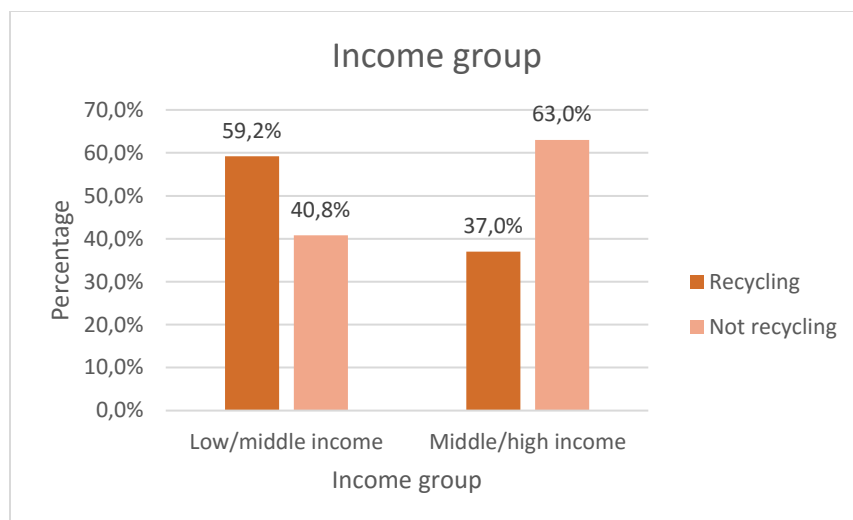


Figure 1: Recycling per income group

Koger & Winter (2011) and Pensini & Caltabiano (2012) concluded that women are more concerned about the environment, making them more likely to engage in pro-environmental behaviour. Studies conducted by Ando & Gosselin (2005) and Barr (2007) showed that women are more likely to recycle. Figure 2 shows that there is no significant gender difference in recycling participation. This result aligns with studies of Tindall et al., (2003) and Gillham (2008) that failed to find a significant gender difference in environmental activism.

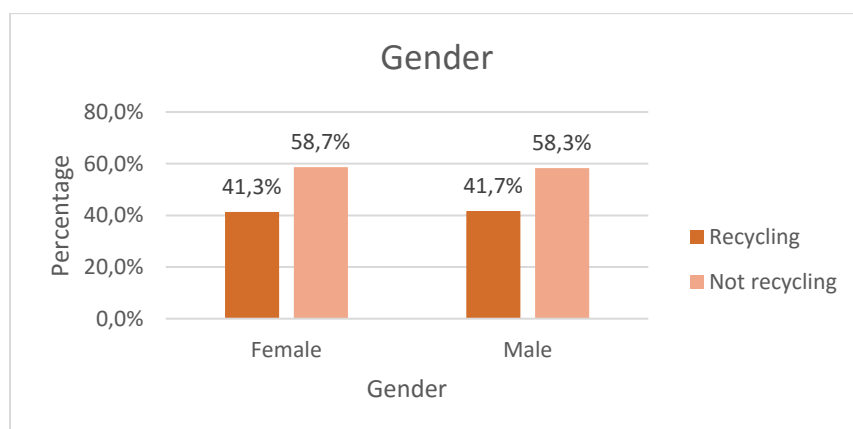


Figure 2: Recycling for the different genders

Studies in the Netherlands, Germany and Norway suggest that older respondents are more devoted to recycling (Fenech, 2002). Barr et al. (2001), Guerin et al. (2001) and Jenkins et al. (2003) reported similar findings. The findings of this study have the opposite results with 77.8% of respondents 60 years and older not participating in recycling (Figure 3). Furthermore, the age group 50-59 years has the second lowest recycling rate of 61.8%. The age groups 30-39 and 40-49 years show the best recycling behaviour with 50% participating in recycling.

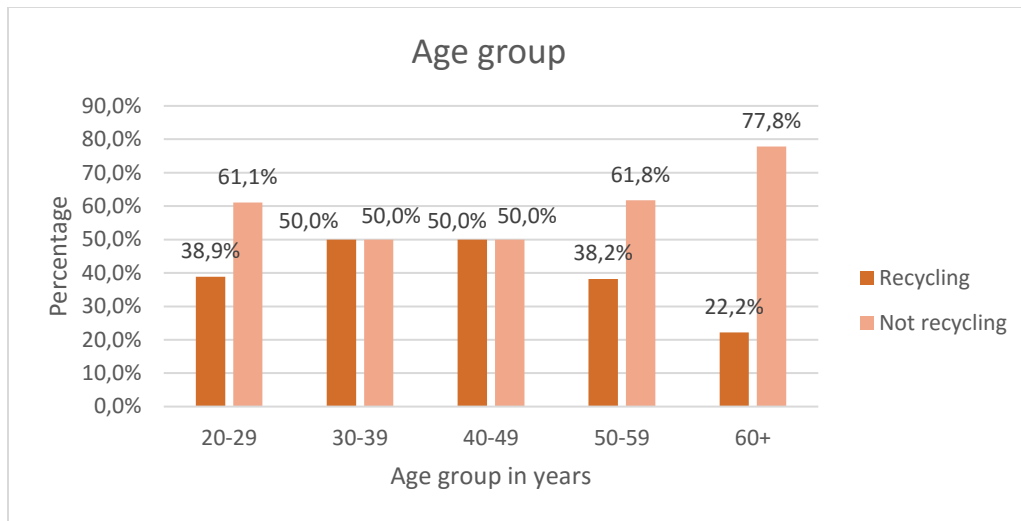


Figure 3: Recycling per age group

Anderson et al. (2003) found that in Black households the relationships between recycling and educational level was both negative and significant. In the study area, the Asian/Indian population has the highest participation in recycling (66.7%), followed by Coloureds (50%) as shown in Figure 4. The White population shows the worst behaviour with only 35.6% participating in recycling at household level.

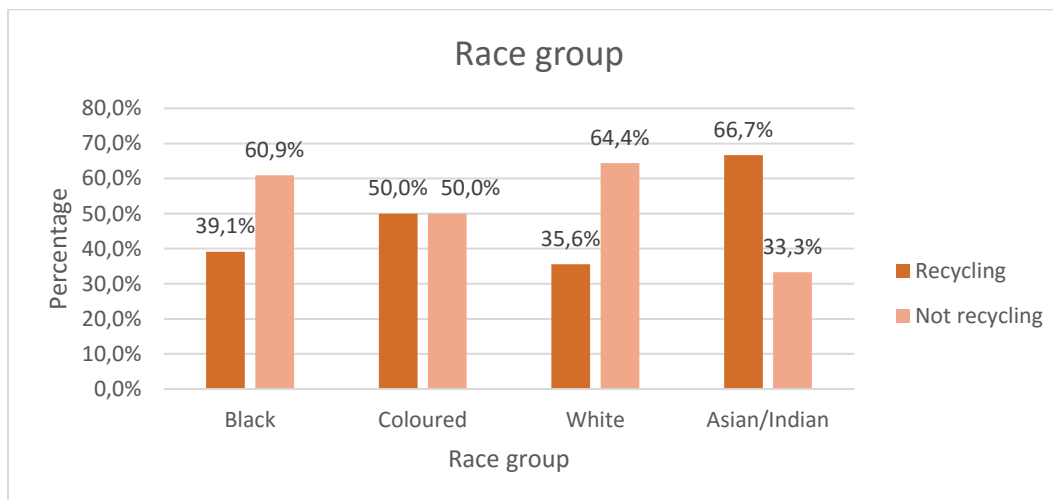


Figure 4: Recycling for the different population groups

Kaplowitz et al. (2009) and Latif et al. (2013) showed that personal resources, such as time, play a significant role in recycling behaviour. The results of this study show similar results with 64.4% employed respondents not participating in recycling (Figure 5). It is deduced that homemakers have more time than employed respondents and therefore a higher recycling participation rate of 60%. This result agrees with Meneses & Palacio (2005) that stated that recycling tasks are deeply rooted in the domestic area where women traditionally are dominant.

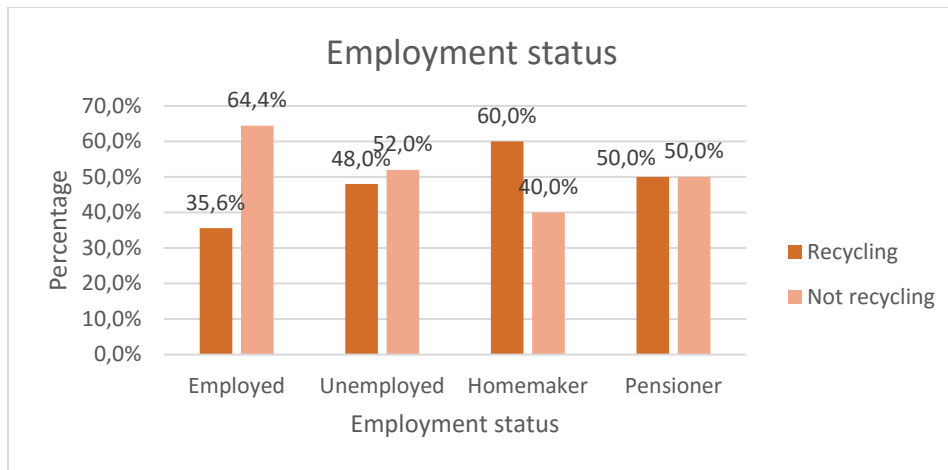


Figure 5: Recycling participation per employment status

Studies conducted by Perrin & Barton (2001) and Jenkins et al. (2003) showed that the level of education has a significant impact in the intensity of recycling with higher levels of education correlating with higher recycling participation. Meneses & Palacio (2005) state that the level of education is an antecedent of environmentally friendly behaviour. The respondents with only some high school education had the highest participation rate in recycling (50%) followed by those with a degree (47.8%) as shown in Figure 6. The highest rates for not participating in recycling is found in the respondents with only a primary school level education (80%) followed by respondents with a post-degree qualification (72%). Once again the results of this study is opposite from those of previous studies.

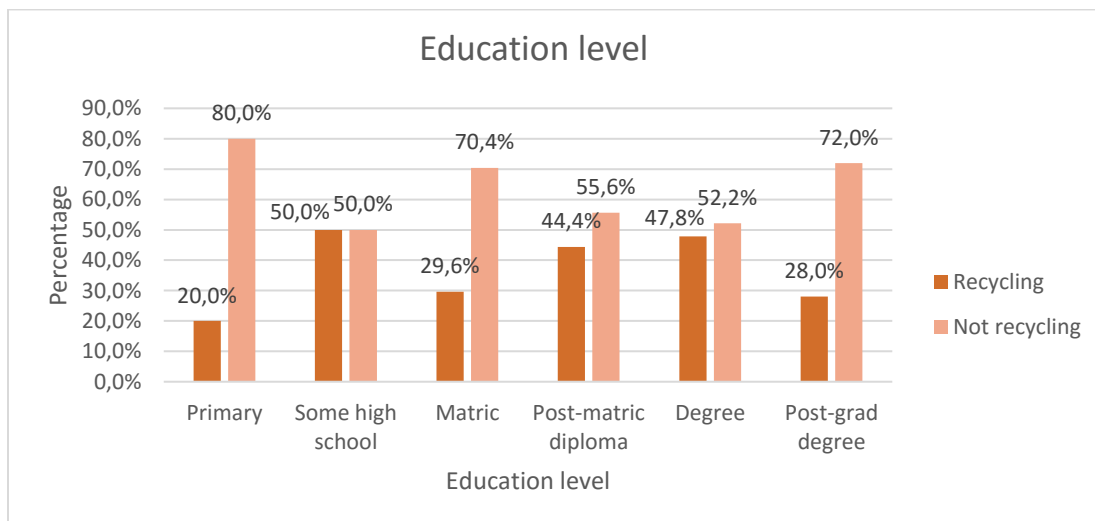


Figure 6: Recycling per education level

We have not as yet found any studies that correlate recycling behaviour with residential type. In the study area a wide range of residential types are found - from block of flats where often lower income groups reside to upmarket estates for the high income group. Figure 7 shows the respondents living in a commune have the highest recycling rate (75%), followed by those residing in a complex (44.4%). Three respondents live on a plot ('Other' in Figure 7) and none of them participate in any recycling activity. The high income earners living in an estate have the second lowest recycling rate of 14.3%.

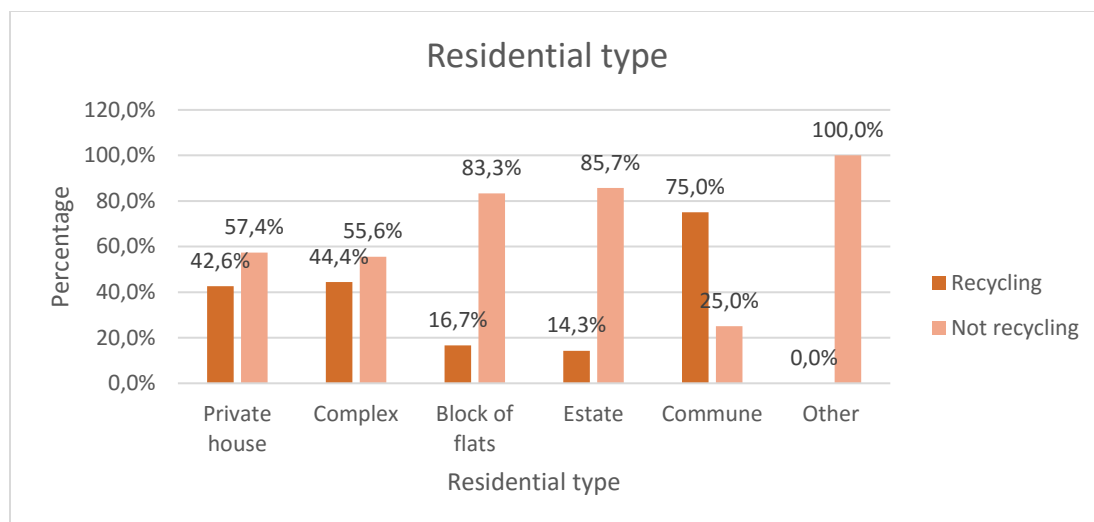


Figure 7: Recycling according to residential type

As stated, the Pikitup Separation@Source project started with a pilot project in October 2009. It was extended and now covers all of the CoJ's seven regions in six of its eleven depots with an estimated 490 000 households having access to this programme (Pikitup, 2015). Despite this, 58.5% of the respondents are still unaware of this recycling programme. The level of participation in the programme was also investigated. From Figure 8, it can be seen that only 29.7% of respondents participated in the recycling project with 35.5% not participating. For 34.8% of the respondents the programme was not available in the area they reside. However, with 58.5% of respondents unaware of the programme, this figure might be lower than reported.

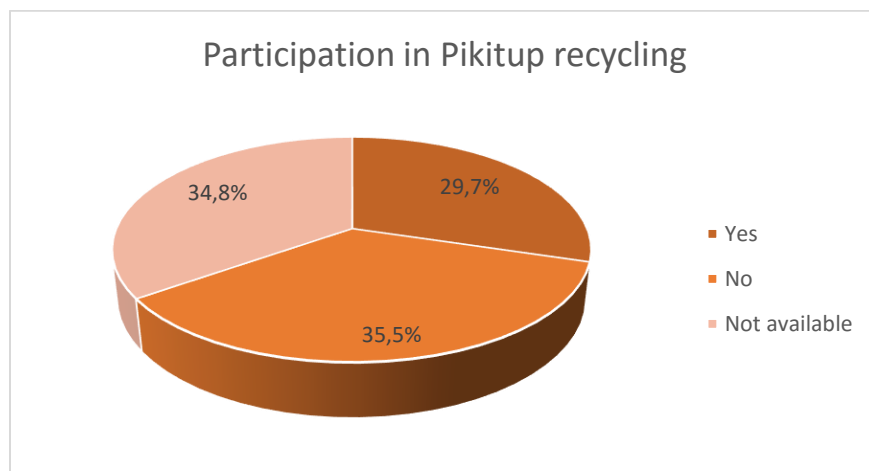


Figure 8: Participation in the Separation@Source recycling programme

Respondents were tested on their willingness to participate in the Separation@Source programme. An encouraging 73.5% indicated their willingness to participate with only 8.4% indicating they have no interest in recycling (Figure 9). A further 18.1% can be persuaded to recycle as they indicated they are not sure about participating in the programme.

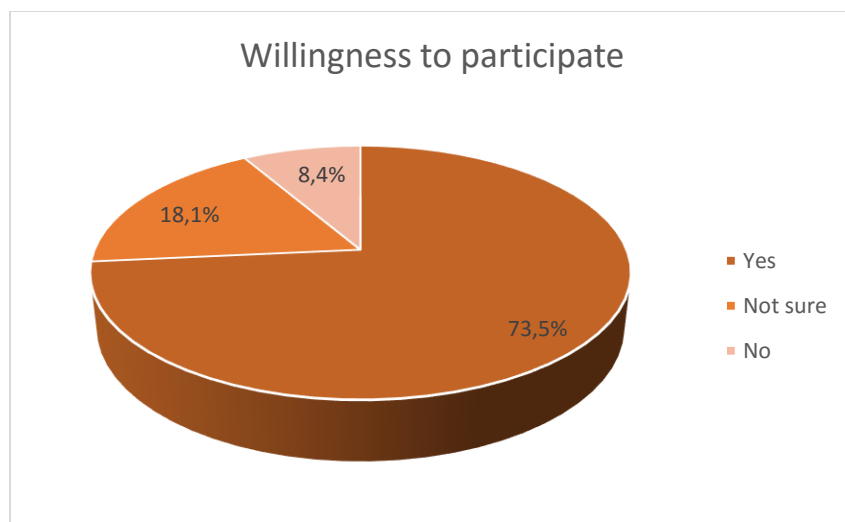


Figure 9: Willingness to participate in the Separation@Source programme

This research paper further investigated respondents' knowledge on whether an item is recyclable, if further consumer education is needed on recycling and what measures can increase recycling. Respondents were asked if they are always sure whether an item is recyclable or not. There is definitely confusion on what items are recyclable, as 63% of respondents indicated that they are not always sure if an item can be recycled (Figure 10).



Figure 10: Awareness if items can be recycled

Figure 11 shows that 65% of respondents that recycle and 66.7% of the non-recyclers strongly agree that they need to be educated on recycling. Only 1.2% of the non-recyclers strongly disagreed with this statement. From these results it is clear that there is a dire need for residents of CoJ to be educated on recycling.

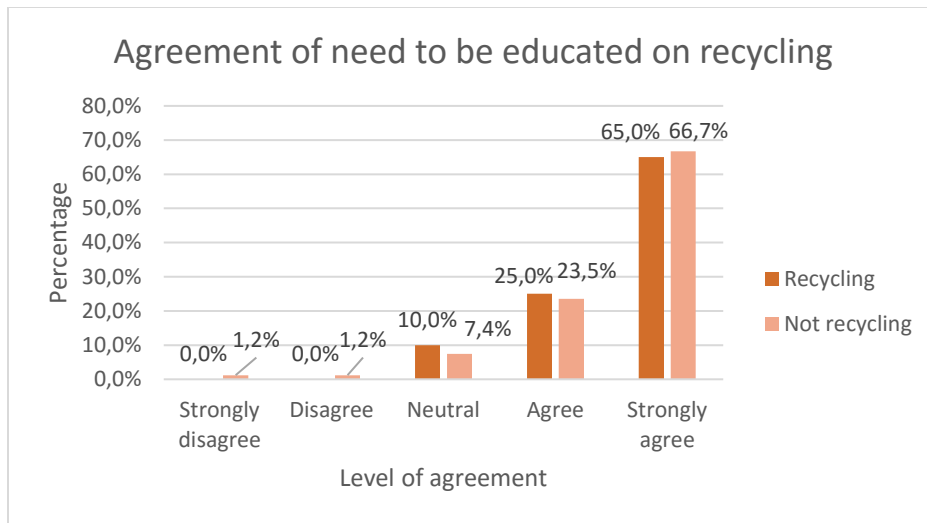


Figure 11: Levels of agreement for education on recycling

Measures for enhancing the recycling behaviour of respondents were summarised into five questions, namely would the participant:

- Recycle more if a wheelie bin is provided for recyclables?
- Like to know more on whether an item can be recycled or not?
- Prefer a recycling logo on items to know whether it is recyclable?
- Like to know where recycling facilities are in your area?
- Use recycling facilities more if it were closer to your home?

Figure 12 shows that if any or all of the above measures are implemented, respondents will increase their recycling rates. 90% indicated that they would prefer a recycling logo on items and 78% like to know more on whether an item can be recycled or not. This strongly correlates with the confusion respondents experience (Figure 10) where 63% indicated they are not always sure whether an item is recyclable or not. Various studies have shown that knowledge of how and where to recycle increases the frequency and volume of waste recovery by households (Meneses & Palacio, 2005). This is reflected in the study area as 81% indicated they need more information on recycling facilities, while 75% would recycle more if facilities are located closer. Instead of a two bag system, a wheelie bin for recyclables needs to be considered as 77% indicated they would recycle or increase their recycling rate if a wheelie bin is provided.

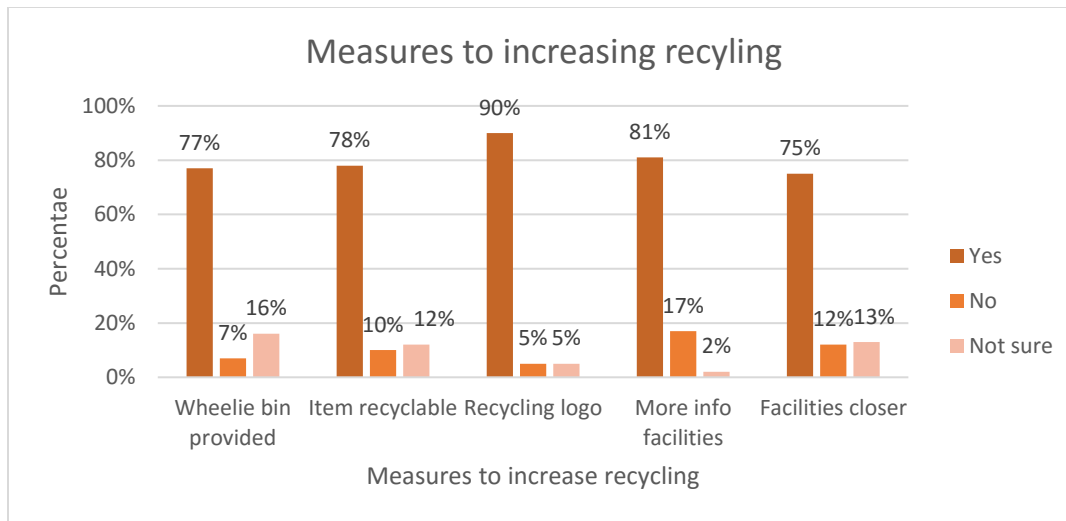


Figure 12: Measures that can be implemented to increase recycling rates

Conclusion and the way forward

In the academic field of recycling behaviour ample research is available on participatory behaviour. However, very few studies investigated recycling behaviour in South Africa and this is the first study that targets residents in the CoJ. This explorative study on recycling behaviour of residents of CoJ showed some surprising results that do not correlate with the findings of previous studies. Although information on recycling behaviour in the CoJ came to the fore, so did more research questions on why the behaviour of residents is often different than those of previous studies in this field. We suggest that more in depth research is needed cross tabulating the relationship between different variables when it comes to recycling in the CoJ. Such research should attempt cover a bigger geographical area of the CoJ and also include townships residents in the research.

Solving the landfill crisis and environmental problems in the CoJ depends more on desirable behaviour such as recycling than on the development of specific attitudes or motivations. The greatest barrier to recycling is found in consumers and what they consider in their personal convenience and comfort (Meneses & Palacio, 2005). Recycling requires a voluntary effort on behalf of the householder (Perrin & Barton, 2001) and therefore convenience of recycling plays a major role in participating in recycling programmes. It therefore suggests that those responsible for the design, implementation and maintenance of recycling programmes should be aware that residents of the CoJ might show different behaviour than in other parts of the world and that there is a need for further education on recycling in the broadest sense.

Disclosure statement

No potential conflict of interest was reported by the authors.

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IMPACT OF URBAN AGRICULTURE ON POVERTY REDUCTION IN OSOGBO, NIGERIA

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Abstract: Urban agriculture (UA) has become very popular in Nigeria cities, taken different forms and intensity, depending on the availability of capital, lands and the purposes for which it is carried out. Due to difficult economic conditions, which have affected job opportunities in the urban formal sector, consequently many of the urban residents were forced to embark in informal sector activities to sustain themselves. One major traditional sector they have adapted is agriculture, carried out both within and at the periphery of the urban area. This paper examines urban agriculture (UA) and its effect on poverty reduction in Osogbo, the state capital of Osun State, Nigeria. A two-stage sampling technique was used for data collection. The first stage involved the purposive selection of four communities in Osogbo metropolis, well known with urban farming. In each selected community, fifty (50) farmers were randomly selected from the list of urban farmers registered under Fadama III project, administrated by Osun State Ministry of Agriculture and Food Security, Osogbo, Nigeria. The second stage involved an in-depth interview with selected farmers. Descriptive and inferential statistics were employed to analyze the data collected. The study shows that urban farming in the study area, is a male dominated activity. Among those involved, 40% are civil servants, 38% are privately employed while 22% are unemployed. The main socio-economic factors responsible for their engagement in urban farming activities include the desire for food security at household level and need to save money to meet up household demand. The study recommended that capital should be made available for urban farmers to enhance food security in the state and in the nation at large.

Introduction

Food production in cities has a long tradition in both developed and developing countries (Golden, 2013). A UNDP study carried out in 1996, reported that urban agriculture (UA) produces between 15 and 20% of world' food. In the study, it was estimated that 800 million people worldwide were engaged in urban agriculture while 200 million of them were market producers employing about 150 million people full time. Since then, the numbers have greatly increased. Previous studies have reported that urban agriculture is increasingly gaining attention of scholars and policy makers as a measure of boosting food security and poverty alleviation in major cities worldwide (Smit et al., 2001; Adefioye & Ujoh 2012; Taiwo, 2013; Waters, 2013; Poulsen et al. 2015, Nyantakyi-Frimpong, 2016). Globally, the rapid population growth and urbanization imply high demand for food, which invariably require urgent supply to prevent widespread famine and malnutrition, especially among low income earners (Pingali et al., 2006; Poulsen et al. 2015). Yakubu et al., (2007) reported that since the oil boom of the 1970 in Nigeria, urban agriculture has made cities a notable hot spot for vegetable gardening, due to increase in demand for vegetable produce by the growing urban and affluent population.

Worldwide, as cities grow, they add jobs and services, becoming more complex economically as well as physically. The need for new jobs places huge demands on cities that are struggling to provide the public services that growth demands, often in the face of existing unemployment. Similarly, the population of urban poor and informally employed is growing absolutely and relatively in cities across the world. Universally, they seek for a liveable city that provides ways of earning money and meeting basic needs, whether within or outside the formal labour market. One of the activities they turn to is agriculture carried out both within and outside urban areas. Mougeot (1994) expressed that informal urban agriculture is one livelihood strategy that the urban poor use in combination with other strategies. Today, urban agriculture has become a contemporary issue, gaining prominence because it has been discovered to be a viable poverty intervention strategy for the urban poor.

Urban agriculture (UA) refers not merely to the growing of food crops and fruit trees but that it also encompasses the raising of animals, poultry, fish, snails, bees, rabbits, guinea pigs, or other stock considered edible locally (Axumite et al., 1994). It is the practice of producing vegetables, food and fruits within urban environment for household consumption as well as sale to the rapidly growing urban population (Dimas et al., 2002). Urban agriculture at the onset was viewed as merely the result of traditional habits brought by rural migrants to the city, expected to fade away overtime when the people integrated into the city economy. There was opposition to urban agriculture from public health and urban planning circles, which perceived urban agriculture either as a threat to public health that should be abandoned, or as a low-rent land use that would not be able to compete with other urban land uses. Such perceptions were institutionalized in restrictive bye-laws and regulations at national and city levels, although these have remained largely ineffective (Hovorka et al., 2009). As rapid urbanization is accompanied by increasing urban poverty, food insecurity and malnutrition, the number of people involved in UA tends to increase with

ongoing urbanization rather than decreasing, as had been previously assumed.

The roles of UA cannot be over stressed as it supplies much of the food cities require without expensive transport cost. Such system can ease urban waste disposal problems, since waste water and organic refuse are potential inputs for urban farming (Yakubu, 2014, Lynch et al., 2002). Another factor is the growing urban demand for perishable products, including vegetables, meat, milk, and eggs, coupled with the comparative advantage of producing close to the markets; and the availability of productive resources including urban organic wastes, wastewater and vacant public lands (Hovorka et al., 2009). Evidence presented from the city of Kano in northern Nigeria suggests that urban agriculture is providing farmers with food and employment (Lynch et al., 2002). Urban agriculture has a high potential for improving the urban environment by using organic waste-solid wastes and waste water as inputs by improving the micro-climate. It also conserves energy and food, because there are fewer foods losses during transport and handling and greater energy savings due to the smaller need for storage, processing and packaging. It reduces seasonal gaps in fresh foods for urban dwellers. Food availability is particularly important for fresh foods such as green leaves, fruits, eggs, and milk) which can be in the street, in markets or in local stores. Also, staple foods such as maize, cocoyam and sweet potato are produced in many towns for home consumption (Foeken, 2006).

The potentials of UA in urban area like Osogbo, the state and commercial capital of Osun state, Nigeria is not in doubt most especially during the current economic recession with high inflation rate, instability in food price and low wages of income earners. These have made the average urban dweller liable to food insecurity. Observation showed that urban agriculture is being carried out on private, leased or rented land, in backyards, on roof tops, on vacant public lands, parks, institutions grounds, road-sides as well as ponds, lakes, and rivers. Consequently, this study was designed to examine the impact of urban agriculture on poverty reduction in Osogbo, Nigeria.

Materials and methods

Study area, population, sample, and research design

The study area is Osun state's Osogbo Metropolis. It covers an area of about 140 Km² and lies at a height of 366 metres above sea level. The city is only moderately industrialized (Fakayode & Olu-Owolabi 2003), with an estimated population of about 156,694 in 2012 (Sule et al., 2012). There are two distinct geographical seasons in Osogbo; these are the rainy season, starting in late March and ending in October and the dry seasons, which start from November to early March (Oguntoyinbo, 1981). The mean annual temperature varies between 21.1°C and 31.1°C. Annual rainfall is within the range of 800mm – 1500 mm (Ayoade, 1982). The climate is less humid although the effects of the harmattan winds are strongly felt in the dry season. The target population for this study was all urban farmers in Osogbo, the capital of Osun State, Nigeria. A two-stage sampling technique was used for data collection. The first stage involved the purposive selection of four communities from the two local government areas that made up the Osogbo and its environ, well known with urban farming. The selected communities are Kobongbogboe, Oke-Oniti, Oke-Bale and Oke-Ayepe. In each selected community, fifty (50) farmers were randomly selected from the list of urban farmers registered under *Fadama* III project, administered by Osun State Ministry of Agriculture and Food Security, Osogbo, Nigeria. At the second stage, the selected farmers were traced to their respective residential home where an in-depth interview was conducted. Consequently, two hundred (200) questionnaire administered on these farmers constitute the major source of data for the study. Information were obtained on the farmers' socio-economic characteristics such as age, gender, educational qualification, main occupational, years of farming experience, membership of association, use of farm credit and monthly income of urban farmers. Other questions in the questionnaire include types of urban agricultural practiced, perceived benefits derived from urban farming and problems associated with urban farming.

Data obtained were analyzed using descriptive statistics such as frequency and percentage while a 3-Point Likert type scale with response options as; Very Serious constraints (VS) = 3, Serious constraint (S) = 2 and Not Serious constraint (NS) = 1 was used to rate the problems facing urban agriculture. The mean value of the responses was calculated thus: Mean Value (X) = $3+2+1 =$. Therefore, any variable with mean score ≥ 2 was considered a serious constraint while those with mean scores less than 2 were regarded as not serious constraints.

Results and discussion

In this section, results of data obtained from administration of two hundred (200) questionnaires are presented and discussed. Specifically, household characteristics such as age, gender, educational qualification, main occupation, years of farming experience, membership of association, use of farm credit and monthly income of urban farmers are analysed and discussed in Table 1.

Table 1: Socio-economic characteristics of respondents

Item	Frequency	Percentage (%)
Age (years)		
<20	25	12.5
21 - 30	36	18
31 - 40	44	22
41 - 50	60	30
>51	35	17.5
Gender		
Male	148	74
Female	52	26
Education		
Primary	56	28
Secondary	53	26.5
Tertiary	24	12
No formal education	67	33.5
Marital status		
Married	113	56.5
Single	20	10
Others	67	33.5
Main occupation		
Civil servant	80	40
Professional	36	18
Trading	40	20
Full-time farming	44	22
Farming experience (years):		
1 - 5	70	35
6 - 10	50	25
11 - 15	38	19
16 - 20	30	15
>21	12	6
Membership of Cooperative Society		
Yes	95	47.5
No	105	52.5
Use of farm credit		
Yes	36	18
No	164	82
Monthly Income		
<10,000	16	8
11,000 – 20,000	24	12
21,000 – 30,000	40	20
31,000 – 40,000	52	26
>41,000	68	34

From Table 1, most respondents (30%) are within the age of 41–50 years followed by those within the range of 31–40 years (22%), while those below 20 years (12.5%). On gender distribution of respondents, majority (74%) are male while 26% are female. Urban agriculture in the study area is male dominated venture. This finding disagreed with that of Hovorka et al., (2009) and Salau & Attah (2012) who reported that women were the majority among the urban farmers worldwide. They added that women constituted about 80% of urban farmers in Uganda and 56% in Kenya.

Majority of the respondents are married (56.5%), 10% are single while 33.5% others which made up of widowed, widower and

divorced. This implies that most of the urban farmers in the area are married and their participation in urban farming will ensure food security for their families.

Educational level: the results reveal that most of the respondents (33.5%) had no formal education, 28% had secondary education, 26.5% had secondary education while 12.8% had tertiary education respectively. This implies that a bulk of the respondents had very low level of education. Formal education has always been known to positively influence the adoption of improved technologies among farmers (Agbamu, 2006).

Occupational structure: Among those involved are, 40% civil servants, 38% privately employed (professionals and traders) while 22% full time farmers respectively. It is right to say that most of the farming activities in urban areas are carried out on part time basis by people engaged in other occupations as this finding agrees with that of Foeken & Mwangi (2000) and Salau & Attah (2012). Their involvement in urban agriculture was to augment household food/income.

Years of farming experience: Respondents with 1 to 5 years' experiences in urban farming had the highest percentage while those with 6 to 10 years recorded the lowest. Others fall in between. Majority of the respondents are well experienced in urban farming and are expected to have acquired relevant skills for effective operations.

Membership of Cooperative Society: Majority of the respondents did not belong to any cooperative society as claimed by 52.5% while 47.5% belong to one or more cooperative societies.

Use of farm credit: Most urban farmers in Osogbo do not use utilize farm credit as indicate by 82% respondents while 18% used farm credit. This finding is in line with that of Hovorka et al., (2009) in Ghana and Salau & Attah (2012) in Nigeria who reported that urban farmers did not have access to formal credit schemes due to their limited land space for cultivation.

Monthly income: 34% respondents are on monthly income of over N40,000 (\$160) while the least have a monthly income of N10,000 (\$40) per month. Although it could be argued that the general income is low, it has greatly helped in poverty reduction because they first consume before selling the excess in the market.

Types of urban agriculture practiced in the study area

Table 2 shows the type of agricultural practices by respondents. 42% respondents practiced mixed farming, while 38% and 20% practiced crop production and animal husbandry respectively. The types of crops produced are vegetables, maize, ornamental crops, banana and plantain, sweet potato, yam, cassava, medicinal herbs, flowers and ornamental plants, and tree crops such as oil palm, cocoa, cola nut, cashew, orange, mango among other. The livestock kept poultry production, rabbit, goat and sheep, cattle, piggery, bees farming etc which provided variety of products for the farmers and other urban consumers. Urban farmers undertake these productions of profitable products that are in high demand and have a comparative advantage over rural production.

This implies that urban farming provided household food, additional income and full time employment to the participants. Therefore, the development of urban agriculture would lead increased employment opportunities, national food security and income generation. This finding is in line with that of Yakubu et al., (2015) who reported that urban agriculture has important positive effects on poverty alleviation, local economic development, food security, nutrition and health of the urban poor in Zaria, Nigeria.

Table 2: Types of Urban Agricultural practices

Type	Frequency	Percentage
Crop production only	76	38
Livestock	84	20
Mixed farming	40	42
Total	200	100

Benefits of urban agriculture to poverty reduction and food security

Benefits derived from urban agriculture as perceived by the respondents are shown in Table 3.

Table 3: Perceived benefits of Urban Agriculture

Items	Frequency of Responses	Percentage (%)
Full time employment	90	23
Household feeding	162	45
Additional income	108	32
Total	360	100

The 45% respondents indicated household feeding. This is followed by provision of additional income (32%) and full time employment (23%). This is an indication that the development of urban agriculture leads to increase employment opportunities, national food security and income generation. This finding is in line with that of Hovorka et al., (2009) who reported that urban agriculture has important positive effects on poverty alleviation, local economic development, food security, nutrition and health of the urban poor. The benefits of urban agriculture extend beyond better nutrition, poverty reduction and jobs for the poor. Agricultural methods make the most out of scarce land, water and other natural resources, and often make use of wastes and industrial by-products as well. UA can contribute to food security in several ways. It increases the amount of food available and enhances the freshness of perishable foods reaching urban consumers. It also offers opportunities for productive employment in a sector with low barriers to entry.

The intensive horticultural and livestock production that thrives in peri-urban areas employs workers and produces high value-added products that can yield reasonable income and returns. UA compliments rural agriculture and also increases the efficiency of the national food supply. It can be a substitute for food imports intended for urban consumption and thus save on foreign exchange. It can also make available good rural agricultural land for export-oriented production (Ali & Porciuncula, 1999). In addition, there are direct benefits to produce food locally which can contribute to improved nutritional status, food security, and income. Indirect economic benefits include waste-management (avoided costs of waste disposal), use of under-used resources (uncompleted buildings, roadsides and water bodies).

Constraints facing urban agriculture in the study area

The problems of urban agriculture are numerous and they vary depending on the types of farming or the locations where they are found. Table 4 shows the mean scores of the Likert rating of the constraints. Five constraints out of the identified eleven constraints were rated as the most serious constraints. These problems are Insecurity of tenure on land ($X=2.52$), Disturbance from intruders and animals ($X=2.50$) Poor financial support ($X=2.46$), Poor extension service ($X=2.32$), and high cost of labour ($X=2.09$) in that order. These problems are capable of lowering farm productivity, household income and food security in Osogbo and the country at large. This finding agrees with that of Salau & Attah (2012), Olawepo (2012) and Yakubu et al., (2015) who identified some of the constraints to the development of urban agriculture in Nigeria to include poor financial support, poor access to land, high cost of labour, lack of support services, theft of crops on the farm among others.

As ranked first in Table 4, insecurity of tenure on land is a major challenge to the viability of UA. Looming over many urban farmers, both men and women, is the constant threat of losing access to their plot and being forced to stop production. Urban farmers often encounter harassment by officials and policemen. Fear for eviction makes most of these farmers grow only quick-yielding seasonal crops. A major complication is that there are often different systems of legislation relating to land, and different forms of tenure, co-existing in the same city, or between an urban area and its surroundings. Often there are a large number of institutional actors, varying in size and legal status, that sometimes overlapping jurisdiction over urban land. Urban agriculture throws both challenges and opportunities to planning and urban development, which make it essential not to be seen as mere informal activity but vital to the sustainability of the city (Yakubu & Oduniyi, 2009). Therefore, it requires a conscious and proactive integration in the urban planning and developmental process (Golden, 2013).

Table 4: Likert rating of constraints facing Urban Agriculture

Constraints	Mean scores	Ranking
Disturbance from intruders and animals	2.50*	2 nd
Dwindling price of farm produce	1.75	10 th
High cost of labour	2.09*	5 th
Inadequate extension service	1.95	6 th
Inadequate inputs supply	1.78	9 th
Insecurity of tenure on land	2.52*	1 st
Insufficient time to work on the farm	1.85	7 th
Poor extension service	2.32*	4 th
Poor financial support	2.46*	3 rd
Poor yield	1.65	11 th
Shortage of water supply	1.82	8 th

*serious constraint

Conclusion

The impact of urban agriculture in reducing poverty of urban dwellers cannot be underestimated as it goes a long way in improving their livelihood. This study has revealed that the major benefits derived from urban farming are household food supply, income generation and offer of employment opportunity. As employment situations in the urban areas do not generate adequate income for the poor urban, thus, urban agriculture should be regarded as an integral component of income generation, employment opportunity and food supply systems. It is therefore recommended that urban agriculture should be integrated into land use planning of all urban centers in Nigeria. There is need for positive policy that minimizes uncertainties faced by urban farmers. There is need to establish a greenbelt zone in all major cities to halt urban development while urban farming should be integrated into our national agricultural research agenda so as to evolve environment friendly technologies for commercial production.

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LAND, PEOPLE AND THE ENVIRONMENT

CONTESTED LAND IN PEACE PARKS: THE CASE OF GREATER MAPUNGUBWE

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Abstract: Over the past three decades, conservation of biodiversity has become transboundary. Proponents of the so-called peace parks argue that since ecosystems cross human imposed borders, conservation requires cooperation between neighbouring states. One way of stimulating cooperation is amalgamation of a mosaic of land, often under various forms of tenure to create one conservation unit to be managed jointly by the countries involved. The assumption is that various pieces of land which could be state, communal and private will be easily integrated across the border to create a borderless landscape for wildlife. This article critically explores this assumption. Using Greater Mapungubwe Peace Parks spanning Botswana, South Africa and Zimbabwe as a case study, it argues that the establishment of peace parks involves a complex networks of actors who have interest in the land and its resources. The actors include game and irrigation farmers and land claimants whose interest is not conservation. The study concludes that contestation of land by various stakeholders makes it difficult to harmonize various pieces of land across the border which weakens the realization of a borderless landscape.

Introduction

The conservation of biodiversity over the past three decades has become transboundary. Although the notion of transboundary conservation has a long history which dates back to the creation of the first bi-national park in 1932 (Water-Glacier International Peace Park), it really started mushrooming on a global scale as peace parks in the mid-1990s (Ramutsindela, 2007; Van Amerom and Büscher, 2005; Büscher, 2013). In southern Africa, the revival of the interest in peace parks can be attributed to political changes in the region. For instance, South Africa was re-emerging from Cold War and apartheid rule in 1990s (Wolmer, 2003; Draper et al., 2004; Ramutsindela, 2004), and the government was looking for a popular movement to improve its international image. Similarly, the Zimbabwean government needed a means of recuperating its international image after controversial but successful land reform programme and collapse of its economy (Wolmer, 2003). The civil war in Mozambique came to an end in 1992 (Wolmer, 2003; Ramutsindela, 2004). All these conditions significantly shaped the geopolitical landscape of southern Africa, and opened up opportunities for the establishment of transfrontier conservation areas (TFCAs) – popularly known as peace parks in the region and in other parts of the world.

Peace parks are biodiversity and wildlife conservation areas that straddle the borders of, and are managed in common by, two or more countries (Van Amerom and Büscher, 2005). The creation of peace parks requires amalgamation of pieces of land often under various forms of tenure (state, communal and private) across the border. By fostering joint conservation, peace parks are claimed to improve biodiversity, re-establish seasonal migration routes, tourism development (Sandwith et al., 2001; Hanks, 2003; Munthali, 2007), promotion of peace and security and poverty reduction (De Villiers, 1999; Van der Linde et al., 2001). In addition, it is anticipated that peace parks will promote regional cooperation among the participating countries (Katerere et al., 2001; Hanks, 2003). The pursuit of consolidation of a mosaic of land to create one conservation unit to be managed jointly by the countries involved has become an important aspect to stimulate cooperation among participating countries and peace parks are increasingly promoted and supported in post-colonial era on this basis. The idea of integrating land across the border is to create a borderless landscape to allow free movement of wildlife and tourists (Van der Linde et al., 2001; Sandwith et al., 2001, Hanks, 2003). In this sense, peace parks are explicitly based on the assumption that land to be integrated across the border is readily available all over the world. This assumption by proponents of peace parks seemingly arose without empirical basis and should be subjected to scrutiny. This study uses empirical evidence to argue that, the establishment of peace parks involves a complex networks of actors who also have interest in the land targeted for transboundary conservation. This leads to contestation of land by various actors which make it difficult to realize the full potential of peace parks. To substantiate this argument, the study uses Greater Mapungubwe Peace Parks (GMPP) spanning Botswana, South Africa and Zimbabwe as a case study.

Peace parks planning and biodiversity conservation

Conservationists and ecologists are at the forefront of proposals for enlarging protected areas across state frontiers to construct peace parks. The environmental philosophy that underpins the notion of peace parks is the idea of bioregionalism (Fall, 2003; Wolmer, 2003; Ferreira, 2006; Ramutsindela, 2007). Bioregionalism has evolved in response to the challenge of reconnecting socially-just human cultures in a sustainable manner to the region-scale ecosystems in which they are irrevocably embedded (Aberley, 1999; Sale, 2000). This environmental philosophy focuses on bioregions as unit of management. Two main arguments have emerged with regard to bioregionalism. One argument relates to a social movement that hold an opinion that

bioregional planning should take place at a local or village land (Sale, 1985, 2000; Aberley, 1999; Berg, 2002). This argument does not advocate for bigger land to promote conservation of biodiversity. The rationale for promoting the creation of bioregions at a local or village land is clear from Sale (2000) who argued that people will tend to protect the place and the environment in which they live and depend on. This is only possible at a local level where the effects of different human activities can be noticed and addressed (Sale, 2000). This leads to the development of bioregions which support the idea that 'smaller is beautiful'.

The second argument regarding bioregion manifests in conservation planning paradigm or landscape regional ecology (Brunckhorst, 2002). Whilst social movement on one hand encourages bioregion at a local level (Sale, 1985; 2000), landscape regional planning on the other hand conceptualizes bioregion at a regional level (Miller, 1996; Brunckhorst, 2002). This argument advocate for bigger land to promote conservation of biodiversity. The rationale behind regional conservation is protection of internationally shared ecosystems (Munthali, 2007), increasing the land size which is seen as necessary for the maintenance of an adequately diverse and sufficient large gene pool, or to encompass the range necessary for large mammals (Van der Linde et al., 2001; Sandwith et al., 2001; Hanks, 2003; Trisurat, 2006) and to promote natural ecosystem flow (Williamson et al., 2011). In this sense, regional landscape planning aim to protect biodiversity wherever it is found, from parks to farms, commercial forests, coastal zones, fishing areas, and people's backyards (Miller, 1996). Essentially, this thinking encourages conservation of biodiversity beyond protected areas (national parks and nature reserves) and political borders. This leads to the development of bioregions which support the idea that 'bigger is better'.

Contemporary peace parks owe their existence to landscape regional planning. Conservation planning paradigm as applied in peace parks aims at linking isolated protected areas and other land use types across the borders of two or more countries. The idea is to bring together protected areas, private land, communal land, forest reserves and wildlife management areas that are in close proximity to one another yet separated by international borders, and to manage them as a single entity (De Villiers, 1999; Sandwith et al., 2001; Hanks, 2003). Ecologically, it can be said that peace parks and regional landscape planning are similar as they both intend to conserve the integrity of ecological landscape for future sustainability. In areas where ecological landscape has been disturbed or destroyed by different land use activities that compromise the ecological integrity of the area, peace parks is meant to reclaim this integrity. This is done through the creation of habitat corridors as a conservation tool to increase connectivity between habitat islands into a continuum of habitat across the border (Bennett, 2003; Bennett, 2004). Proponents of peace parks claim that connecting protected areas and other land use types by removing fences and ignoring the traditional functions of international borders will create a larger and contiguous area for conservation which will increase biodiversity (Griffin, 1999; Van der Linde et al., 2001; Sandwith et al., 2001; Hanks, 2003). This begs the question of how the removal of fences and borders and connecting separated protected areas increase biodiversity. On which lands and under which conditions does the connection of protected areas and other land use types take place?

Materials and methods

Study area

The study area is GMPP which is located at the confluence of the Limpopo and Shashe River. The Mapungubwe Peace Park straddles the borders of Botswana, South Africa and Zimbabwe (Figure 1). The Park came into official existence on 22nd June 2006 with the signing of the Memorandum of Understanding (MoU) by the Ministers of the three countries. Prior to the signing of the MoU, on 5th July 2003 Mapungubwe National Park which is the core of South Africa's contribution into the Park was declared a World Heritage Site by United Nations Educational, Scientific and Cultural Organisation (UNESCO) (Peace Parks Foundation, 2012). This was due to remarkable cultural significance of the area dating between AD900 and AD1300. Of particular interest are the Zhizo site (AD 900-AD 1000) on farm Schroda, K2 or Bambandyanalo (AD 1030-AD1220) and Mapungubwe Hill (AD1220-1290 AD) situated on farm Greefswald (Robinson,1996). In addition to Mapungubwe National Park, other properties forming part of the Park in South Africa includes contracted freehold land and Venetia Limpopo Nature Reserve. In Botswana, the freehold land committed to the park is Northern Tuli Game Reserve (NOTUGRE) (Grafhorst, 2012). The Zimbabwean portion of the park integrates the Tuli Circle Safari area, the western portions of the Machuchuta Wildlife Management Areas (WMA) along the Shashe River, the western and eastern portions of the Maramani WMA, River Ranch WMA, Sentinel Ranch and Nottingham Estate. According to GMTFCA TTC (2010), the total contribution of the Zimbabwe into the scheme is 130 000 ha.

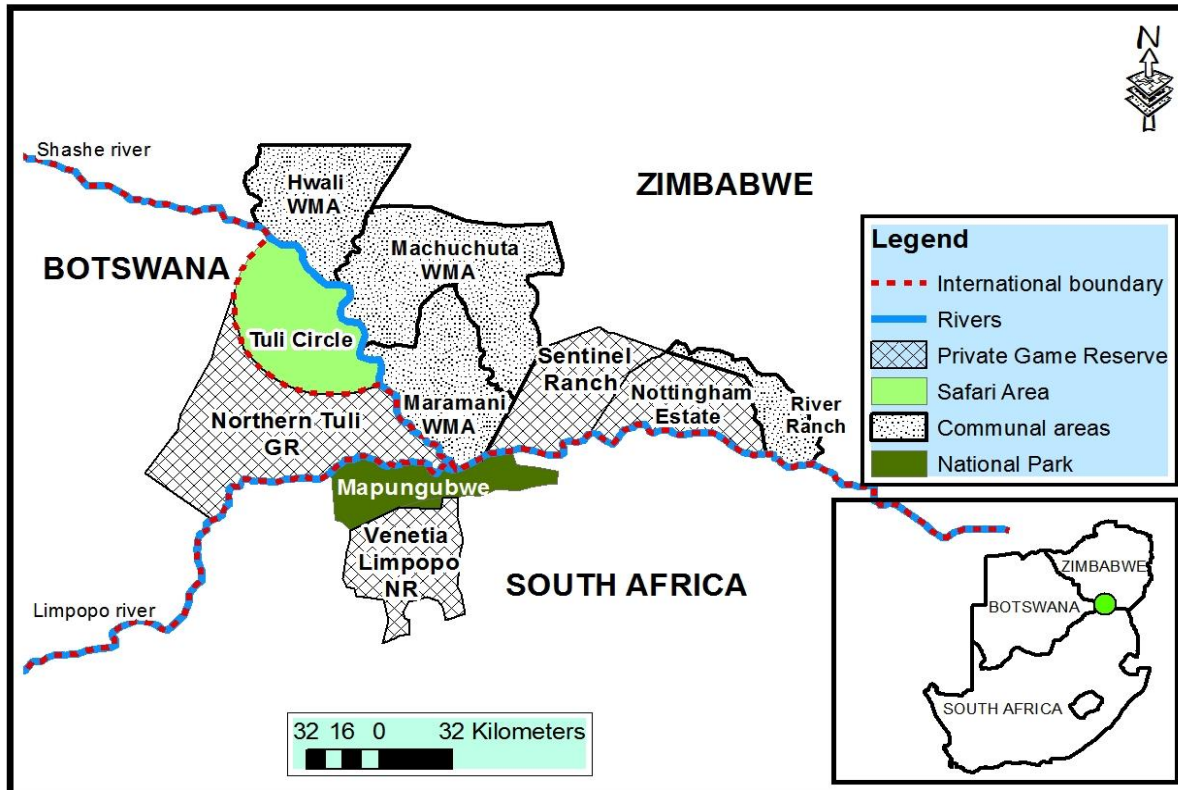


Figure 1: Greater Mapungubwe Peace Park (Source, Author)

Collection of data

The fieldwork that supports this paper was conducted between 2011 and 2016 in the GMPP. Participant observation and semi-structured interviews were used as the main primary data collection methods. The key stakeholders that were interviewed included international coordinator of GMPP, government officials, officials from Peace Parks Foundation (PPF), South African National Parks (SANParks) officials, game and irrigation farmers, farm managers, land claimants, villagers, war veterans and conservation Non-governmental Organisations (NGOs) who are directly involved in the creation of the Park. Topics explored in these interviews included the local peace parks narratives, ownership of the land, current and future plans of land owners, and the process of establishing GMPP and how the process is affected by different land use activities. Interviewees were selected based on a purposive sampling approach. The author attended the Trilateral Technical Committee meeting of 8th June 2011 of delegates from Botswana, South Africa and Zimbabwe. The author also attended Mapungubwe Park Forum meeting with staff, private land owners, local communities and other stakeholders. Secondary data sources included historical reports, transcripts of parliamentary debates, minutes of Trilateral Technical Committee meetings, government reports, PPF reports and maps, Memorandum of Understanding signed by the three countries and the integrated development plan of the GMPP. Both primary and secondary data were analysed and synthesized to develop narratives that reflects historical contestation of land and its linkages to the current contestation of land by private land owners in Mapungubwe region.

Results and discussion

Historical contestation of land

The idea of a peace park at the confluence of Limpopo and Shashe Rivers has a long history that dates back to 1922 from an initiative of General Jan Smuts who was then Prime Minister of the Union of South Africa. It would have been the first formal peace park in Africa, because the neighboring Rhodesian (now Zimbabwe) government and the colony of Bechuanaland (now Botswana) were willing to cooperate in the venture (Carruthers, 2006; 2009). Unfortunately, the idea of a peace park in the Mapungubwe region led to contestation of land between conservationists, irrigation and livestock farmers (Union of South Africa, 1945). The farmers were against the idea based on grounds that Mapungubwe region was more suitable for farming than conservation. Farmers were concerned that closing down farming and related activities would have detrimental impact on the economy of the country as the production of food would entirely cease over a wide area. Farmers were also against the idea of expropriation of land to promote conservation. The park was also objected on the account that South Africa already had bigger game reserves and that the country had more protection for game than any other country in the whole world. In addition,

the park was also objected to as farmers, who were land owners, claimed that they were not informed about the project and as a result it was unknown to most of the public (The Dongola Committee, 1944). The objection of peace parks in Mapungubwe not only came from farmers, rather, the idea of a Park was fiercely debated in parliament with Smuts' United Party government in favour of the reserve while the opposition (National Party) was against it (Hall-Martin et al., 1994; Robinson 1996; Carruthers 2006; 2009). Despite political tension, the governing United Party passed legislation on 28th March 1947 of establishing a peace parks in the region (Union of South Africa, 1947a) and the Act became law on 1 November 1947 (Union of South Africa, 1947b). The victory of the National Party in the 1948 general elections was a blow to the plan for the peace park. The victorious National Party quickly abolished the Park, which is what it had promised its supporters it would do (Union of South Africa, 1949). The Act was repealed in 1949; money raised was repaid to donors and farms returned to the original owners (Union of South Africa, 1949).

Contemporary contestation of land

The idea of General Smuts of establishing a peace park in Mapungubwe has been revived by conservationists over the last two decades. As noted above, the idea of a peace park was formalised by signing the MoU by the Ministers of Botswana, South Africa and Zimbabwe on the 22nd June 2006. The next step was to amalgamate the land across the border in order to create a borderland landscape. However, in the Mapungubwe region, the land targeted to be integrated into a peace park not only belonged to the state, but the area is dominated by private land and a number of communal areas. All these stakeholders have interest in the land and its resources and this has led to contestation of land in Mapungubwe region. Details of how land is contested by in each country is explained below.

In Botswana, the land committed to the TFCA is the Northern Tuli Game Reserve (NOTUGRE) – a consortium of private properties which extends over an area of approximately 75 000 ha, making it one of the largest private conservancy in Africa. The reserve was established in the 1960s when a total of 36 game farmers in the area agreed to pull down their fences to allow free movement of wildlife. Such removal of fences is akin to de-bordering. De-fencing and the consequent amalgamation of game farms have led to the creation of NOTUGRE as it is known today. When the idea of peace park emerged in the Mapungubwe region after 1994, NOTUGRE members found it necessary as they already had a conservancy and decided to be part of GMPP. Within NOTUGRE, there are two farms–Talana and Lentswe le Moriti that are not part of NOTUGRE and GMPP.

Talana farm which is 1800ha is a large scale irrigation farm that is used by the owner to plant vegetables. A portion of the property is also used to breed ostriches which sees the meat and leather exported to Europe. The property is surrounded by electric fence to prohibit animals entering the farm. Financially, the farm is doing well and the farm owner has no interest in using the farm for conservation purposes. Similarly, Lentswe le Moriti is a communal land within NOTUGRE. The communities use the land for religious purposes, livestock farming, harvesting of natural resources particularly wood and as a residential area. The communities have been staying in the village since 1953 and have no intention of moving off the land.

In South Africa, the land dedicated for the peace park include Mapungubwe National Park (a World Heritage Site), contracted freehold land that is not owned by South African National Parks (SANParks) but found within Mapungubwe National Park, and Venetia Limpopo Nature Reserve. The formation of Mapungubwe National Park was made possible through contractual agreement land owners who support conservation and through buying of land from private land owners. However, a majority of private land owners are not interested in selling their land to SANParks. To date, there are 10 large scale irrigation farms that are within Mapungubwe National Park and the GMPP (Table 1).

The total area covered by the farms above is 8 994.41, and are owned by different farmers. Just like in Botswana, the irrigation farms are surrounded by electric fence in order to prevent wildlife entering the farm. Tuscanen 17/1, Welton 34/0, Weipe 2-7, Den Staat 27/1, Skutwater and Hanaline Boerdery are commercial vegetable farms whereas Modena 13/0, Depo Weipe and Noordgrens Landgoed are commercial citrus farms. All commercial farmers that were interviewed claimed Mapungubwe to be the best agricultural area in South Africa as the soil is fertile, there is an abundance of water from Limpopo River, and good climate conditions (area is free from frost and it is dry and warm) which make it favourable for farming. Farmers claim that the citrus and vegetables produced in Mapungubwe area is of good quality that they export to Europe with good economic returns. As a result, farmers have no intention of giving up their farms to conservation.

In addition to irrigation farms, game farmers are also not interested to sell their land for conservation purposes. There are a ten game farms within the borders of Mapungubwe National Park and the GMPP that fall outside the management of SANParks (Table 2).

Table 1: Commercial irrigation farms within Mapungubwe National Park

Farm name and number		Portion	Size (ha)
Modena 13		0	216.35
Tuscanen 17		1	875.71
Den Staat 27		1	1835.91
Welton 34		0	186.44
Weipe 47	Skutwater & Weipe	2-4	400
	Weipe	5	100
	Weipe	6-7	700
	Hanaline Boerdery	0	1340
	Depo Weipe	0	1340
	Noordgrens Landgoed	0	2000
TOTAL			8994.41

Source: Author

Table 2: Private game farms within Mapungubwe National Park

Farm name and number		Portion	Size (ha)
Pont Drift 12		0	2.51
Pont Drift 12		1	204.30
Modena 13		1	1032.59
Parma 40		0	218.35
Samaria 28		1	891.77
Samaria 28		2	881.50
Koaxa bush camp		0	958.84
Hackthorne 30		0	1033.73
Athens 31		0	532.46
Riedel 48		0	353.57
TOTAL			6109.62

Source: Author

The game farmers were against the idea of selling their land to SANParks as they claimed to have conserved the land for ages, and were therefore not interested in selling their land. Other motivations included that they inherited the land from their parents and the area has good memories. Some game farmers are also not comfortable to be part of either Mapungubwe National Park or GMPP because they fear losing their only source of income which is derived from game hunting and live game capturing. In South Africa and other southern African countries, game hunting and live game capturing are lucrative businesses. In the same manner, game farmers have no intention of giving up their land for conservation purposes.

In addition, the whole of Mapungubwe National Park and Venetia Limpopo Nature Reserve have been claimed by Machete and Tshivhula communities in 1998 and the claims were gazetted in 2006. To date, these claims have not been resolved. However, one claim of Den Staat farm, which is within the borders of Mapungubwe National Park, but not part of the Park, has been resolved. The claim was finalized in favour of the Machete Royal family and was gazetted on 8 September 2006. The land claimants moved back onto the farm in 2009 and at the time of this study the land claimants were using the farm for settlement and farming. The study also found that the land claimants have no interest in selling their land for conservation purposes or to be part of the conservation scheme. It remains to be seen how the remaining land claims in the Mapungubwe National Park and Venetia Limpopo Nature Reserve will be resolved.

In Zimbabwe, Tuli Circle Safari Area is government land, whilst Sentinel Ranch and Nottingham Estate are private land, Maramani, Machuchuta and River Ranch area are communal land. Portions of land in Sentinel Ranch and Nottingham Estate that remained in private hands after land reform measures have continued to be used for commercial irrigation farming. Although Sentinel Ranch and Nottingham Estate are part of the GMPP, the area used for irrigation purposes have been fenced off and are not part of the peace park. Similarly, in South Africa, private land owners have no intention of giving up their irrigation schemes for conservation because of good revenues generated from farming. For instance, Nottingham estates is able to produce 20 000 to 25 000 tonnes of oranges a year which are exported to overseas market and bring good profits. The agricultural activities rely entirely on water from Limpopo for irrigation purposes.

The creation of peace parks is premised on erasing states borders. The rationale behind the removal of state borders is that they are political rather than natural. As a result, they are out of line with ecological systems (Sandwith et al., 2001; Hanks, 2003; Munthali, 2007). The removal of borders is considered a necessary condition for re-establishing natural ecological systems that were disrupted by human imposed borders. Essentially, the idea is to create a borderless landscape. In comparison to the claims by conservationists that peace parks represent a borderless landscape, the study found that game and irrigation farms that are within the borders of peace parks are surrounded by fences. The implication is that human imposed fences have disjointed conservation habitat in the region and does not encourage free movement of wildlife. This challenges the idea of turning Mapungubwe into a borderless landscape or a bioregion. In addition, the differences of opinion by various stakeholders regarding the use of Mapungubwe region threaten the creation of Mapungubwe as a peace park.

Conclusion

The study has demonstrated that the land required to be integrated into a peace park has several uses and values for different actors. These include being a main source and contributor to livelihoods, financial investment for others, home and territory of families which has deep emotional attachments for land owners. This study has also highlighted the complex networks of actors involved which include game and irrigation farmers, and land claimants whose interest is not conservation. The complex network of actors (with their different uses) has made it difficult to integrate various pieces of land to create a borderless landscape or a bioregion. It can therefore be concluded that the assumption that various pieces of land often under different forms of tenure can be neatly integrated, needs rethinking.

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FISHERIES IN TRANSITION: FISHERS' PERCEPTIONS OF THE NEW SOUTH AFRICAN SMALL-SCALE FISHERIES POLICY AND ITS IMPLEMENTATION

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Abstract: The small-scale fisheries sector has a new policy in place. Its development has been a painstakingly slow process, however its finalisation and proposed implementation is viewed as a catalyst for change in this sector. In addition to concerns for sustainable resource use, principles of equity and social justice, accountability and transparency have all been incorporated into this new legal framework. For the first time, small-scale fishers and this sector have been legally recognised, an aspect that has been neglected in other legal frameworks. This paper aims to examine and reflect on fishers' experiences and perceptions of the small-scale fisheries policy and policy process (and its looming implementation) in two coastal fishing communities on the Cape West Coast. Data was obtained through qualitative research methods. In both cases results have shown that fishers have varied perceptions about the policy and policy process and limited progress have been made to address concerns fishers have for their livelihoods, sustaining their activities and the persistent challenges still facing this sector. This was evidenced with views expressed that the only way that ongoing challenges in the sector and the voices of fishers will be heard, is through recourse to legal action.

Introduction

The reform of the fisheries sector in South Africa after the advent of democracy has been a difficult process fraught with challenges. The introduction and implementation of the Marine Living Resources Act (1998) (MLRA) was only the beginning of a long reform process that is still continuing. The MLRA advocated three overall goals including the sustainable use of resources, equity and stability in the fishing industry. The policy signalled an intention to transform the industry, and was aimed at addressing racial inequalities in the sector. It therefore had objectives to deliver greater access to fisheries resources, especially for the poor and marginalised (Isaacs 2006; Sowman 2006). In practice, however, despite the rhetoric, the implementation of this act faced several challenges and the targeted groups, namely those traditional fishers who depend on marine resources for food and livelihoods, remained a neglected sector (Sowman 2006). In society and among ordinary fishers, transformation meant that access would be significantly expanded to the historically disadvantaged sectors of society who were supported by the MLRA (Section 18(5)). However, the official interpretation of transformation meant that any historically disadvantaged individuals (HDIs) were eligible for access rights irrespective of their historical links to fishing (Isaacs 2006). This interpretation allowed leeway and resulted in many 'bona fide' fishers being left out of the rights allocation process in favour of HDIs in general. Thus, the process of rights allocation in terms of the MLRA was perceived as flawed as it failed to produce any major reallocation of access rights to new entrants or to those it aimed to include (Isaacs 2006). While there were some who viewed the fisheries transformation process as remarkable (Branch & Clark 2006) at the time, others believed that the process excluded those who it needed to target (Hauck 2008; Harris *et al.* 2007; Cardoso *et al.* 2005). Therefore, dissatisfaction with the fisheries governance regime led to a range of protests by fishing communities, public hearings and finally legal action that set in motion a requirement to develop a new Small-Scale Fisheries Policy (SSFP).

The development of the new SSFP: A paradigm shift and its relevance for fisher livelihoods

Research and experience in terms of the implementation of the MLRA demonstrated that many small-scale fishers claimed that they were excluded from gaining legal access to fisheries resources and forced to harvest resources 'illegally' (Hauck 2008; Isaacs 2003). Supported by the Legal Resources Centre⁴, the case of Kenneth George and others versus the Minister of Environmental Affairs and Tourism (DEAT) came before an Equality court and focussed on fishers' rights to secure a livelihood. The proceedings were settled in an out-of-court agreement in 2007. The judge signed a court order stating that the parties concerned would engage in preparing a new legislative and policy framework that would include all traditional fishers in South Africa (Sowman *et al.* 2014; Van Sittert *et al.* 2006). The Minister agreed to embark on this new participatory policy process and also to issue 'Interim Relief Permits' (IRPs) to traditional fishers while the process of establishing a comprehensive policy was under negotiation. It was envisaged that the IRPs will be awarded to fishers until such time that the SSFP is implemented.

⁴ The Legal Resources Centre is a public interest, human rights law clinic in South Africa.

Following the Equality Court ruling, government and civil society embarked on a process to develop a new policy. The drafting of a policy that specifically catered to the needs of traditional and small-scale fishers came at a time of great importance when fishers and fisher communities were demanding that their livelihoods, access to food security and economic as well as cultural rights were recognised. Furthermore, the process and new policy would recognise those individuals involved in pre- and post-harvesting activities whom had also been excluded. The policy development process ensured that fishers and their representatives were involved in the drafting of the new policy, together with a host of other stakeholders including Non-Governmental Organisations (NGOs), academics and researchers, environmentalists, politicians, local authorities and the general public. The policy is underpinned by a set of principles that Sowman *et al* (2014, p. 31) adds broadly conform with 'good governance' principles. The primary objective of the policy is to ensure a fundamental shift in the government's approach to the small-scale fisheries sector. The policy's vision highlights the simultaneous need to: (i) address ecological sustainability of the resource, and (ii) provide for the progressive realisation of human rights within the affected communities⁵. Thus, the new policy introduces a paradigm shift and new governance approach to the small-scale fisheries sector. The fisheries authority recognised that the new approach must address the ecological sustainability of the resource, and concurrently address the progressive realisation of human rights and developmental objectives, recognising current economic realities.

In early 2016 the SSFP process saw calls being made to communities to register themselves as small-scale fishing communities with the responsible authorities, Department of Forestry and Fishing (DAFF). This process therefore allows communities to identify individuals who are small-scale fishers or involved in small-scale fishing activities and compile lists which is then forwarded to the DAFF. The policy sets out specific criteria that individuals and communities should exhibit in order to be classified as small-scale fisher or small-scale fisher community. The fisheries authorities would then embark on a verification process of the members on the community lists and once completed, will inform communities of the outcomes of their application to register as a small-scale fishing community. Those who are rejected would have thirty days to lodge an appeal with the fisheries authorities. A community based rights system has been adopted for the sector and will see successful communities being awarded a community right. What this therefore means is that no individual rights will be allocated to community members and that communities will collectively exercise their fishing rights through a co-operative that would serve as the legal entity. It is envisaged that the first community based small-scale fishing rights will be allocated in March 2017.

Research location and methodology

The two fishing settlements, Lamberts Bay and Elands Bay is situated on the West Coast of the Western Cape, South Africa (Figure 1). In the last national census, the total population saw just over 6100 people residing in Lamberts Bay⁶ while Elands Bay⁷ recorded 1525 residents. Both these areas can be classified as semi-rural with very few industrial, retail, residential or recreational areas being located here. The actual distance between the two settlements varies according to the road route taken, but roughly amounts to 30-40 minutes apart. For many local resident's, employment is found in the servicing industries of both areas or employment at a large potato processing factory (Lamberts Bay) where a vast amount of people from the community is employed. The tradition and fishing and associated activities is an important employment generator in both areas which sees the harvesting of West coast rock lobster (WCRL) (*Jasus lalandii*) and line fish such as snoek (*Thyrsites atum*) caught here. Currently, fishers are able to legally harvest these resources either through IRPs or existing individual quota rights (Nthane 2015).

⁵ Section 2.2, South African Small-Scale Fisheries Policy (DAFF 2012)

⁶ Available online at Statistics South Africa http://www.statssa.gov.za/?page_id=4286&id=14

⁷ Available online at Statistics South Africa http://www.statssa.gov.za/?page_id=4286&id=19

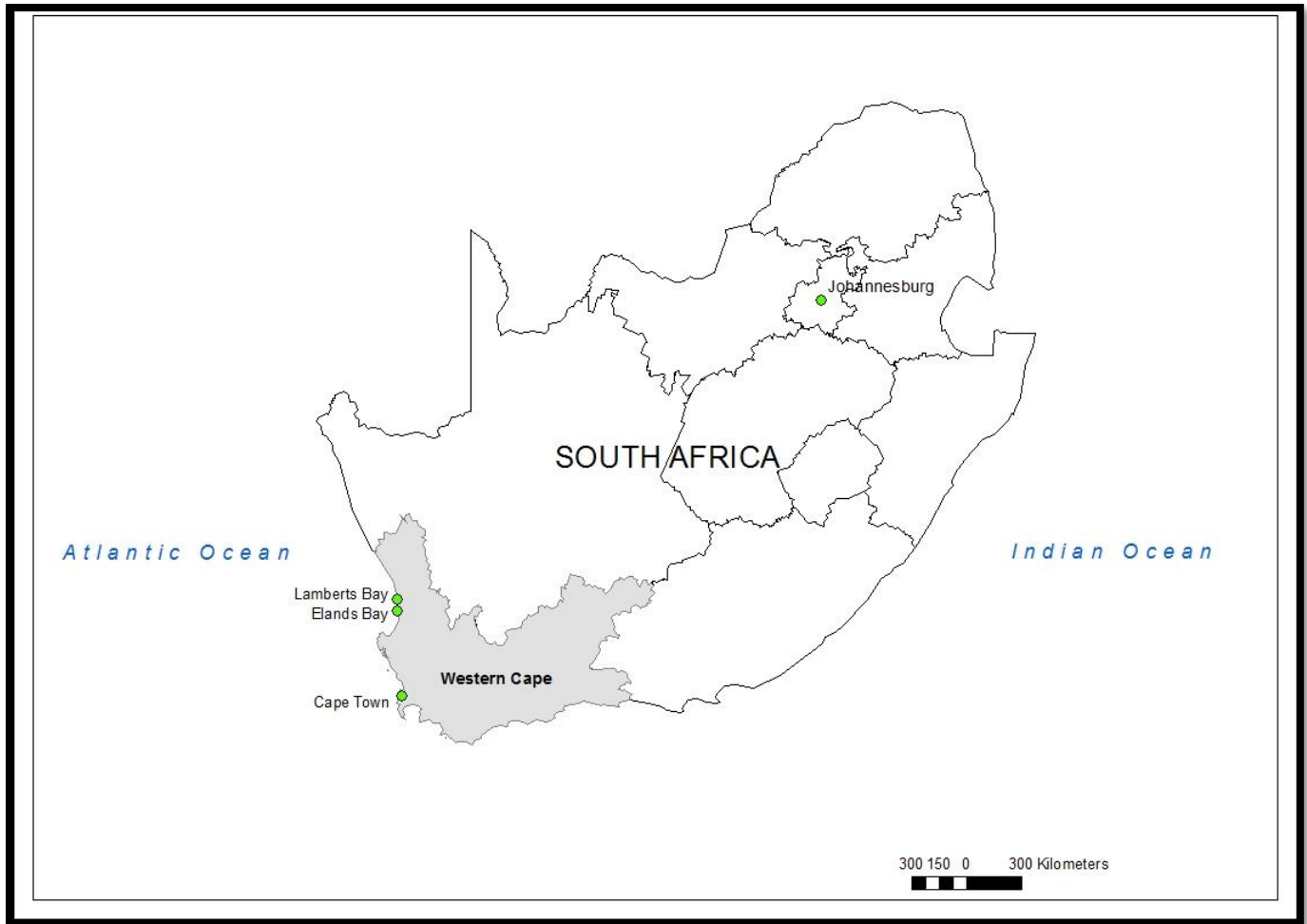


Figure 1: Map of South Africa highlighting the case study sites, Lamberts Bay and Elands Bay in the Western Cape.

Data for this study saw 28 semi-structured interviews (17 interviews in Lamberts Bay and 11 in Elands Bay) being conducted with fishers during October and November 2015. Interviewees were also presented with statements which they ranked and elaborated on during the interviews. In addition, one focus group session was held with 9 community members (8 fishers and one female community member from Lamberts Bay). Several informal meetings and participant observation at community fisher meetings (in both communities) were also used to gain information. During informal discussions with fisher's aspects around policy processes were frequently the major topic of discussion and people's perceptions of the sustainability of the small-scale fishing industry-from biological, economic and social points of view- to mention a few, were key aspects highlighted. These discussions proved invaluable as it, at times, provided otherwise frank insights into local community and fishery related dynamics.

Results

Fishers perceptions of the SSFP process

Given that the policy development process has been a long and slow process the research aimed to document (amongst others) interviewees' experiences and views of the process. All the interviewees (100%) who were interviewed commented that they were involved in some way or the other in the policy development process. Here, they stated that they attended a meeting in some form or the other (100%) either participating in workshops and/or information sessions that were held in their respective communities (Table 1). When asked about access to information during the policy development stages, interesting responses about information and participation were made by interviewees. Respondents added that they believed information was sufficient (21.4% strongly agreeing and 60.7% agreeing), but a few respondents did not agree (17.8%). These negative responses were expanded on and based on the fact that the respondents stated that it was NGOs, their fisher organisations and academic researchers who were the key sources of information and organisers of meetings. This they commented was how they

and other community members stayed updated with current processes during the policy development phases. Regular reference was made to one NGO in particular, Masifundise (Based in Cape Town), who was identified as the main source of information by having a local presence through the fisher network group, Coastal Links. Respondents added that they believed that it was the role and responsibility of government to ensure that fishers and their communities are kept abreast of any developments in the sector, but that their interaction with fisheries authorities have been limited in that regard. Some fishers added that the relationship and past interaction experiences with fisheries authorities have not been ideal or what they would consider productive at all. During a focus group discussion, a fisher explained “They [management] don’t meet with us and explain things as they should. You barely even see them and it is not always possible for us to go to Cape Town to have meetings with them. They are not accessible in my opinion and they will implement the policy, but we have to be participate and take ownership of this thing as they won’t”.

Questions about the impact of these meetings saw over 90% of respondents in agreement that it was useful with some adding that information provided by NGOs for instance meant that they were updated about developments. Linked to issues around information, saw knowledge about the content of the policy and its broad overarching aims and objectives producing results on exactly what fishers thought of the policy.

Statement	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
You or your hh members participated in the SSFP process	100	0	0	0	0
Information about the process & activities was sufficient in your community	21.4	60.7	0	17.8	0
The meetings/information had impact	17.8	75	7.1	0	0
This policy will create changes in the SSF sector	25	64.3	10.7	0	0

Table 1: Examples of statements and rankings recorded during data collection

Respondents were asked if they have read, could comment on some aspects of the policy content or have any ideas and thoughts they wanted to share about the policy. While very few fishers read the entire policy, many could comment that they have seen or read some of the document. General remarks and responses included that they have been able to access user friendly and shortened versions of the policy through booklets that were developed and distributed by the NGOs and academic researchers working in the community. These were also available in Afrikaans and made reading and understanding some of the major objectives, plans and key information contained in the official policy more accessible to community members. Some remarks and perceptions regarding novel aspects of the policy saw fishers adding that “*die feit dat die vissers se individuele regte beskerm word in die gemeenskapsreg is belangrik*” (the individual fisher’s right is protected by the community right is important). This was described as a unique aspect of the policy as fishers thought it might promote better co-operation between fishers in the community and importantly see rebuilding and strengthening of community bonds. At a focus group session respondents added that the individual quota system (IQS) as a process was not only flawed, but one that placed strain on community relations and in some cases divided many fishers and their communities. During interviews some fishers expressed the belief that it is important that the SSFP be implemented as soon as possible as the IR permit system also created an individual rights culture that might not be easily changed.

As the small-scale fisheries sector will be based on a community right based system, questions about how all of this will work evoked some worrying viewpoints from a few respondents. Whilst fishers felt secured in the knowledge that a community right would mean that their individual rights are protected within this right, there was concern about what this right will allow them access to. At the time of interviewing fishers in both communities were not entirely sure what would be allocated to their communities or what the amounts would entail. When questions were asked about allocations and what might be in the community basket, there were fewer perceptions shared on this aspect. During an interview a fisher remarked that he has an idea of what this basket of rights might look like, but that he would not want to speculate and put something on record. He

added “I’m not sure how the cake will be shared, or how much will be in the basket of species, so this causes some uncertainty”. Discussions around what the community based right would therefore include for each community resulted in no confident responses recorded with some sharing the view that species will most likely be allocated in terms of what is available in their areas.

Implementation of the SSFP and the sector’s future

During the data collection stages, a generally optimistic sense was observed from responses about the actual policy and how likely it will bring about change in the sector. From the sample, included in the interviews, the majority (25% strongly agreeing and 64.3% agreeing) thought that the policy will bring about change. Fishers again had varied perceptions of what this change would mean and responses were often supplemented with a cautionary explanation. Interviewees’ responses included that there is likely to be change as fishers and communities will be empowered through this process. Here fishers added that the new policy, when implemented, will promote a community based rights system with the aim of keeping the majority of benefits derived from fishing, within the community. During an interview a fisher explained “*die belied sal die vissers meer werkseleenthede gee en sal tot beter ekonomiese ontwikkeling lei. Alle aktiwiteite van vangst tot verwerking en bemarking moet alles deur die gemeenskap gedoen word*” (the policy will create more job opportunities and will create economic growth. All activities which include fishing, processing and marketing should be controlled by the community). Fishers from Lamberts Bay commented that they are already thinking about marketing aspects and considering potential partners to work with. These fishers added that contact has already been made with a major retailer (in South Africa) which could assist with marketing and sale of their catches.

From a management perspective the small-scale fisheries sector still faces a host of challenges, especially around balancing resource sustainability and rights allocation. There were some respondents (10.7% interviewed here) who expressed feelings of uncertainty about change and plans for implementation of the policy and more generally, the future of the sector. During interviewing (and informal conversations) with members in both communities, those who felt uncertain added motivations to their comments. Broadly speaking, their uncertainty was linked mostly to past experiences i.e. either of their own, their family or fellow community members who might have been excluded from gaining fishing rights. Further explanations shared was that they do not want to have too much hope and be disappointed or as a fisher from Elands Bay explained “the fishers operating in this sector still receive the ‘crumbs’ after the commercial sector has been catered for”. This sentiment has lingered and been present in many conversations and interviews held. It is therefore a major topic of discontent the small-scale fishers have with the fisheries rights allocation process and the DAFF. The realisation of a more equitable distribution of rights, between the two sectors, are therefore some of the desires fishers have in terms of moving forward.

Discussion

It is evident that there has been change and challenges observed in South Africa’s small-scale fisheries sector. Whilst remaining challenges and insecurities about livelihood prospects will have to be addressed, two recurring themes have strongly featured during interviews, but has also observed in other studies elsewhere along the coast (Nthane 2015; Sowman *et al.* 2014; Williams 2013; Mbatha 2011). The emphasis of this research did not necessarily focus on these themes (and therefore did not present these in the findings section), but there was constant reference made to these aspects. As these recurring themes bear relevance to the objectives of the SSFP it warrants some discussion here. The first is that fishing remains an important activity and critical in terms of food security and second, that fishing is perceived as more than an income and tied together with people’s identity and cultural practices.

Fish as food and food security

Fish has long been recognised as a healthy food with many coastal and other communities in developing countries relying heavily on fish as part of their diet (FAO 2014; Cheuenpagdee *et al.* 2005). Not only does fishing contribute directly to food security, but also acts as a means of revenue generated from production and/or related processing and marketing activities (FAO 2005; Béné 2003). At both case study sites the role of fish for food was observed as fundamental to livelihoods, especially at household level. While fishing contributes to food security, the level of commercialisation played a role in how much is consumed at home. At both Lamberts Bay and Elands Bay, fishers reported that the majority of their catches are sold, but that a proportion of their catches are still consumed within their households and therefore an important source of food. For many fisher households, limited sources to secure disposable income to purchase household goods or pay for needed services, such as public transport, means that the sale of the majority of a fish catch is an essential livelihood contributor. However, fish remains a source of food especially in the event when little or no alternatives are available. During interviews the researcher would frequently record comments such as ‘all you need is fish and bread’ and that if fishers are not able to fish then it means that they have nothing to put on their table. As a source of food it is therefore still important for many households.

Coupled to food security is the aspect of associated food security rights. In South Africa, access to food and food security is acknowledged in the Constitution (Section 27(1)(b)). In various interviews, the right to food security was usually woven into responses or a key thread present throughout discussions. It is an aspect that was acutely stressed by fishers and that the researcher suggests has been reinforced through participation in policy development and fishers being aware of their Constitutional rights. In both communities used in this analysis, very few opportunities for alternative sources of employment (and hence income) means that the role fishing continues to play in ensuring food security remains a critical aspect for fisher livelihoods. The SSFP acknowledges (as part of its major objectives) the importance of socio-economic development, poverty alleviation and ensuring food security. Consequently, in realising these rights, it means that people will continue to engage in fishing activities whether legal or illegally.

Fishing as part of identity and culture

Various work and reference to how fishers describe themselves and their activities have seen these activities being closely associated with their identity and cultural practices (Béné & Friend 2011; Jones 2005; Acheson 1981). In the case studies, fishing remains a core livelihood contributor and is linked to people's perceptions of identity and culture. Therefore, various references were made to how fishers are "born a fisherman", that the tradition has spanned several generations with fathers and grandfathers being fishers or that growing up and being part of a fishing community meant that "you simply know how to fish". A sense of pride is also observed to be attached to this profession and being part of a fisher community. This pride, Pollnac and Poggie (2006, p. 31) adds can be attributed to being able to be free to be one's own boss and/ or to meet the challenges that fishing activities present.

The process of making reference to identity and culture when asserting fisheries rights is an important aspect in the South African context and is recognised as a key objective in the SSFP. Given a legacy of dispossession, discrimination and marginalisation, fishing activities (and therefore aspects of fisher livelihoods) have been vastly affected and neglected. The recognition for the need and development of the SSFP bears witness to this. However, discriminatory processes have not resulted in the elimination of fishing practices or the fishing culture of these communities which makes the desire to continue with these practices still relevant. This desire was expressed in interviewees as motivations put forward for survival, both from a livelihood as well as a cultural perspective. There is, therefore, a strong sense and perceptions expressed of injustices suffered and losses experienced under the former dispensation and in the current context a real desire to avert past experiences. Here, opinions expressed included the fact that if fishers are marginalised and attempts made to silence their voices again, then legal action remains the only recourse. From the research outcomes it can be concluded that there is a need for reconciling fishers' (and their communities) aspirations, needs, values, fears and future prospects with the sector's development as a whole. Failure to do this will result in a repeat of the whole rigmarole experienced before policy development and may delay implementation of the policy. This will undoubtedly undermine various gains made in the sector to date and leave fishers disillusioned if their rights to a livelihood, identity and culture are not realised.

Conclusion

The ultimate success and sustainability of the small-scale fisheries sector rests on a range of activities that will need to be undertaken to realise the policy's objectives. Key to this is the engagement of a host of stakeholders championing the policy's vision. Important here would be to ensure that fishers and small-scale fisher communities experience empowerment and a sense of restorative justice through policy implementation and management of the sector. If the fishers have negative perceptions or do not feel empowered by change in the sector, then they are unlikely to show support and work towards realising the full potential and benefits outlined in policy objectives. This work has demonstrated that perceptions regarding the policy and processes are generally positive, albeit some concerns for ongoing challenges still faced by fishers. In this regard, plans to adopt a co-management approach in the sector could see small-scale fishing communities fully embracing the vision outlined in the policy. It would be essential to acknowledge and recognise the importance and role of fishing to fisher livelihoods. This may reinforce a sense of responsibility and ownership of the role fishers play in the sector which may improve overall governance of small-scale fisheries in South Africa.

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TRANSFORMING NAMIBIA'S COMMUNAL LAND: FROM LABOUR RESERVES TO SITES OF ACCUMULATION

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Abstract: The discourse on land reform in Namibia has been dominated by the need to redress the imbalances in land ownership and access to agricultural land by previously disadvantaged Namibians who are poor and landless. The official land reform programme was preceded by a less well documented and debated land reform, which also improved access to agricultural land for those presently referred to as previously disadvantaged. It differed, however, in 'target' group and locality is so far as it involved predominantly wealthy individuals fencing large tracts of communal grazing for private use. The process was facilitated by tenure reforms in the communal areas which were initiated by the South African government to promote commercial farming in the 1960s. These tenure changes involved the surveying of communal rangelands for private use and set the precedence for well-off individuals to enclose communal grazing areas. Communal areas gradually changed from being labour reserves only for the colonial economy to potential sites for capital accumulation through the privatisation of communal grazing land. The pace of this process picked up after Independence until the Communal Land Reform Act came into force in 2003. At that point the Namibian government started to survey communal land for small-scale commercial farming as part of its land reform programme.

Introduction

The discourse on land reform in Namibia has been dominated by the need to redress the imbalances in land ownership and access to agricultural land by previously disadvantaged Namibians who are poor and landless. The official land reform programme was preceded by a less well documented and debated land reform, which also improved access to agricultural land for those presently referred to as previously disadvantaged. It differed, however, in 'target' group and locality is so far as it involved predominantly wealthy individuals fencing large tracts of communal grazing for private use. This process was facilitated by tenure reforms in the communal areas which were initiated by the South African government to promote commercial farming in the 1960s and early 1970s. As a result, the nature of communal areas gradually changed from being labour reserves for the colonial economy to potential sites for capital accumulation through a process of privatising communal grazing land (Werner, 2015, p. 72).

The Odendaal Commission (Republic of South Africa, 1964) and the Five Year Development Plan for Native Areas (South West Africa, 1966) which followed in its wake, laid the foundation for land enclosures in communal areas by recommending the survey of communal grazing areas for small-scale commercial farming in three communal areas. As a result, 100 farms were surveyed in an area under the jurisdiction of the Ndonga traditional authority in the current Oshikoto region, another 56 in an area previously referred to as Hereroland West in Otjozondjupa region and 44 farms in Kavango West region.

While the scale of these enclosures were modest, they set an important precedent leading to large-scale private enclosures, particularly in the three communal areas where land had been officially surveyed (Cox & Behnke, 1998, p. 3). The extent of this process has been described by at least one author as 'land grabbing' (Odendaal, 2011a, 2011b). More commonly, the privatisation of communal pastures is commonly referred to as illegal fencing, suggesting that the private enclosure of commonages not only violated existing laws, but deprived the poor of grazing resources. However, until 2003 when the Communal Land Reform Act came into force and prohibited any new enclosures, the legal framework governing 'native reserves' and homelands was sufficiently ambiguous to argue that the legality of communal land enclosures spanned the entire continuum from illegal, i.e. with no authorisation whatsoever, to legal (See Werner, 2011).

The overall extent of communal land enclosures has not been reliably established. However, evidence suggests that in the eastern Oshikoto and southern Ohangwena regions, 141 farms have been fenced off unofficially in addition to 124 units surveyed by the Ministry of Land Reform (MLR) (Ministry of Lands and Resettlement / KfW, 2009, pp. 21–22). Mendelsohn (2013, p. 3) reported that in mid-2013, about 45% of communal land in Kavango or 622 farms had been allocated by traditional authorities. A rough estimate suggests that in the eastern parts of Otjozondjupa and Omaheke regions in excess of 150 farms measuring at least 2,000ha each had been fenced by 2010, with the process continuing (Ministry of Lands and Resettlement, 2012, p. 11). It is generally assumed that large enclosures of communal rangelands for private use have been carried out by wealthy and well-connected individuals, including many senior politicians. Infrastructure development on these farms such as water, boundary and internal fences was done without any financial support from the state. Government is in the process of

developing un- or underutilised communal land into small-scale commercial farms. Averaging 2,500 hectares in size, these farms, once fully developed, are expected to accelerate economic development and poverty reduction. Beneficiaries will be able to register long-term lease agreements over their units to encourage investments.

Against this background this paper traces the origins of communal land enclosures in a part of the north-central regions of Namibia which is under the jurisdiction of the Ndonga traditional authority. It will show that enclosures of communal grazing for private use represented the assertion of specific class interests, which dovetailed neatly with the recommendations of the Odendaal Commission in the 1960s. These were aimed at developing and strengthening an incipient black middle class as a bulwark against the armed liberation struggle. It will conclude that the current programme to develop communal land for agricultural purposes is driven by similar class interests, essentially adopting the same discourse of modernisation that was first developed by the Odendaal Commission.

Customary tenure system

During the early part of the 20th century Owamboland had large reserves of unused land. Interstitial areas between different polities were kept as long as possible for grazing purposes. Traditionally, two categories of land existed: settled or inhabited land (*oshilongo*) on the one hand and uninhabited land or bush areas (*ofuka*) on the other (Namibia Economic Policy Research Unit, 1991). In the inhabited areas or *oshilongo*, land for cultivation and residence was allocated through a hierarchy of traditional leaders. Areas of jurisdiction of chiefs or kings were sub-divided into a number of 'districts' under the authority of 'headman-councillors' (later referred to as senior headmen), who were 'responsible to the tribal council.' Districts, in turn, were composed of several wards or *omikunda* (*omukunda*, sg.). *Omikunda* were granted to people who could afford to pay a certain amount of cash or cattle to the Chief. Upon payment, the new 'owner' became a headman with certain rights and responsibilities. Apart from 'exercising native administration and judicial authority'⁸ in their *omikunda*, headmen were entitled to 'sell' portions of their *omikunda* to individual homesteads (Hinz, 1996, p. 31). The sizes of *omikunda* varied, but 'comprise[d] anything from 10 to 100 or more kraals [homesteads].'⁹

Ofuka or bush areas served for the establishment of cattle posts. Much of this land was considered to be waterless and thus could not be settled or used on a permanent basis, and utilisation was limited to seasonal grazing. Conversely, those with the means to open up permanent water claimed ownership over the water and hence were able to control access to grazing. It was observed that

'well established cattle posts (with waterholes) have definite owners ... [while] at other posts the first man on the post each year acquires the right of user. Every new waterhole dug in the bush belongs to the man who digs it.'¹⁰

Much of the private enclosure of communal rangeland occurred in the *ofuka*.

Class formation

Colonial subjugation, the integration into a market economy and concomitant class formation gradually transformed customary tenure systems. In the early 1960s, the Odendaal Commission¹¹ (Republic of South Africa, 1964, p. 425 original emphasis) found that 'social stratification according to income and level of occupation' had taken place in 'native reserves', as 'the traditional system of supplying their own needs' had gradually been 'supplanted by a *money system* peculiar to the system of the Whites'. For a small but growing group of traders, clergy, farmers and teachers the accumulation of personal wealth became a priority. They availed themselves of the new homeland structures to assert their interests, and more specifically, to change specific customary practices that were perceived to impede capital accumulation. The communal system of land ownership and the dominant role of traditional leaders in administering customary land rights were rejected by certain groups such as traders.

It is therefore not surprising that two years after the first Legislative Council of Owamboland was established in 1968, a lively debate ensued concerning the pros and cons of fencing off communal grazing areas into camps. Protagonists of private enclosures argued that fences were an important management tool which would assist farmers to improve grazing and either substitute for the decline in the number of herd boys resulting from increased school attendance, or enable those still herding cattle to attend school.¹² The shortage of labour for herding and the simultaneous absence of fences increased the problem of

⁸ A 450 Vol.7 2/18 *Annual Report 1937*, 22.12.1937, p.13.

⁹ *Ibid.*

¹⁰ A 450 Vol.9 2/38 Typed ms of Section of the Tribal Customs of the Owambos, n.d. p.32

¹¹ This commission is commonly referred to as the 'Odendaal Commission' after its chairman.

¹² RSA 1970. Verbatimverslag van die Ovambolandse Wetgewende Raad. Derde Sessie, Eerste Wetgewende Raad, 16.3.1970-25.3.1970, p.39.

stray cattle.¹³ Moreover, fenced camps would greatly facilitate the breeding of cattle. These proposals were opposed by some, largely on technical rather than on equity grounds. The arguments against fences included that enclosures would eventually lead to a depletion of soil fertility, as taking cattle away to distant camps would deprive farmland of manure. In addition, milking would take place far away from homesteads. One of the opponents of fencing concluded that if the Legislative Council were to agree to the proposal, they would be getting a hiding outside, saying ‘if we approve this planning, it will bring about unrest, today.’¹⁴

The discussion on whether to continue with the customary land tenure system, or whether to introduce a new system based on private rights to communal land was referred to a Select Committee on Land Tenure and Utilisation of the homeland government (Tötemeyer, 1978, p. 77). In view of the tension between the ‘old and new’, the Select Committee steered clear of recommending any changes to the ownership of land at household level and proposed that the system of lifelong usufruct to arable land be retained. Other recommendations amounted to a weakening of the powers of traditional leaders, such as that the ownership of all land in Owamboland be transferred to the Owambo government (Toetemeyer, 1978, p. 78 as cited in Werner, 2011, p. 37).

Although traditional leaders were represented on the tribal Legislative Council, these new political homeland structures led to a loss of authority and accountability towards their subjects on account of the fact that certain powers were transferred from the local to higher government (Vlachos, 1995, p. 14 cited in Werner, 2011, p. 35). Moreover, their popular legitimacy suffered, as they participated in senior positions in a homeland structure that was set up to oppose SWAPO (Ibid.). Enjoying the support of the colonial government, they were able ‘to interpret traditional law as they saw fit. This included the right to allocate land’ (Tapscott & Hangula, 1994, pp. 6-7 as cited in Werner, 2011, p. 35).

Transitioning from subsistence to commercial farming

The articulation of these class interests received support from a discourse on modernizing economic production in the ‘native reserves’ which was developed by the Odendaal Commission in the early 1960s (Republic of South Africa, 1964). It was a political and economic response by the colonial government to ‘a change of method within black politics in South West Africa’, which culminated in a defiance campaign against forced removals from the Old Location in Windhoek (du Pisani, 1986, p. 155), which developed into an armed struggle against apartheid South Africa within a few years. On a political level, the Commission recommended the establishment of tribal *homelands*, which were designed to divide the black population. Economically, the Commission made recommendations which sought to support the transformation of the existing subsistence economy into a viable market economy (Union of South Africa, 1929, p. 429).

Economic activities had to be brought to the reserve areas through a ‘broad programme of capital expenditure’, the focus of which was on animal husbandry, agriculture, forestry and mining’ (Republic of South Africa, 1964, p. 429). The development of animal husbandry and the efficient marketing of livestock and of meat were considered to be important (Ibid, p.277).

Although the Commission clearly supported a transition from subsistence to a market economy, it did not make any specific recommendations on land tenure, except to propose that in the case of former Owamboland, all land within its boundaries was to be transferred to the new homeland Legislative Council ‘in trust for the population’. It further recommended that the Legislative Council should be allowed to alienate land to ‘individual citizens’ in those areas that were recommended to be added to Owamboland with the permission of the South African State President (Ibid, p. 85). The area recommended to be added comprised of 1.4 m ha. These recommendations provided the growing middle class with the legal and political tools to officially fence off land.

Carrying capacity, economic units and fences

The *Five Year Plan for the Development of the Native Areas* (South West Africa, 1966), operationalised many of the recommendations of the Odendaal Commission. It developed specific interventions to improve agricultural production in the former native reserves. Central to these proposals was the conviction that ‘agricultural planning must ... pave the way in converting an existing subsistence economy to an exchange economy’ (South West Africa, 1966, p. 94). To facilitate proper agricultural and farm planning, the Development Plan assessed the carrying capacity of grazing on the basis of distinct agro-ecological zones. This in turn made it possible to determine the size of economic farming units and the ‘ultimate human carrying capacity for the region to be planned’ (Ibid, p. 95).

¹³ During the same session a Select Committee tabled a short report dealing with stray animals. It recommended that a number of fenced camps be established in every tribal area to accommodate stray animals until they were claimed by their owners (Ibid, p. 53).

¹⁴ Ibid, pp. 38-39.

Training and research projects were to support the process of ‘modernising’ agriculture in Owamboland. Proposed fields for agricultural research included grazing systems for saline soils, improvement of sanga cattle, sheep and goat breeds and livestock management practices with special reference to diseases and parasites (Ibid, p.102). Despite the fact that the Development Plan introduced the notion of economic units, it did not make any specific recommendations on how the tenure system in Owamboland should be changed. This was in stark contrast to its proposals that ‘a large scale fencing programme’ be implemented in former Hereroland. This would facilitate ‘proper pasture rotation’ as ‘a prerequisite for optimal utilisation of available resources’ (South West Africa, 1966, p. 163).

These omissions notwithstanding, the transition from subsistence farming to commercial farming was driven by colonial government officials in Owamboland, who wielded considerable power in the homeland administration with regard to the initiation and development of policy (Werner, 2011, p. 31). In terms of agricultural development, these officials were imbued with the modernisation discourse developed by the Odendaal Commission and the Five Year Development Plan. They regarded the enclosure of commonages to be of particular importance in promoting agricultural development and argued that the customary system of land ownership and utilisation had a limiting influence on production.¹⁵ Consequently, serious attention needed to be paid to the transformation of the traditional system of land ownership of Owamboland which should be settled on ‘a healthy and economic basis.’ To achieve this, *economic units* corresponding to 100 large stock units or 400 small stock units were determined.¹⁶ This approach was approved by the Owambo Cabinet and applied to farm planning.

Anticipating that the Owambo public would be very critical of the establishment of individual farms, it was proposed to initiate the process in the more lightly settled areas in the west (Ukweludhi and Ongandjera) and in the east (land added to former Owamboland as a result of the recommendations of the Odendaal Commission). In time, the process was to be extended into more densely settled areas. The proposed target was to plan 200,000 ha a year for farming between 1971 and 1974.¹⁷ Implementation of this approach was delegated to the Bantu Investment Corporation (BIC).

Enclosure as defence against land alienation

The BIC obtained 104,000 ha of land in the Ndonga area between Etosha and the West Mangetti after consultations with the Ndonga Tribal Authority¹⁸. It had been appointed as the sole agent for cattle marketing in Koakoveld and Owamboland in 1973 and needed the land to store unfinished and young animals, which represented 50-75% of the cattle on offer. One hundred units were surveyed and allocated to individual farmers, except for four which became Okapya LDC. Government anticipated this development to extend east to the Kavango border and then all along that border in a northerly direction. The Ndonga Tribal Authority agreed to the scheme, as it regarded the development of cattle marketing as important. It was not in favour, however, of fencing any more communal land and therefore opposed government plans to develop the area east and north-east of the quarantine farms into economic units.

Suspicion of government plans was reinforced by perceptions that the BIC was fostering competition to local business people instead of supporting their development. It was thus feared that it and the government had colluded to take the land away from local people for the benefit of someone else. In an attempt to prevent this from happening, the Ndonga Tribal Authority gave permission and encouraged its own people to fence off land. It remains a moot point whether this action was legal or illegal at the time, as the traditional authority was represented in the homeland administration, which was permitted to allocate land to ‘individual citizens’ in the area added to Owamboland in the wake of the Odendaal Commission. Suffice to say that the Tribal Authority established its own procedures in terms of which allocations for fencing were to be made.

Interested parties had to approach the Senior Headman of the area to obtain his approval before the latter took the application to the King and his Council. The King would normally send someone to the land in question in order to ascertain its borders and exact location. Once this had been done, the Council assessed the application against a set of criteria. These included a requirement that the applicant had to be a Namibian citizen; that he/she was of good character, *i.e.* had no criminal record and was not utilising fenced land elsewhere. Upon approval by the King and his Council, an agreement was signed which reflected the name of the grazing area, the name of the recipient, name of the farm and date of occupation. A copy of this ‘agreement’ was kept by the Ondonga Tribal Authority. In late 1996, it had records of more than one hundred approved farms.

¹⁵ OVA, 49, 6/8/4/1 Vergadering van die Onderkomitee oor Dorpsbeplanning en ontwikkeling en Landbouontwikkeling van die Beplannings- en Koördinerende Komitee op Woensdag 2 September 1970, p. 2.

¹⁶ See OVA 49, 6/10/2/7 (II), Sekretaris Departement van Landbou en Bosbou to Sekretaris van die Hoofminister, Ondangua, 2.7.1973, p. 2.

¹⁷ OVA, 45, 6/8/1-7(I) Direkteur: Landbou to BENBO, 4.5.1971, pp. 1-2.

¹⁸ At Independence Tribal Authorities became Traditional Authorities.

This suggests that the Ndonga Tribal Authority was not against the enclosure of communal pastures for individual use. Indeed, as Tapscott and Hangula (1994, p. 7 as cited in Werner, 2011, p. 35) have argued, after the 96 farms had been surveyed and allocated, 'it was just a small step for traditional leaders to permit enclosure of communal land in areas outside this designated zone'. The important point is that the Tribal Authority wanted to be in control of the process to ensure that the fenced area remained under its jurisdiction.

Continuities and discontinuities after independence

The process of fencing off communal pastures for individual use accelerated after Independence across former Owamboland. This has been ascribed by informants to several reasons.

In the first place, the Namibian Constitution placed the ownership of all communal land in the hands of the state. For many people this was an indication that traditional leaders had no more authority over their land and thus no powers to restrict the fencing of land. This was compounded by the abolition of pre-Independence ethnic Representative Authorities (the successor institutions of homelands), which left a political and legal vacuum with regard to customary land administration in communal areas.

Secondly, some people justified the enclosure of communal grazing by referring to Article 21 of the Constitution which provides that 'all persons shall have the right to...reside and settle in any part of Namibia'. To them it was their constitutional right to settle wherever there was space. The possible prohibition by a traditional authority to do so was interpreted as an infringement of a fundamental constitutional right. In addition, some people argued that they had fought for the land, and if they could not get freehold commercial farms, they would simply fence off communal land (Kerven, 1998, p. 72).

The first piece of legislation that explicitly prohibited any form of enclosures of commonages appeared in 2002 in the form of the Communal Land Reform Act, No. 5 of 2002. Several Cabinet resolutions and political pronouncements to declare the enclosure of communal land as null and void were never implemented and thus did little to stop the process (Cox, 1998, p. 15). Resolutions taken at the National Conference on Land Reform and the Land Question in 1991 called for an end to illegal fencing of communal areas, and that areas fenced already should be reduced to make space for 'small farmers' (Republic of Namibia, 1991, p. 39).

The latter resolution notwithstanding, government embarked on a programme to develop communal land for commercial farming purposes. In 1997 Cabinet approved the Small Scale Commercial Farms Development Project based on developing 'virgin' land. Consultants were appointed to assess the availability of under- and unutilised land in communal areas. They presented their findings in 2000 (International Development Consultants, 2000). Apart from providing estimates on the areas of communal land that were either under- or unutilised, International Development Consultants (IDC) also proposed a development model which was identical to the small-scale farms which were developed before Independence in the Owambo and Kavango Mangetti and Okamatapati.

Based on the recommendations of IDC, the Ministry of Lands and Resettlement (MLR) commenced with the development of small scale farms in 2003. The concept was to demarcate and survey land parcels of 2,500ha to be leased to farmers for purposes of small scale commercial farming, primarily with livestock. It is believed that this approach broadens access to land and will make communal land more productive. The first surveyed farms in Zambezi Region, East and West Kavango and Ohangwena were gazetted in 2007.

Conclusion

The Ministry of Land Reform, with financial assistance from the German government and the EU, is in the process of developing water, fencing and marketing infrastructure on these farms. To date a total of 625 farms have been surveyed for this purpose in 3 regions. Given the farm sizes, it is clear that the target group of this development are farmers with sufficient assets to engage in commercial farming. The choice of this particular model for the development of communal land signifies that the interests driving this process are those of a middle class and not those of small-scale farmers in need of land and infrastructure.

The *Road Map Land Reform and Infrastructure Development in Communal Areas* (Ministry of Lands and Resettlement, 2012, p. 64) recommended that all large enclosures of communal rangeland should be regularised in accordance with the provisions of current legislation. The recommendation was partly informed by the conviction that it would be politically indefensible to criminalise all appropriations of large farms, the development of which was done with private capital, while legally fencing off and developing communal land with government and donor money.

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TOWARDS UNDERSTANDING THE EFFECTS OF INFORMAL HARVESTING OF SAND FOREST IN MAPUTALAND, SOUTH AFRICA

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Abstract: Sand Forest is regarded as being critically endangered and is considered to hold various endemic species. The fragmented patch occurrence of this rare and valuable forest type, combined with the lack of necessary knowledge and prior interest in its management, has resulted in the Sand Forest being subjected to uncontrolled utilisation within communal areas. This study aims to contribute towards understanding the effects that could emerge from trends of informal Sand Forest wood harvesting, quantified through a spatial-temporal analysis. Quantifying the impact of a declining canopy closure resulting from selective wood harvesting required the use of remote sensing techniques and procedures that could potentially account for this effect. To this end, remote sensing techniques were utilised, which quantified the accumulated total loss in the extent of Sand Forest to 15.53 km² over a period of 16 years. The possible effects that continued uncontrolled informal wood harvesting of Sand Forest will have on biodiversity, communities and social-ecological system of Maputaland includes loss of genetic diversity, impacts relating to the edge effect, reduction in the abundance and distribution of Sand Forest, impact on overall ecological functioning, depletion of wildlife habitat, effect on communities' livelihood security and climate resilience, and the reduction of the ecological infrastructure supporting the social-ecological system.

Introduction

Sand Forest, which is also referred to as Licuáti Forest in Mozambique, is a type of forest that has a very idiosyncratic floral and faunal component (Matthews, 2007). Sand Forest is regarded as being critically endangered (Mucina & Rutherford, 2006; Gaugris, Van Rooyen & Bothma, 2008) and is considered to hold various endemic species, several of which are viewed as being rare and atypical (Kirkwood & Midgley, 1999; Gaugris & Van Rooyen, 2007; Matthews, 2007). As a result of the constrained distribution of Sand Forest and the uncommon species composition, Matthews (2007) perceives Sand Forest as one of the most important habitat types in Maputaland, forming the core of the Maputaland Regional Centre of Endemism (Mucina & Rutherford, 2006). Sand Forest occurs as fragmented patches in South Africa and Southern Mozambique, from False Bay (KwaZulu-Natal) in the south to Maputo in the north (Kirkwood & Midgley, 1999; Mucina & Rutherford, 2006; Matthews, 2007). Matthews (2007) estimates that the area in which the Sand Forest occurs, covers a narrow 500 km zone. Only 150 km occurs within South Africa, which was the focus area for this study (Figure 1).

Indigenous forests and savannah, such as Sand Forest, provide numerous benefits for rural communities (Pote, Shackleton, Cocks, & Lubke, 2006; Shackleton, Shackleton, Buiten, & Bird, 2007) and are utilised as a source of firewood, building material and woodcraft (Lawes & Obiri, 2003; Mucina & Rutherford, 2006; Gaugris & Van Rooyen, 2010). The increase in human population within Northern Maputaland has also increased the use of wooded ecosystems to meet basic household needs. This increase in population has raised concerns regarding the fragmentation and loss of Sand Forest, particularly in communal areas (Gaugris & Van Rooyen, 2007). The fragmented patch occurrence of this rare and valuable forest type, combined with the lack of necessary knowledge and prior interest in its management, has resulted in the Sand Forest being subjected to uncontrolled utilisation within communal areas (Matthews *et al.*, 2001; Gaugris, Van Rooyen, Bothma, & Van der Linde, 2006). There is currently an insufficient amount of information on the magnitude of human pressure affecting Sand Forest in communal areas (Mucina, Matthews, & Lawes, 2003), from which an understanding on the potential effects can be established. This study aims to contribute towards understanding the effects that could emerge from trends of informal Sand Forest wood harvesting, quantified through a spatial-temporal analysis.

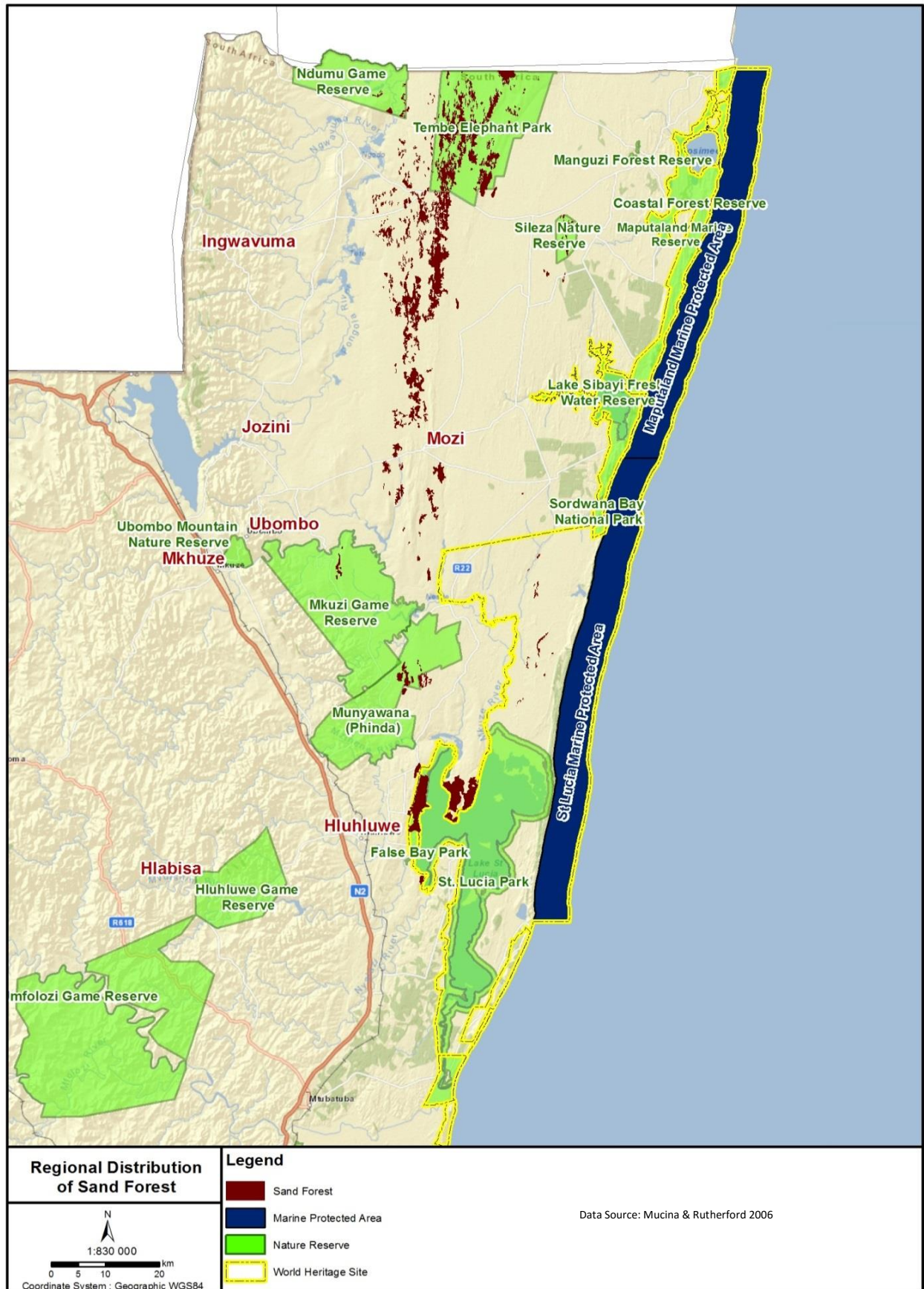


Figure 1: Regional distribution of Sand Forest

Informal wood harvesting

Wooded ecosystems such as forests provide numerous benefits to humankind in general and to rural communities in particular (Pote *et al.*, 2006). In rural communities, informally harvested wood is the main resource utilised as fuelwood for energy, woodcraft for economic value, building material for housing and for medicinal purposes (Shackleton, 1998; Lawes & Obiri, 2003; Gaugris *et al.*, 2006; Pote *et al.*, 2006; Paumgarten & Shackleton, 2009; Matsika, Erasmus, & Twine, 2013). According to Shackleton *et al.* (2007), the contribution of forest resources in study areas comprising South Africa, Zimbabwe and Cameroon, is estimated at 20% of total livelihood for rural communities. Projections for developing nations have shown that there are insufficient woodland reserves to meet the demand of rural communities (Matsika *et al.*, 2013). A study by Matsika *et al.* (2013) has revealed that 68% of rural households in South Africa that are electrified, still use fuelwood as their primary source of energy. The same study also showed that rural households opted for fuelwood as a primary source of energy even where wood resources become less available and the cost of collecting or purchasing fuelwood increased. Observations demonstrate that, as wood resources become increasingly limited, rural communities adjust their wood collection trends, such as increasing the frequency and length of collection excursions (Matsika *et al.*, 2013). The reliance of rural communities on wooded ecosystems is further substantiated by Mander and Quinn (1995) who established that 85% of rural households in KwaZulu-Natal relied on wood as part of their livelihood.

Various studies have been undertaken (Gaugris *et al.*, 2006; Gaugris *et al.*, 2008) in which the Sand Forest species that are utilised in rural communities were identified. The study by Gaugris *et al.* (2006), which identified Sand Forest species used for building material, undertook to determine the hard wood requirements for buildings in rural households within the Manqakulane Community. The study predicted that, over an 8-year period, the number of wooded elements that may need to be harvested for building requirements alone is 628 main posts, 477 main beams, 1, 416 roof laths and 28,147 wall laths per year.

The studies on informal wood harvesting (Gaugris *et al.*, 2006; Gaugris *et al.*, 2008) have shown that selection of wooded resources is not based solely on species type, but also on the structural requirements related to the intended use i.e. stem length and stem diameter. Furthermore, as observed in other wooded ecosystems (Lawes, Griffiths & Boudreau, 2007; Paumgarten & Shackleton, 2009; Matsika *et al.*, 2013) factors such as availability and accessibility will also influence informal wood harvesting trends. Informal wood harvesting within Sand Forest has been proven to occur, and wooded resources have been shown to be an essential part of the livelihoods of the local rural communities.

Livelihood security

Livelihoods are regarded as containing different assets, strategies, activities and other factors that contribute to the requirements for living (Chambers & Conway, 1992; Chen *et al.*, 2013), and such requirements include wooded ecosystems for basic household needs in developing countries (Byron & Arnold, 1999; Shackleton *et al.*, 2007). Shackleton *et al.* (2007) postulate that a significant portion of the South African population utilises forests and wooded resources. Moreover, Shackleton *et al.* (2007) hypothesise that these resources are such an essential part of the livelihoods of rural populations that the resources are useful in preventing further descent into poverty. This is further substantiated by Shackleton *et al.* (2007), who stated that the dry nature of South African forests, the high unemployment rate and the restricted availability of locally-based livelihood alternatives has intensified the reliance on wooded ecosystems. Therefore, the management of these resources forms an integral part of the livelihoods of the rural communities who depend on the resources as a basic household need.

Perez *et al.* (2015) consider sub-Saharan Africa as one of the regions that is at the greatest risk of climate variability and change. This is a result of factors such as, but not limited to, lack of food security, increasing population, water scarcity and reliance on climate-sensitive activities and resources, such as woody ecosystems. These factors, as well as restricted access to the formal economy, limits the adaptability of rural communities. Perez *et al.* (2015) further explain climate change vulnerability by citing various authors who indicate that climate change vulnerability is directly linked to the climate risks that communities experience, and is indirectly proportional to the ability of communities to adapt within the social-ecological system. Ultimately, a sensitive social-ecological system, in terms of climate change vulnerability, will be associated with a high degree of reliance on climate-susceptible natural resources, such as woody ecosystems, for livelihood security (Marshall *et al.*, 2010; Perez *et al.*, 2015).

Deforestation leads to floods, soil erosion and ultimately the loss of arable land (Bhandari & Grant, 2007). Subsequently, this environmental degradation results in the livelihoods of communities becoming threatened (Thapa, 2001; Bhandari & Grant, 2007) and increases the vulnerability of these communities to climate change. Livelihood insecurity in vulnerable communities is a key reason of increased social and economic adversity (Seddon & Adhikari, 2003; Bhandari & Grant 2007). The informal harvesting of wood may lead to the deforestation of complete areas, thus affecting livelihood security, so the management of these resources is essential.

Spatial concerns and characteristics, such as the extent, spatial heterogeneity, spatial-ecological and economic processes of natural resources are critical to decisions regarding their management (Albers, 2013). Therefore, it is essential to determine the extent to which informal wood harvesting affects woody ecosystems (Wessels *et al.*, 2011).

Quantitative analysis of informal harvesting

The sporadic distribution of Sand Forest over a narrow 150 km zone across Maputaland, Northern KwaZulu-Natal, brings to reason that spatial-temporal monitoring of the structures of Sand Forest areas within this landscape is the most viable method to detect and model deteriorating trends in forest structures and functioning. Through the use of remote sensing techniques, this study investigated the extent of informal wood harvesting on Sand Forest within the South African section of Maputaland, situated in Northern KwaZulu-Natal.

Nel (2016) derived the rates of change for the study period (1998 to 2014), based on using remote sensing techniques that utilised Landsat 5 TM (1998 and 2004) and Landsat 8 OLI (2014) images, in order to provide quantified information on the magnitude of human pressure affecting Sand Forest throughout Maputaland. The rates of change showed that the accumulated total loss in the extent of Sand Forest was 15.53 km² over a period of 16 years (1998 to 2014), resulting in a –6.6% net change (Nel, 2016). Through these quantified trends, a clearer understanding of the processes affecting Sand Forest could be derived, subsequently allowing for notions to be formed on the impacts that could emerge from these trends.

Influence of informal Sand Forest wood harvesting

Effects on the ecological system

The actual and expected loss of Sand Forest has pervasive consequences for the immediate surrounding ecological system as well as the regional and global systems i.e. on the micro, macro and global scale.

The immediate ecological system (micro-scale) is the most altered. The continued observed rate of informal wood harvesting of Sand Forest will result in the loss of genetic diversity within a Sand Forest patch, specifically relating to the economically important species exploited. The plausibility of this occurrence is justified through studies conducted by Gaugris *et al.* (2006) and Gaugris *et al.* (2008) on the economically valuable Sand Forest species as well as the distinctive sporadic distribution of Sand Forest. The observation by Mucina *et al.* (2003) that Sand Forest has a low rate of regeneration, therefore inducing higher susceptibility to encroachment and the impacts of the edge effect, further rationalises the probable impacts influencing Sand Forest as a consequence of the observed informal wood harvesting. Dupuch and Fortin (2013) cited substantial literature concerning the relationship between informal wood harvesting and the edge effect. Post harvesting, the microclimatic conditions are significantly dissimilar within the forest interior as opposed to the forest periphery. The changes in microclimatic conditions, such as greater sunlight penetration, higher wind speeds and a discernible difference in humidity and temperature deviations at the forest edge, cause a modification in the ecological system. The probable change experienced at the forest fringe increases the susceptibility of Sand Forest and affects the overall ecological functioning. These influences and effects of informal wood harvesting illustrate the significance of the impacts encountered by a single Sand Forest patch, and the probable consequences of continued over-utilisation.

The informal wood harvesting of Sand Forest is not confined to a single area; hence it has a macro-scale effect. Informal wood harvesting will eventually result in a reduction of the abundance and distribution of Sand Forest patches and may lead to changes in the community structure, further fragmentation of communities, increase in the surface area of the forest edge (increased edge effect) and the eventual extinction of species. The regional effects are further exacerbated due to the reduced extent of Sand Forest also being considered as the depletion of wildlife habitat. The *Neotragus moschatus* (Suni) is considered a declining small antelope species in South Africa (Belton, Dalerum, & Van Rensburg, 2008) and is commonly associated with Sand Forest (Friedmann & Daly, 2004; Van Eeden, 2006). According to Belton *et al.* (2008), Sand Forest reduction is considered as a possible cause of a decline in the Suni population. The relationship between Sand Forest and the Suni illustrates its importance within the macro system. The loss of Sand Forest will probably have a resounding regional impact; however, the details and extent of the cascade effect that may occur are unknown.

Although 100 ha of forest lost annually may not be considered immensely significant on a global scale, the cumulative effects of deforestation, including Sand Forest, has created the current global situation in which biodiversity is currently being lost at rates significantly higher than those revealed by fossil records (Biggs *et al.*, 2008). According to Sunderlin *et al.* (2004) the extent of forests on earth has almost halved over the last 8,000 years. Furthermore, selective and clear-logging disturbances are major contributors to ambient global CO₂ levels and are considered to account for an estimated 20% increase in atmospheric CO₂. This is a result of forest net CO₂ sinks

being converted into net CO² sources due to sustained respiratory loss and a stark decline in photosynthetic uptake (Schimel *et al.*, 2001; Denman *et al.*, 2007; Paul-Limoges, Black, Christen, Nesic, & Jassal, 2014). The loss of Sand Forest, therefore, contributes to climate change and further intensifies the overall effects of deforestation within the global system.

Effects on communities

If there is a continued increase in population, by even a small percentage, will also increase the demand for natural resources, thereby accelerating over-utilisation in communal areas. Continued over-utilisation of natural resources has a cascading effect on the communities that rely on these resources as the cornerstone of their livelihoods. Shackleton *et al.* (2007) hypothesises that these resources are such an essential part of their livelihoods that the resources have a relative probability of preventing further descent into poverty. However, the inverse is also accurate, as a reduction of these natural resources, due to over-utilisation through informal wood harvesting practices, is likely to further increase poverty within these communities. The high unemployment rate and restricted availability of locally-based livelihood alternatives have intensified the reliance on wooded ecosystems (Shackleton *et al.*, 2007). Therefore, a depletion of these resources in proximity to communities will necessitate the adaptation of harvesting practices. This adaptation may result in exploitation of the same resources in areas that are a substantial distance from the previous supply, which will have economic and social repercussions for the people who rely on them. From an economic viewpoint, adaptation may translate into the need to finance harvesting trips and involve transportation requirements and increased time for gathering, and thus less time available to create products from resources (woodcraft) and less time to attempt to become actively involved in formal economic activities (job-seeking). These factors all aggravate economic decline and the change in harvesting practices might also impact on social conditions. An increased duration of harvesting trips will ultimately reduce the time that people will spend within their communities and families. Eventually, the loss of Sand Forest to a degree that these resources are no longer easily accessible will have a significant negative effect on the livelihood security of communities within Maputaland, affecting the ability of households to generate income and to meet their basic needs.

The effects on communities, as with ecological systems, have a micro (community) and a macro (region) scale impact. The interactions and relationships communities have with natural resources do not occur in isolation. These relationships exist within numerous communities across Maputaland. The depletion of resources in one part of the region may result in conflict and unwanted social interactions in areas where resources are abundant. This is particularly relevant for the larger communities, which have established road networks and which may be identified as areas where significant loss could be expected over the next ten years. Furthermore, the increased usage of these resources due to an influx of informal harvesters may result in a Sand Forest patch that was being harvested sustainably becoming depleted in a short duration, thus creating a negative cascade of adaptation in harvesting practices and an accumulation of negative impacts.

The effects of over-utilisation of Sand Forest can also be linked to a decrease in resilience to global occurrences affecting communities, further impacting on livelihood security. African Development Bank (2003) indicated that the livelihood resources and adaptation opportunities associated with rural communities are limited and are more climate-sensitive. Moreover, a region's ability to respond and adapt to climate risk is ultimately determined by its communities' vulnerability to climate change. Considering the reliance communities have on natural resources and the limited economic opportunities available, it is not implausible to recognise the vulnerability of these communities to climate change. Climate-resilient communities are able to absorb the stress of climate change. However, in the event that climate change results in the depletion of natural resources (inclusive of woody resources and water), the adaptation possibilities of communities within Maputaland are limited, thereby further exacerbating the negative impacts previously discussed. The magnitude of this limitation, the possible effects of climate change on communities and the possibilities for improved climate resilience require further research.

Effects on the social-ecological system

The Resilience Alliance (2007) defines a social-ecological system as “*integrated systems of ecosystems and human society with reciprocal feedback and interdependence*”. Various authors (Scholz & Binder, 2003; Scholz, Binder, & Lang, 2011; Binder, Hinkel, Bots, & Pahl-Wostl, 2013) have identified three critical forms of interactions occurring within a social-ecological system: the effect of the ecological system on human society, anthropogenic influences on the ecosystem and its services, and the reciprocal feedback experienced between the ecological and social systems. The social-ecological system that exists between the communities and the environment is generally complex. Therefore, in order to identify the possible effects informal wood harvesting of Sand Forest may have, the elements within the system being viewed will be defined as follows:

- Ecosystem: Maputaland;
- Human Society: Communities in Maputaland; and
- Anthropogenic Influence: Informal Sand Forest Wood Harvesting.

The effects of the ecological system on human society and anthropogenic influences on the ecosystem and its services, have been discussed extensively in the preceding sections. Understanding the reciprocal feedback experienced between the ecological and social systems is vital in ensuring socio-ecological resilience. Socio-ecological systems that are resilient are able to absorb negative influences, adapt to negative changes and maintain functionality (Bamutaze, 2015).

As discussed above, the social-ecological system is complex and comprises multiple interactions. Currently there is insufficient information on the social-ecological system and its interactions within Maputaland, especially in the context of informal Sand Forest wood harvesting. However, a simple example of a social-ecological interaction that may occur as a result of the informal wood harvesting of Sand Forest is presented in Figure 2. To accurately identify the complete extent of the effects of informal Sand Forest wood harvesting, the social-ecological system in which Sand Forest forms an integral part of the ecological infrastructure would need to be understood and mapped.

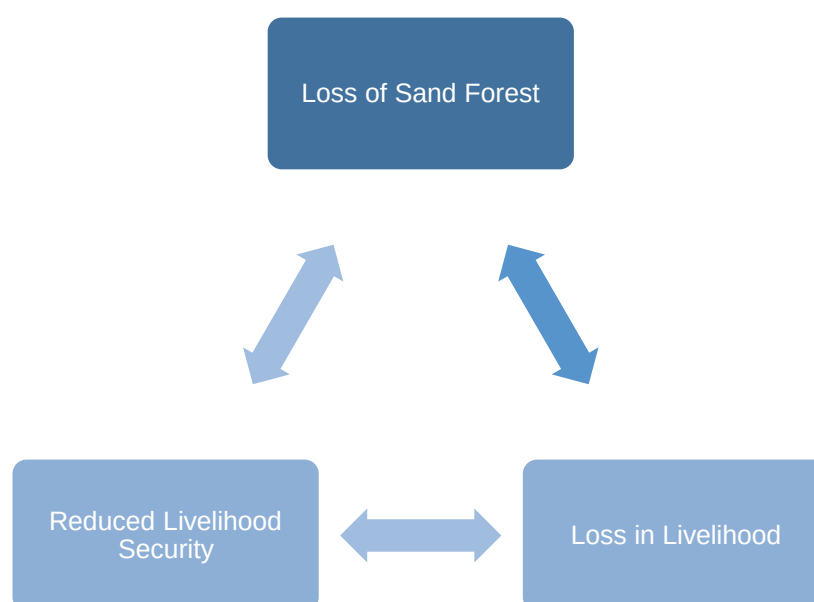


Figure 2: Example of a social-ecological interaction within a system

Conservation recommendations

As stated by Mckinley, Briggs and Bartuska (2012), the ideology centred on resource management has changed from a single resource extraction focus into a multi-dimensional approach that takes recreation, tourism, conservation, social importance and sustainability into account. The social and economic situation within Maputaland, and the trends associated with the informal wood harvesting of Sand Forest, can be considered a precursor of trends in other natural resources, and presents a system that is complex and demands innovative resource management strategies.

The protection of natural resources in Maputaland has been considered from various points of view, including conservation (Smith, Goodman, & Matthews, 2006; Van Eeden, 2006; Smith *et al.*, 2008) and resource management (Kyle, 2004). In the study undertaken by Smith *et al.* (2006) a preliminary conservation assessment was done which considers several potential areas for development, such as community-operated or privately-operated ecotourism or game-ranching enterprises. However, this approach to resource-management planning is generally conservation and protection focused, and does not quantify the livelihood security requirements of the communities. Studies have been carried out that considered the needs of communities. Kyle (2004) showed that the most successful option for conservation is joint management between communities and authorities. A distinct example is the Tshanini Community Conservation Area, which has served as an economic support for communities, as well as making a

considerable contribution to conservation targets, especially for Sand Forest (Van Eeden, 2006). The concept of community-based co-management has been shown to greatly increase livelihood assets (Chen *et al.*, 2013), thus increasing livelihood security.

On the other hand, developing a natural resource management strategy for the entire Maputaland with conservation targets as the main aim and community upliftment as a secondary objective may result in further loss of natural resources. A recommended approach would be the development of a resource management and utilisation strategy that has objectives for conservation, community upliftment and for utilisation (i.e. involve identifying areas for sustainable utilisation). Certain Sand Forest patches exist in a fragmented state and, due to high utilisation, lack the opportunity to form part of a protected system (e.g. the patches south of Mozi). Furthermore, Sand Forest patches also exist near protected areas, although they are an integral part of the livelihoods of communities. If these areas form part of a protected area, this may affect the livelihoods of the communities and will result in the protected status being ignored or lead to an adaptation in harvesting practices, which, as previously discussed, has cascading negative effects. An example is the KwaNibela Peninsula, which has been observed through this study as an area that has been extensively harvested, and this trend is expected to persist into the future. The KwaNibela Peninsula, however, exists in close proximity to the iSimangaliso Wetland Park, and so would normally be considered for conservation.

The recommended approach to a resource management and utilisation strategy for Sand Forest will need to (1) determine the conservation targets for Sand Forest; (2) identify suitable areas for community based ecotourism; and (3) determine the utilisation requirements of the communities to meet their livelihood security needs.

The areas identified in the strategy should be viable for community-based ecotourism, so as to replace the resource revenue obtained by Sand Forest harvesting with monetary revenue. This can only be done through quantifying the utilisation requirements of the community. Moreover, understanding the resource requirements will also assist in identifying areas that are viable for protection and those that should be considered as areas containing natural assets for communities. These natural asset areas would require a sustainable utilisation programme in order to ensure that the resources meet the current and future needs of the communities. A resource management and utilisation strategy may offer a way of preventing significant impacts on Sand Forest while ensuring that the livelihood requirements of the local communities remain intact.

Conclusion

Sand Forest is considered as being a highly significant vegetation unit, for both its conservation value (rare and atypical in nature) and as it forms an integral part of the ecological infrastructure that is entrenched in the livelihood security and resilience of the communities within Maputaland. The extensive and continued utilisation of Sand Forest for fuelwood, building materials and woodcraft through informal wood harvesting has resulted in sustained pressure on this natural resource.

Literature has provided extensive information on the structure, conservation importance and the economic importance of Sand Forest. However, little information was available on the extent of Sand Forest harvesting and the potential effects informal wood harvesting of Sand Forest would have on the social-ecological system in Maputaland. Literature on informal wood harvesting of Sand Forest, however, can be found in which the practices are described, thereby providing valuable information for the study. As shown in the quantified trends of informal Sand Forest harvesting, the need for effective measures for conservation and sustainable utilisation are rationalised through the possible effects of continued uncontrolled informal wood harvesting of Sand Forest will have on biodiversity, communities and on the social-ecological system of Maputaland, which can be viewed as being significant.

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TEACHING, TECHNOLOGIES, MAPS AND PRACTICALS

TWEETING AND ENVIRONMENTAL AWARENESS: SOCIAL MEDIA'S CONTRIBUTION

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Abstract: The study investigates the contribution that social media makes to the environmental awareness of South Africans. It probes the environmental issues that South Africans are concerned with, their opinions regarding these issues, and attempts to determine whether social media contributes to positive action or reaction. A pilot study is reported on. Twitter, a microblogging social media platform, and the rhino hashtag (#rhino), was chosen. Phrases, or tweets, related to “rhino” or “rhinoceros” were collected over a period of 10 days from 15 – 24 June 2016. A total of 28,331 tweets were downloaded, analysed, and visualised in terms of word and term frequencies, top hashtags, tweeters’ location and twitter sentiments. More than 50% of the tweeters were American, whilst a sentiment analysis showed that tweets tended to be more negative.

Introduction

The conference held during September 2016 by the Society of South African Geographers (SSAG), not only offered an opportunity to rethink and reinterpret historical and contemporary geography, but also to reflect on how teaching and learning takes place in the lecture hall. In an environmental management module taught in the Geography Department (UFS), students undertake an environmental awareness exercise in which the aim is twofold: (1) to teach basic research skills (working with questionnaires and analysing the results); and (2) to test the general level of environmental awareness of the public, part of which refers to the use of printed or visual media. As students rarely make use of printed media themselves, the exercise was updated to use social media as a platform.

Social media – mobile and web-based applications that allow people to communicate and share information across multiple platforms – is experiencing rapid growth and is being adopted by many (Hughes & Palen, 2009). Twitter, an information network, allows users to access the latest news related to subjects that they care about (Twitter, 2016a). Twitter (2016a) claims that its usefulness lies in it being “like a newspaper whose headlines you’ll always find interesting...discovering news as it’s happening...get[-ting] the inside scoop in real time.” Twitter use hashtags that are generated by a community, allowing users to use any hashtag for any tweeted message. Hashtagged messages may disperse widely in unpremeditated combinations across a variety of feeds and networks (Seegerberg & Bennett, 2011). Approximately 6000 tweets are sent per second, corresponding to about 500 million tweets per day and 200 billion per year (Internet Live Stats, 2016). Twitter is thus a rich research space offering valuable insights into among other things, the reaction (or lack thereof) to real time news events, and people’s beliefs, perceptions, and opinions about an event (Clark, 2009; Twitter, 2016b).

Although one of the earliest uses of a Twitter hashtag was environmental in its nature – tracking wildfires in Southern California, USA in October 2007 and using Twitter to inform citizens of time-critical information regarding road closures, community evacuations, shifts in fire lines, and shelter information (Clark, 2009; Hughes & Palen, 2009) – using Twitter as a research platform to gauge environmental awareness and sentiment towards environmental issues has been limited. Mooney, Winstanley, and Corcoran (2009) explored its use as a platform in environmental awareness campaigns, but most previous studies focused on specific environmental issues, especially climate change. Abbar, Zanoouda, Berti-Equille, and Borge-Holthoefer (2016) for example investigated the Twittersphere of Qatar to gain a sense of public awareness towards climate change. Seegerberg and Bennett (2011) surveyed the role of Twitter as an organizing mechanism and window into two climate change protest ecologies. Other studies have used Twitter to assess people’s level of geographical awareness (Han, Tsou & Clarke, 2015); and to determine its contribution to situational awareness in natural hazards events (Vieweg, Hughes, Starbird & Palen, 2010). In terms of sentiments and opinions, studies have mostly focused on social media marketing and public affairs to gain an understanding of consumers and their specific engagement needs (Kietzmann, Silvestre, McCarthy & Pitt, 2012; Mooney et al., 2009). Evidence of studies exploring tweets related to environmental issues in general and opinions concerning such issues, especially in the South African context, has not been found. World Wide Worx (2016) reported that nearly 7.4 million users are registered on Twitter in South Africa, making it the second most used social platform besides Facebook. It therefore seemed worthwhile to delve into a portion of the South African Twittersphere.

In the context of environmental awareness and Tobler’s first law of geography (which states that everything is related to everything else, but near things are more related than distant things), it can be expected that individuals

would be more aware of environmental issues close to home or which directly affects them, than they would be of environmental issues farther away or not directly affecting them. Similarly, it can be expected that a tweeter is more likely to tweet about nearby events or issues than distant events or issues. In other words, it would be expected that South Africans are more likely to tweet about rhino poaching than Americans, and similarly within South Africa, more tweets are likely to come from people living close to the Kruger National Park (as an example) than from anywhere else in the country. The location of tweets (if available) can thus be used to map the sphere of influence of an environmental issue – i.e. are local people tweeting about rhino poaching or international people? To test this hypothesis a pilot study was conducted in which tweets related to “South Africa”, “rhino”, and “poaching” were collected for 10 days from 2016/06/15 – 2016/06/24. The study will be broadened in the future, investigating the general Twittersphere of South Africa to establish which environmental issues South Africans are concerned with and what their opinions are about these issues.

Literature review

Environmental awareness

One of the main goals of the UNEP and UNESCO International Workshop of Environmental Education in 1975, as published in the conference document, was to educate a world population that shows a positive environmental awareness and concern and who would have the necessary knowledge, skills, attitudes, motivations and commitments to work towards solving environmental issues (Mittelstaedt, Sanker & VanderVeer, 1999).

Environmental awareness is a broad term, which incorporates a number of issues. Although a formal definition seems to be lacking, Waldman (1992) (as quoted in Jeronen & Kaikkonen, 2002, p. 342) describes environmental awareness as “the wholeness of observation, attitudes, wishes, fears, and appreciations concerning the natural environment, our cultural environment and any relationships between them”. Environmental awareness is therefore more than just academic knowledge, it is a deeply personal experience. An individual’s values as reflected in his/her environmental worldview will play an essential role in developing an environmental awareness and responsibility towards the environment (Jeronen & Kaikkonen, 2002; Stern & Dietz, 1994). Various studies that followed on the work of Stern & Dietz (1994) have confirmed that individuals with a biospheric value orientation and eco-centered worldview are more likely to have a positive attitude towards environmental protection.

Many debates have centred around the so-called “literacy model” which implies that greater environmental *knowledge* will result in a change in *attitude* which will in turn result in voluntary *action* which will prevent the associated detrimental environmental effects (Spellman, Field & Sinclair, 2003). There has been much critique against this simple cause-and-effect school of thought. Kaiser, Wolfgang and Fuhrer (1999) argue that environmental attitude is a powerful predictor of environmental behaviour. However, Ivy, Lee, and Chaun (1998) conclude (in contrast to the first law of geography) that students’ attitudes tended to be strongly positive only with respect to items which are more general in nature and have less direct bearing on their lives. Ivy et al. (1998) as well as Lee (2011) further speculate on the possibility that people talk about issues because it is socially or culturally expected of them, but this will not necessarily affect their actions. Other authors have failed to establish a link between attitude and actual behaviour. The results of Mittelstaedt et al. (1999) indicates that children show a positive attitude and intention towards action when surrounded by an environmental experience. However this intended positive action towards the environment greatly diminished a year after the original experience. There is therefore a strong link between knowledge and attitude but not necessarily between attitude and action.

Bord, O’Connor, and Fisher (2000), as well as Ajzen (2002), confirms this idea and argues that environmental values, norms and perceptions, and personal risk play a greater role in intended action than knowledge. In Lee’s more recent work (2011) there is a shift towards the context-value-attitude-behaviour model. Lee (2011) states that, among Hong Kong adolescents at least, there is a strong link between value orientation and attitude. This positive environmental attitude has in turn been proven to have a strong relationship with an adolescent’s intention to act in an environmentally friendly manner.

Media exposure (mainly TV and advertising) is also found to positively influence adolescents’ environmental values by raising the issues in their minds, by presenting environmental values and environmental participation in a positive way, and lastly by showing what is considered acceptable environmental behaviour in society (Lee, 2011). The majority of Twitter users are young adults and this can have a positive impact on environmental awareness and ultimately environmental protection as Lee (2011) argues that younger people tend to have a higher level of environmental concern. He states that “adolescents constitute a potentially large force for environmentalism for the following reasons: they are becoming more environmentally conscious, their anticipated life-span is longer, and they can serve as an influencing force in their families and peer networks” (Lee, 2011, p. 302).

Improved technology and the emergence of social media (with specific reference to Twitter) can play a large role in bringing the environmental message home – literally to your phone. However, Dosemagen (2016) cautions against

what is termed “clicktivism” (the use of social media to promote or support a cause). People tend to easily support causes online through sharing, liking or re-tweeting, but this does not necessarily translate to real environmental transformation.

Big data, social media, cyber geography, challenges

Large, dynamic data sets, such as Big Data – a term referring to big ideas, impacts and changes, along with big volume data sets – consists predominantly of user generated content (UGC) such as posts, digital photos, and online comments which provides unstructured data (Tsou, 2015). Although Big Data in the form of social media messages offer an opportunity to study unique spatial distribution patterns, complicated social networks, and dynamic user-generated locational information, it requires a different approach for its representation and analysis. According to Tsou and Leitner (2013) an entirely new discipline, cyber geography, is needed to analyse the spatiotemporal dynamics found in social media. Within this, social network analysis and tools that can be used include Gephi, NodeXL, R, and NetworkX, with research opportunities relating to amongst others creating digital maps of the diffusion of social movements (Tsou, 2015).

Although there are ample research opportunities in Big Data and social media, there are also many challenges associated with the mapping of such data (Tsou, 2015). Challenges include: biased data (approximately 75% of Twitter users are in the age range of 15–25; 50.99% of users are from USA; and there are 6% more female users than men (Beevolve, 2014)); the current limitation of spatial (multiple scales of geolocation) and temporal (comparison, before/after, trends) analysis; protection of user privacy and locational privacy whilst also being able to use it in research; and cutting through the noise created by advertisements, robots, non-relevant conversations, and marketing messages. Additionally, the dynamic and unstructured nature of Big Data calls for multidisciplinary collaboration – collaborations which have yet to be established in many instances. Tsou (2015) also warns against the over-emphasis on data content whilst neglecting the context of data collection and users. Content and context should be linked. A big challenge in Big Data is that proprietary Big Data cannot be shared among research communities, making re-tests or re-runs by other researchers on recently published social media and Big Data research impossible. This is a hindrance to advancement in social media research.

Bringing environmental awareness and social media together

Ultimately our goal as geographers and environmentalists is to protect all the diverse facets of our environment. We need to promote positive attitudes and values in order to prompt positive actions. Actions such as adjustments in lifestyle and consumption habits that will reduce the overall impact on the environment (Ivy et al., 1998). Whether this change occurs due to knowledge, cultural pressure or media bombardment is irrelevant.

Research framework, data collected and results

Research framework

Knowledge Discovery in Cyberspace (Figure 1), derived from Knowledge Discovery in Databases (Fayyad, Piatetsky-Shapiro, and Smyth, 1996), is a research framework used to reveal knowledge in social media platforms (Tsou & Leitner, 2013). The interdependent relationship among place, time, and content can be explored with the use of information mining algorithms, GIS, visualisation tools (e.g. Tableau), and spatial statistical methods.

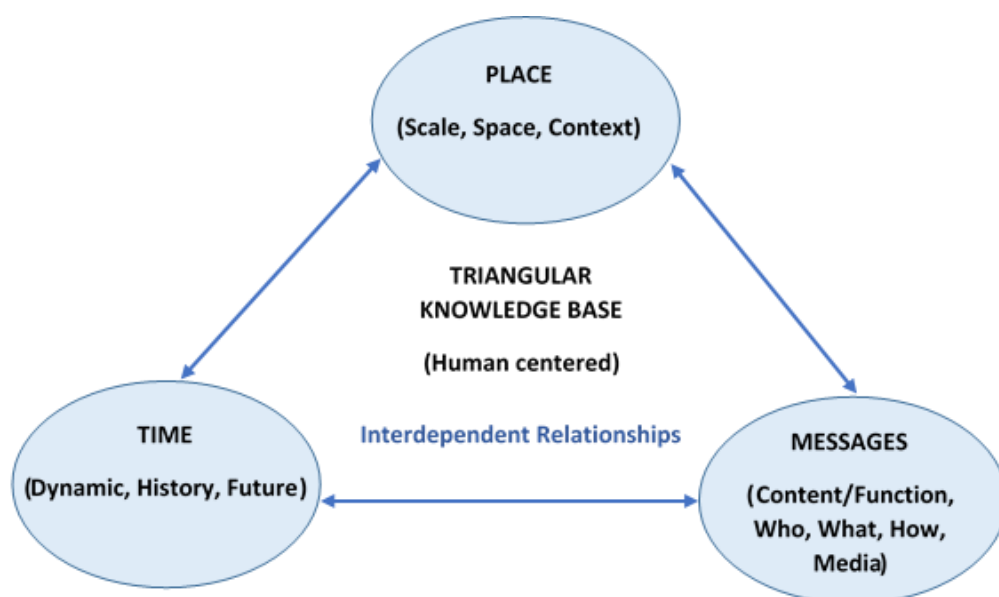


Figure1: Knowledge discovery in cyberspace - a conceptual framework based on the interdependence between place, time, and social media messages (adapted from Tsou & Leitner, 2013)

Data sources

Twitter.com, the microblogging service, was chosen as the primary data source for this study. To collect the data, the Twitter Streaming Application Programming Interface (API) was used, which provides researchers with a queryable sample (maximum 1% of all content) of tweets in near real-time. A Twitter collector was developed in Python 2.7 to collect the Twitter data. Since the focus of the study was on rhino poaching, we used logical keyword combinations to retrieve the relevant tweets. These keywords were extracted from suggested Google search terms in conjunction with the “rhino” keyword (Table 1). In total, 28,331 tweets were downloaded between the 15th and 24th of June 2016. To put it into perspective: during the earthquake in Nepal more than 1.1 million tweets were recorded between the 30th of April and 6th of May, 2015 (Radiante, Hiltz & Labaka, 2016). It illustrates that a natural disaster of this magnitude and with international media coverage generated a lot more tweets in 6 days, than rhinos being poached in South Africa in 10 days.

Table 1: Keywords used to collect tweets related to Rhino poaching.

Keyword:	Phrases with the keyword:
Rhino	How to stop
Keyword and:	Stop
Poaching	Wessa initiative
Trade	
Conservation	
Horn	
Dehorning	
Save the	
Extinct	
Endangered	
Illegal	
Project	
Volunteer	
Protect	
Donate	
WWF	
initiative	
Campaign	
White	
Black	

Text pre-processing

Since the text differs from tweet to tweet and uses emoticons, URLs, *RT* for re-tweets, *@* for user mentions, and *#* for hashtags, it is necessary to pre-process and clean the data. As it is standard in Natural Language Processing (NLP) practices, the text was tokenised for pre-processing. Several tokenisers were investigated and the NLTK TweetTokenizer was found to be best suited for the study. The tokeniser correctly handled emoticons, HTML tags, URLs, re-tweets and Unicode characters. Finally to prepare the textual data for further analysis, all English stop words (i.e. words that only have grammatical significance) and punctuations were eliminated.

Data aggregation

Once the data was pre-processed, textual data analysis operations were carried out. Table 2 shows the top words, followed by top hashtags, and then finally top terms (without hashtags). For example, of the 28,331 tweets, 22,131 had the word rhino in it and 4,264 had the hashtag *#rhino* in it.

Table 2: Top words, hashtags and terms

Top 20 Words			Top 20 Hashtags			Top 20 Terms (without hashtags)		
1	rhino	22,131	1	<i>#rhino</i>	4,264	1	rhino	22,131
2	<i>#rhino</i>	4,264	2	<i>#poaching</i>	457	2	poaching	2,230
3	poaching	2,230	3	<i>#animals</i>	330	3	horn	2,005
4	horn	2,005	4	<i>#opblacknamibia</i>	310	4	black	1,589
5	black	1,589	5	<i>#wildlife</i>	281	5	white	1,426
6	white	1,426	6	<i>#sarafina</i>	218	6	baby	1,283
7	baby	1,283	7	<i>#hero</i>	188	7	trade	1,256
8	trade	1,256	8	<i>#animal</i>	181	8	new	1,224
9	<i>@protect_wldlife</i>	1,243	9	<i>#video</i>	171	9	save	1,018
10	new	1,224	10	<i>#animallover</i>	166	10	kaziranga	981
11	save	1,018	11	<i>#animallovers</i>	165	11	video	901
12	kaziranga	981	12	<i>#rhinoceros</i>	163	12	spearmint	894
13	video	901	13	<i>#southafrica</i>	148	13	poachers	849
14	poachers	849	14	<i>#africa</i>	140	14	killed	844
15	killed	844	15	<i>#elephant</i>	137	15	like	743
16	like	743	16	<i>#worldgiraffeday</i>	136	16	africa	734
17	africa	734	17	<i>#ivory</i>	128	17	rhinos	730
18	rhinos	730	18	<i>#rhinos</i>	125	18	people	715
19	people	715	19	<i>#babies</i>	119	19	stop	711

Figure 2 shows a tag-cloud visualisation of the most relevant identified terms occurring in the Twitter messages that contain the tracking keywords mentioned earlier. Tag-cloud software (“Wordle.net”) was employed to implement the tag-cloud visualisation functionality.

a more negative sentiment perspective but then stabilising towards neutral by 22 June 2016. Reasons for this phenomena are unclear and due to time constraints could not be further investigated.

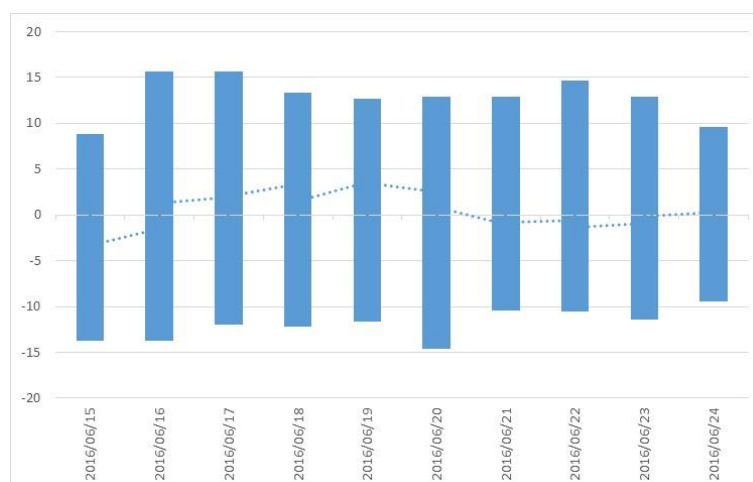


Figure 4: Sentiment analysis over time.

Table 3 shows examples of the most positive and negative tweets and it was interesting to note the difference in type of Twitter conversations at the two opposite sides the sentiment scale. User information was removed to protect the identify of the Tweeter.

Table 3: Most negative and positive tweets

Most negative tweets	Sentiment
RT @WildlifeAtRisk: DALLAS (CN) - A Texan who paid \$350,000 to kill an endangered black rhino in Africa cannot sue Delta Airlines for...	-12.18
So the state corruption ,state money looting and Rhino killing is reported to @Our_DA and racist rant is reported to @MYANC .Very interesting	-12.011
#Rhino #poaching plight dire. #US must insist #China #Vietnam stop slaughter via #trade policy. @SenateFloor #crime	-11.857
Ugly impotent creeps not only senselessly killed endangered rhino but spitting on American flag! Disgusting!	-11.444
Killing an elephant, a tiger, or a rhino is a heinous crime. But right now, gaps in law enforcement mean too many...	-11.248
Most positive tweets	Sentiment
RT @BabyRhinoRescue: Had to share this #beautiful #photo of a white #rhino calf. Have a lovely day rhino #friends.	12.868
Magnificent Rhino in the Brush #SouthAfrica #travel #photography #Adventure #earthXplr	12.732
MAGNIFICENT AREN'T THEY! Beautiful #rhino photo from STROOP's @user #photography #Africa	9.037
Another day of beautiful sunsets and a young rhino with his mom.	8.872
Just a casual #rhino alongside the car while driving around my neighborhood #Africa #Botswana #wildlife #sunset	8.565

Data analysis

The tweets that did include a user's location (n=18,973) and user's time zone (n=15,520) were analysed next. Figures 5 and 6 shows that South Africa falls within the top five, both in terms of user location and the user time zone. Both these metrics were used to assist in identifying the origin of the tweets since the user location field is a free text and specified by the user. The time zone on the other hand must be from the list of TimeZone names (Twitter, 2016c; 2016d). Confirming previous research (Edison Research, 2010; Statista, 2016; Sysomos, 2009),

both graphs illustrate that on average more than 50% of Twitter users are from the United States or other western countries. Furthermore, since the number of US tweeters have grown from 17 million in 2010 to over 60 million in 2016, it is expected that they generate the bulk of tweets (approximately 80%) about any topic in a borderless Twittersphere. It is heartening to see South Africa as well as Kenya on the list – an indication that Tobler’s first law of geography is evident in these two countries.

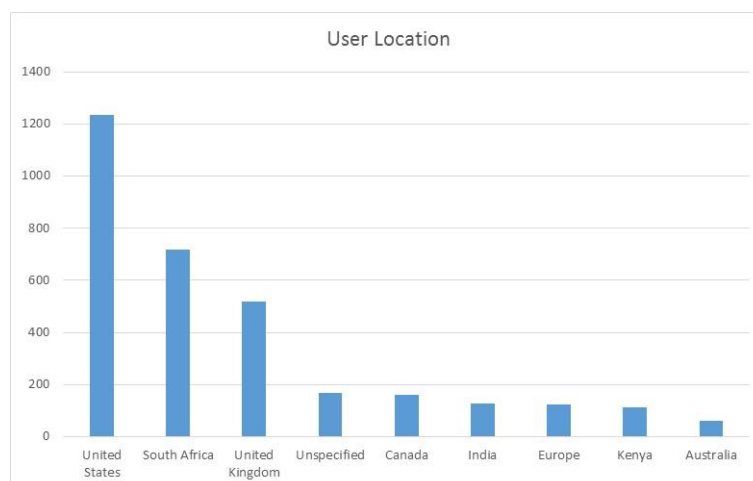


Figure 5: Tweets according to user’s location.

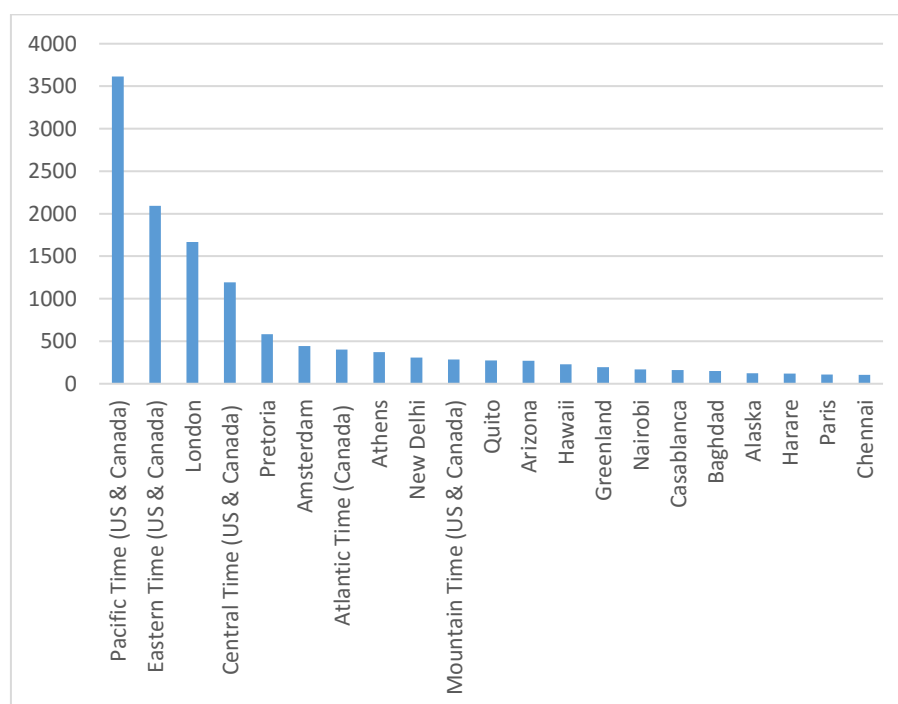


Figure 6: Tweets according to user’s time zone.

Lastly, a time-series analysis was also performed on the corpus. Figure 7 shows the number of tweets who mentioned “rhino” at different hours of the day. The hours of the day are according to the Coordinated Universal Time (UTC) time when the tweet was created (Twitter, 2016e). No clear pattern is visible and it appears on average that people were tweeting anytime of the day. Figure 8 shows the number of tweets over the period and on average the highest number of tweets were sent on 19 and 20 June 2016. The reason for this is still unclear and needs further investigation, but considering that many of the irrelevant tweets included references to Father’s Day (which

happened to be on the 19th of June 2016) this could be a misrepresentation of data. It is also unclear why there is an unusually low number of tweets on 24 June 2016. This implies that a news event could be followed to determine whether a subsequent spike in tweets is observed, which could give clues as to the environmental attitude and awareness of the tweeters.

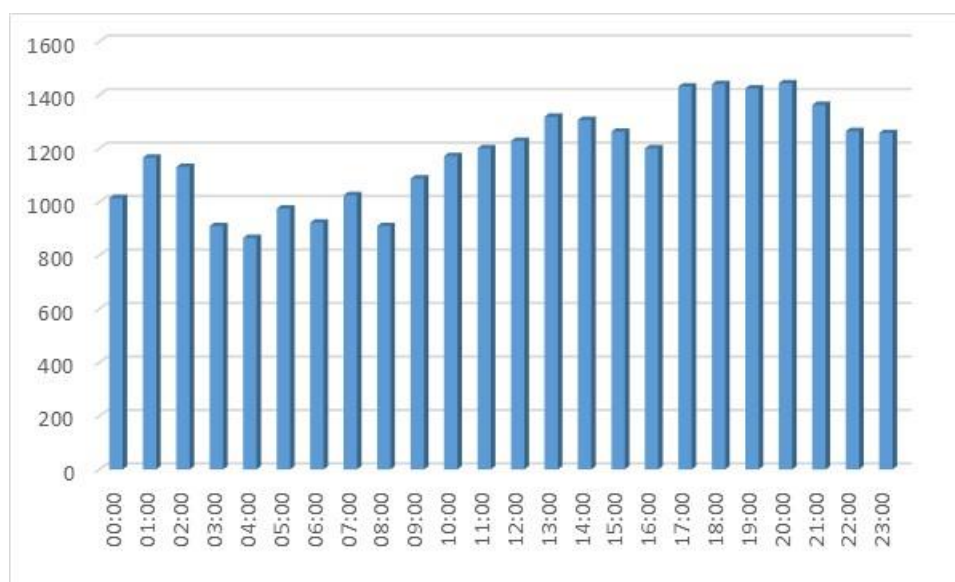


Figure 7: Number of Tweets versus Hour of the Day.

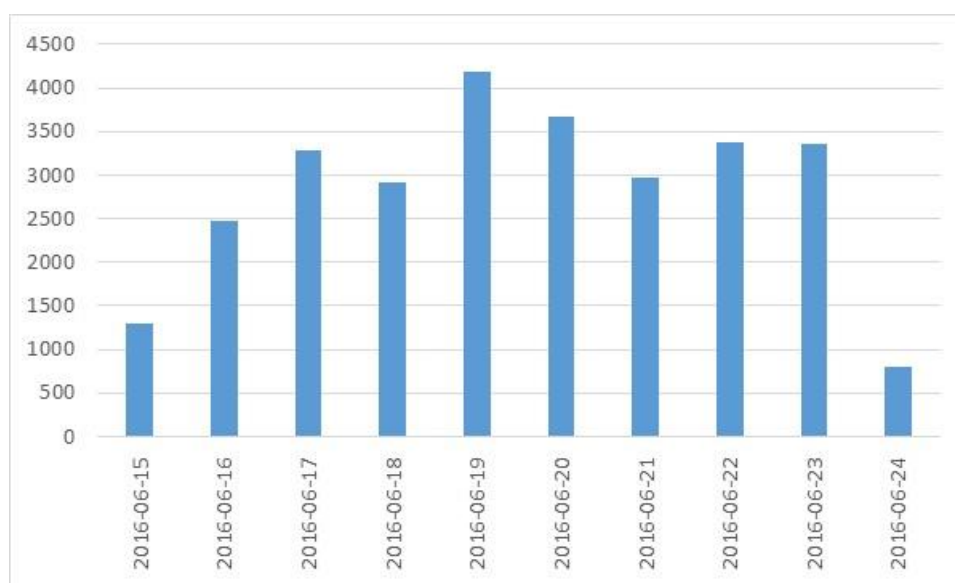


Figure 8: Tweets by date.

Conclusion

The pilot study confirmed many of the generally held beliefs regarding environmental awareness although a complete statistical analysis was impossible. It indicated that social media, especially Twitter, can be used for analysing text and opinion using various applications. The study encountered a number of pitfalls and challenges. Using big data sets requires a mind shift towards multidisciplinary collaboration. The challenges include working with biased data, limitations in spatial and temporal analysis, user and locational privacy and cutting through the “noise”. Researchers who are planning to make use of social media needs to clearly understand the goals of the research and must carefully consider what they aim to gain from tweets. The pilot study has generated further

avenues to investigate: (1) exploring the tweeters (individuals vs. organisations) and those that are most influential in raising awareness; and (2) understanding the ‘virtual spatial outcome’ for rhinos that are created on social media platforms.

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MAPPING CENSUSES IN SOUTH AFRICA: 1911 TOWARDS 2011

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Abstract: Historically censuses in South Africa have been fragmented. A census is one of the most intrusive and comprehensive projects to be undertaken by any country in its quest to collect information concerning its population. However the information sought is more than just a mere headcount, it is also for mapping the past to implement the future. Although census takings can be traced back as far as the 18th century, South Africa's first official census was only conducted in 1911 which covered all population groups, where after subsequent censuses followed with the last one taking place in 2011. Mapping these censuses not only provide a historical overview of growth, it also provides transacted knowledge not to repeat the past.

Introduction

“Sir, the first census of the population of the Union of South Africa was taken on the 7th of May, 1911. In addition to information relating to the persons returned as living at midnight on Sunday, 7th of May, statistics were collected regarding buildings, livestock, agricultural, religious denominations, schools, mines, industrial undertakings and fisheries throughout the Union. Prior to my appointment on the 1st of July, 1910, as Director of the Census for the Union of South Africa, I had no experience whatever of census administration, or statistical work or methods” in the words of J. B. Moffat, the Director of Census (South Africa, 1912).

Historically censuses in South Africa have been fragmented, typically covering only parts of the country and sections of the population. The first census was conducted as far back as 1798 where every head of a household in the Cape Colony had to submit a return stating the size of his family and the number of slaves he owned. According to Bird and Colebrooke (1822) the total population for the Cape of Good Hope in 1798 was standing at 61,947 which included 25,754 slaves. The first South African statistical manuscript, known as *The Annual Blue Book in the Cape of Good Hope*, was released in 1823 and was continued until 1837, but was never published (South Africa and HSRC, 2007).

The sequence of censuses was irregular and the coverage unsystematic during the 19th century. The Cape of Good Hope conducted the first modern scientific census in 1865, following the principles laid down by the British Colonial Office and the exercise was repeated in 1875 and 1891. The Orange Free State followed in 1880 and 1890, copying many of the features of the Cape of Good Hope. The Transvaal followed in 1890; however, the enumeration was restricted to the white population only. Finally, in 1891 Natal conducted a partial enumeration. After the South African War of 1899 - 1902, all the colonies undertook censuses in April 1904, but, although broad coordination took place, the results were presented according to the views of the four individual commissioners (Christopher, 2010).

The establishment of the Union of South Africa as a British dominion in 1910 necessitated a new start to enumeration in the country. The constitution of the Union of South Africa provided for the provincial allocation of the seats in the House of Assembly to be re-determined every five years. In order to achieve this outcome, a population census was required before the appointment of each delimitation commission. The Census Act of 1910 (Christopher, 2010) is therefore one of the founding pieces of legislation of the new state and an integral part of the legislative process until the link between the census and the allocation of seats was ended in the 1950s. A separate Census Office was established in 1910 and the first director, J.B. Moffat was given responsibility for the conduct of the very first census in 1911.

In Christopher's (2010) view, a census is one of the most intrusive and comprehensive projects undertaken by any country in its quest to collect information concerning its population. The information sought is more than a mere headcount, it also reflects the need for official statistics on a wide range of related matters such as sex, age, marital status, economic information, education, occupation, income, just to name a few. Censuses that followed after 1911 which covered all population groups took place in 1921, 1936, 1951, 1960, 1970, 1980, 1985, 1991, 1996, 2001 and 2011 (South Africa and HSRC, 2007). Although legislation required the conduct of censuses every five years which was based on the allocation of seats in the House of Assembly, it seemed that the events around World War I and II resulted in postponing census taking to 1921 hence not having a census in 1916, and 1951 hence not having censuses in 1941 and 1946. The period between 1921 and 1936, although both the 1926 and 1931 censuses were planned, resulted in a whites-only exercise due to economic conditions. According to Christopher (2010) the ten year intervals

which followed after 1951 until 1991 was due to the significant increase in timeframes when producing census results. The results for the 1911 census were published within two years; the results for the 1921 census took four years; the 1936 census took five years and the 1951 census nine years. Therefore, considering that the timeframes were not improving rendered the five year intervals as unattainable. The establishment of a new dispensation with the first democratic general elections held in 1994 and the reincorporation of the homelands into South Africa necessitated a census which was conducted in 1996. The current Statistics Act (Act no. 6 of 1999) which was promulgated in 1999 required censuses to be undertaken every five years starting in 2001. However, the act also stipulates that on the advice of the Statistician General, the five year cycle can be disregarded, hence the reason why the next census after 2001 only followed in 2011. All but the last Union census conducted in September 1960, adopted a date in early May. The reference nights for the Republic censuses that followed, adopted dates in early May for 1970 and 1980; March for 1985 and 1991 and October for 1996, 2001 and 2011 (South Africa and HSRC, 2007).

The purpose of this paper is to illustrate some historical findings of censuses considering methods and snap shots of time-lines between the first official censuses conducted in 1911 to the last census conducted in 2011.

Method of enumeration

Considering Moffat's report to the Minister of the Interior, the approach of enumeration adopted in 1911, it seems, in principle has stayed the same for the subsequent censuses conducted thereafter. According to Moffat (South Africa, 1912), the system inaugurated in 1891 by Henry de Smidt, in the taking of the census in the Cape Colony, also followed to a great extent in the Transvaal and the Orange Free State, in 1904, was adopted throughout the whole Union. Each Magisterial District was constituted a Census District and the resident Magistrate was appointed supervisor with the responsibility for the carrying out of the enumeration throughout the district. Each supervisor was supplied with a copy of a map of their district and was required to sub-divide the district into enumeration areas. As a rule the enumeration area was arranged so that an enumerator could make a complete round of the area within 3 to 5 days. Although the underlying principle for any census is that all parts of an enumeration area should be within comfortable reach of an enumerator, the rules in creating enumeration areas were adjusted with the subsequent censuses that followed. Considering the censuses from 1996 and onwards, enumeration areas were created on the principles of size (maximum of 250 households and extent of area) and that the enumerator should make a complete round of the area within 21 days. These adjustments were primarily based on methodology improvements and the movement towards international standards. However one principle that stayed the same is that enumeration areas serve as the building blocks for the collection and dissemination of census data (South Africa, 2011).

Each enumerator was also required to complete an Enumerator's Summary Book. The compilation of the summary books was a vital element in the conversion of the questionnaire into published data. Each book included a description of the area, with a map, an account of the questionnaire forms issued and their use, spoilage or loss, together with an account of the work done by the enumerator. Each form was listed providing the name of the householder or occupier; number and name of the house or farm; name of the street or road; total number of people; number of Whites (divided into males and females, subdivided into those under 21 and those over or equal to 21 years of age); number of Blacks (similarly divided); number of Coloured people (similarly divided); number of Asians (similarly divided); number of buildings, distinguished between occupied, unoccupied and under construction (South Africa, 1912). When considering the censuses of 1996 and onwards, one major adjustment in completing the Enumerator's Summary Book was the booklet had to be completed before the actual enumeration commenced. This was to inform the actual enumeration and to record whether or not each household had been enumerated. Regarding content, each booklet included maps (orientation, index and enumeration), aerial photographs or descriptions of every area and its boundaries. It also included a summary page providing total households, total persons (divided into males and females) and total dwelling units. Other important information provided were the address or other means of identification of each visiting point, name of head of household, suburb/village or locality, building name, total dwellings per record, feature (usage) classification, number of households per record, divided into male and female (South Africa, 2011).

From Census 2001 and onwards the mapping methodology was further extended with the introduction of technology. Geographic information system technology was used for the first time in the demarcation and map production processes. Data acquired from different government departments and private sector companies were integrated into a comprehensive digital spatial information database and where data proved insufficient, further data were collected in the field by means of utilising global positioning systems (South Africa, 2001 and South Africa and HSRC, 2007).

Population growth

In Hendler's (2015) view, historically South Africa was exposed to five different periods of growth:

- 1) Pre 1913, the basis for segregation was created - From the 19th century until the establishment of the Union in 1910 and the Land Act (No. 27 of 1913), the basis for industrialisation with the discovery of diamonds, gold and the establishment of the mining industry, was created. Pass laws and segregated housing was introduced as instruments to control the movement of black labour within the agricultural and mining sectors.
- 2) 1913 to 1948 the segregation period - The 1921 Transvaal Local Government Commission established the Stallard principle where blacks can only enter urban areas to serve white needs and had to depart thereafter. This resulted in blacks housing themselves in informal areas close to where they worked. Key legislation implemented to control black movement included the Housing Act (No. 35 of 1920); the Urban Areas Act (No. 21 of 1923); the 1931 Transvaal Ordinance; the 1934 Slums Act; the Native Laws Amendment Act (No. 46 of 1937); and the Native Urban Areas Consolidation Act (No. 25 of 1945).
- 3) 1948 to 1976 controlling segregation with the implementation of apartheid as a political system - Under apartheid as a political system the movement of blacks was controlled through spatial planning regulations which were conceptualised within the imperative to racially segregate cities. Spatial planning was articulated in regulations established through the Social and Economic Planning Council; the Natal Town and Regional Planning Commission established in 1951; the 1955 Mentz Committee introducing segregated black townships; the Natural Resources Development Council established in 1947 introducing racial zoning areas; and the 1975 National Physical Development Plan rationalising segregated townships within a broader framework of regional development axes, growth poles, growth points and de-concentration points.
- 4) 1976 to 1994 resulting in revolt and reform against the apartheid system - The June 1976 Soweto students uprising triggered nationwide rebellion against both the use of Afrikaans as a medium of instruction and the apartheid political system. This resulted in various attempts being made to reform the apartheid system. Reform was articulated in the establishment of the Wiehahn Commission which recommended the amendment of the Labour Relations Act granting black trade unions legal recognition, the Riekert Commission which loosened influx control mechanisms, the abolition of pass laws in 1986 and the abolition of certain land use management controls such as township regulations.
- 5) 1994 onwards: the demise of apartheid and the establishment of a new dispensation - In 1994 the first democratic general elections were held with a new dispensation taking control over the functions of government structures. The new dispensation under the African National Congress (ANC) removed all apartheid spatial planning and land use management regulations replacing it with new regulations such as the Reconstruction and Development Plan; the Development Facilitation Act established in 1995; the Municipal Structures Act established in 1998; the Municipal System Act established in 2000; the White Paper on Spatial Planning and Land Use Management established in 2001; the National Spatial Development Perspective established in 2003, the New Growth Path; the National Development Plan established in 2013; and the Spatial Planning and Land Use Management Act established in 2013 introducing the creation of Spatial Development Frameworks by all spheres of government, thereby promoting social and economic inclusion.

A historic analysis of South Africa's population count since 1911 also including the count that was undertaken separately by the four colonies in April 1904 is illustrated by Table 1 below. The count for ease of reference was categorised into 10 year intervals and rounded up to the nearest thousand.

Table 1: Total population counts since 1904

Year	White	Coloured	Asian	Black	Total
1904	1 117 000	445 000	122 000	3 490 000	5 174 000
1911	1 276 000	525 000	152 000	4 018 000	5 971 000
1921	1 521 000	545 000	163 000	4 697 000	6 926 000
1936	2 003 000	769 000	219 000	6 595 000	9 586 000
1946	2 372 000	928 000	285 000	7 830 000	11 415 000
1951	2 641 000	1 103 000	366 000	8 560 000	12 670 000
1960	3 088 000	1 509 000	477 000	10 928 000	16 002 000
1970	3 773 000	2 051 000	630 000	15 340 000	21 794 000
1980	4 512 000	2 688 000	803 000	16 992 000	24 995 000
1991	5 018 000	3 214 000	956 000	21 609 000	30 797 000
2001	4 293 000	3 994 000	1 115 000	35 416 000	44 818 000
2011	4 586 000	4 615 000	1 286 000	41 000 000	51 487 000
Growth:					
1904 - 1911	14,23%	17,98%	24,59%	15,13%	15,40%
1911 - 1921	19,20%	3,81%	7,24%	16,90%	15,99%
1921 - 1936	31,69%	41,10%	34,36%	40,41%	38,41%
1936 - 1946	18,42%	20,68%	30,14%	18,73%	19,08%
1946 - 1951	11,34%	18,86%	28,42%	9,32%	10,99%
1951 - 1960	16,93%	36,81%	30,33%	27,66%	26,30%
1960 - 1970	22,18%	35,92%	32,08%	40,37%	36,20%
1970 - 1980	19,59%	31,06%	27,46%	10,77%	14,69%
1980 - 1991	11,21%	19,57%	19,05%	27,17%	23,21%
1991 - 2001	-14,45%	24,27%	16,63%	63,89%	45,53%
2001 - 2011	6,83%	15,55%	15,34%	15,77%	14,88%
1904 - 2011	310,56%	937,08%	954,10%	1074,79%	895,11%

Source: South Africa 1912; 1921, 1936, 1965, 1970, 1980, 1990, 2001 and 2011

Converting the population counts provided in the table above, into graphs as illustrated below (Figure 1 and 2), it seems that the period 1994 onwards with the demise of apartheid and the establishment of a new dispensation, had a profound impact on the white and black population growth.

- 1) The period around 1995 to 2005 shows a decline from 5 to 4, 2 million in the white population totals. Although there have been periodic bouts of speculation over the extent of South Africa's brain drain, the South African Institute of Race Relations estimated, by comparing the figures in Statistics South Africa household surveys, that close to 800,000 white South Africans had left the country within this period. The commonly listed push factors were the high levels of violent crime and the racial employment policies being implemented by the new dispensation (South Africa and HSRC, 2007).

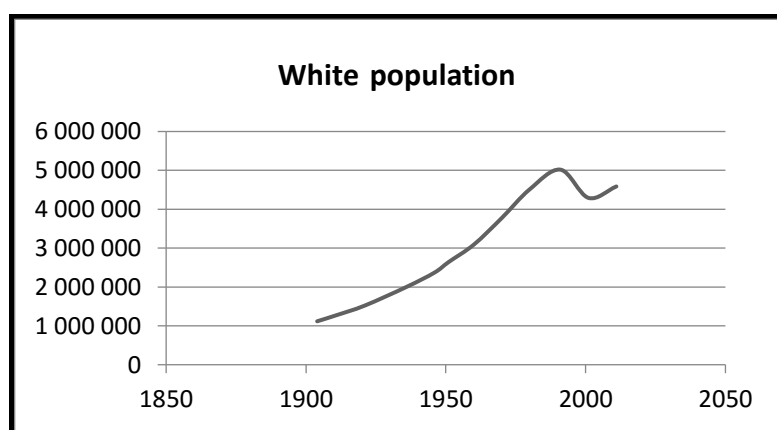


Figure 1: White population growth since 1904

- 2) The period around 1991 to 2001 shows a dramatic increase from 21 to 35 million in the black population totals. It is important to understand the effect homeland policies had on census takings. In 1976 and 1977, respectively, the Republic of Transkei and the Republic of Bophuthatswana were declared independent from South Africa. The same status for the Republic of Venda and the Republic of Ciskei followed in 1979 and 1983 respectively.

(see Figure 3). In 1979 South Africa announced that population estimates would exclude people living in the homelands of Transkei and Bophuthatswana. The homeland of Transkei conducted its own head count in 1980 with Bophuthatswana conducting an identical census at the same time as the South African count. Bophuthatswana conducted a second census in 1985, also concurrent with the South African census. Although censuses for all four independent homelands were only conducted in 1991, it was widely accepted that the homelands would be reincorporated into South Africa. It is clear that the effect of the homeland policy on the quality of official statistics for South Africa was devastating. Information for the country as a whole during the period of the independent homelands could only be estimated through computations. Only in October 1996, was South Africa able to conduct its first census since the advent of democracy in 1994, counting all persons/population groups residing in the country (South Africa and HSRC, 2007).

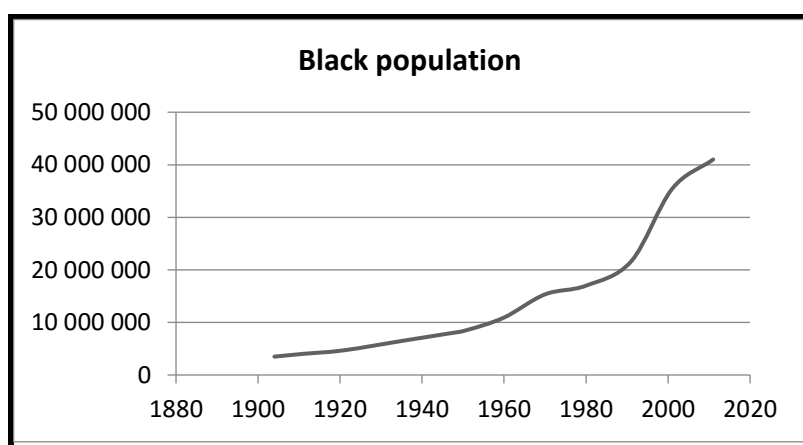


Figure 2: Black population growth since 1904

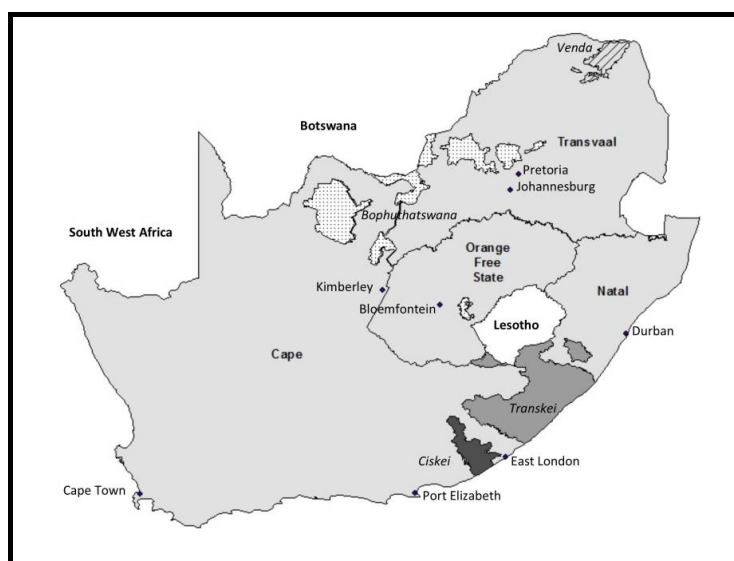


Figure 3: Independent homelands

Furthermore, establishing a population composition time-line as illustrated in Figure 4 below, in relation to the events as described above, it seems that the impact of the events are also evident on the movement of growth for the white and black population groups over the last millennia.

The white population group showing a negative growth dropping from 22 percent in 1904 to 16 percent in 1991, thereafter growth dramatically declined to 9 percent. The black population group showing a slow positive growth increasing from 67 percent in 1904 to 70 percent in 1991, thereafter growth drastically increased to 80 percent. Also, prominent is the movement in growth for the population groups Coloured and Asian showing neither a positive nor a negative (flat-line) growth staying in the proximity of 2 percent for Asians and 9 percent for Coloureds.

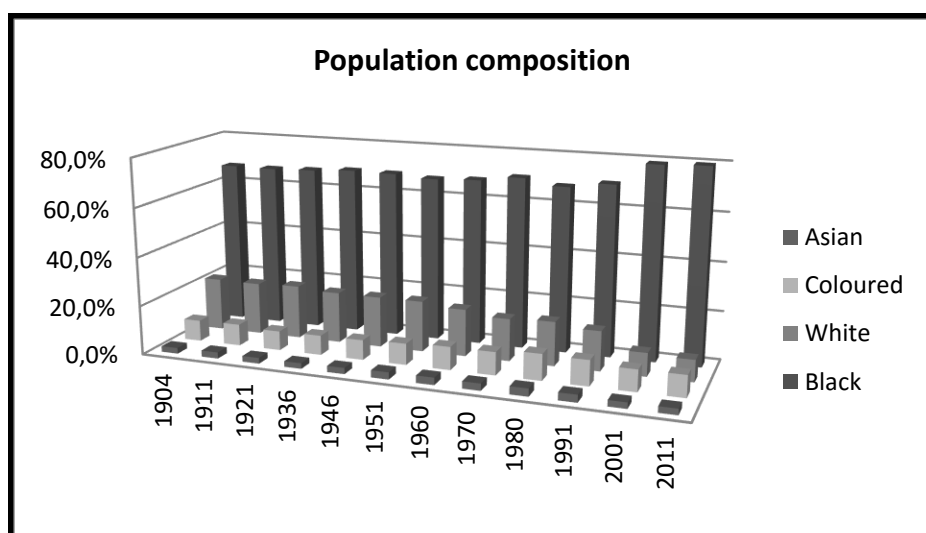


Figure 4: Population composition time-line

Urbanisation

According to Hendler (2015), the urban population in relation to the national population grew dramatically between 1913 and 1951, increasing from 25 percent to 35 percent. Thereafter, over the next 30 years it increased to 43 percent in 1980 with another dramatic increase to 57 percent in 2001 (see Figure 5). It is safe to argue that the drastic increase after the 1980s can be linked to the reincorporation of the four independent homelands into South Africa in 1991 and the demise of apartheid and the establishment of a new dispensation in 1994. However, it also seems that somewhere after the 1921s urbanisation also took a drastic step forward.

Historically, since 1911 South Africa underwent a long phase of intense urban growth with urban areas such as Johannesburg, Cape Town and Durban agglomerating into dominating economic spaces with the emergence of mining and industrial basins. According to Geyer (2003) for the most part, the urban establishment phase of South Africa was completed towards the end of the nineteenth and the beginning of the twentieth century. From then, until the early 1980s as illustrated by Figure 5, the country was in the urbanisation phase.

By the mid-1980s there were signs that the country's urban system was entering the polarization reversal phase. However, due to political changes which significantly affected population redistribution patterns, the urban systems first slipped back into the urbanisation phase only to return to the polarization reversal phase towards the end of the first decade of the new millennium (Geyer and Geyer, 2015a and 2015b). During apartheid, spatially, some areas were excluded from infrastructural development and this exclusion hampered growth. When apartheid ended many people who were prevented from migrating in the past, left rural areas for urban areas. This migration of people, mostly characterised by big numbers of black Africans, which was largely triggered by Todaro's (1969) *bright lights syndrome*, was essentially *productionism* oriented (Hart, 1973; Geyer and Kontuly, 1996 and South Africa, 2016), i.e. when people migrate primarily with the aim of finding employment and better life opportunities.

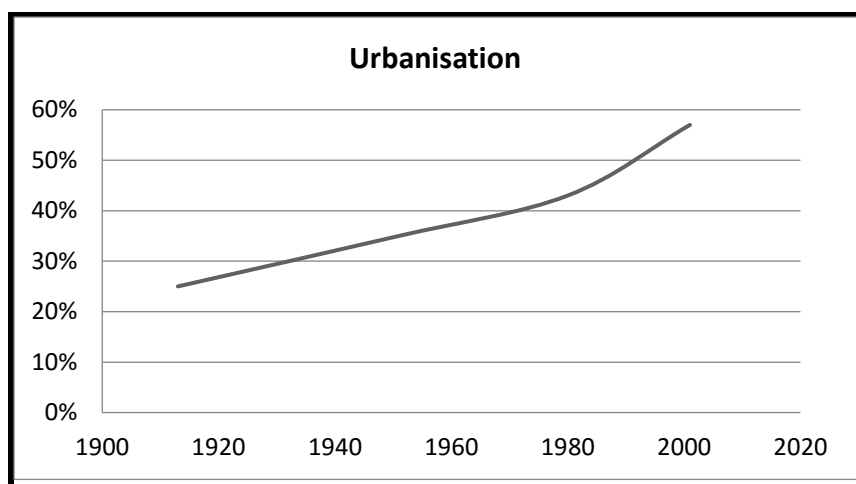


Figure 5: Urbanisation between 1913 and 2001

Considering the period 1911 to 1936, the country had a predominant rural character. Table 2 below illustrates the urban and rural landscape for the Union of South Africa between the period 1911 and 1936. The table shows that between 75 to 68 percent of the population resided in rural areas. The table also illustrates that there was no significant growth in the urban population for the period between 1911 and 1921, however for the period between 1921 and 1936 there was a drastic increase with the urban population growing from 25 to 31 percent. This drastic growth illustrates that the creation of events such as the rapid expansion of industrialization during the 1930s (Kwamena-Poh et al., 1986) and the Great Depression between 1929 and 1934 (Minnaar, 1990), had a strong influence on people migrating to urban areas. However, according to Minnaar (1990), the migration of people due to the Great Depression was primarily to escape poor life conditions.

Table 2: Urban and Rural population counts for 1911, 1921 and 1936

Year	Urban		Rural		Total
1911	1 477 868	24,76%	4 490 233	75,24%	5 968 101
1921	1 735 685	25,05%	5 192 895	74,95%	6 928 580
1936	3 009 531	31,38%	6 580 367	68,62%	9 589 898

Source: South Africa 1912; 1921, 1936

Furthermore, the urban population which in 1951 was standing at 35 percent is an indication that the growth rate for the urban population after 1936 was less significant when considering that it only increased with another 4 percent (Hendler, 2015). In addition, when focusing on the urban population for the major urban areas such as Johannesburg, Pretoria, Pietermaritzburg, Durban, Bloemfontein, Cape Town, East London and Port Elizabeth, it is evident that the biggest influx of people towards these major areas occurred somewhere after 1921. Table 3 and Figure 6 illustrate the urban population growth for these major urban areas between the period 1911 and 1936. This is emphasized by Fourie (2007) stating that the growth in the urban population did accelerate rapidly as people streamed into these cities in search of prosperity. Therefore, one can argue that urbanisation was strongly influenced across two distinct periods, close to the 1930s with the creation of certain key events namely the rapid expansion of industrialization and the Great Depression, and after the 1991s with the establishment of a new dispensation.

Table 3. Urban population growth between 1911 and 1936 for major urban areas

	Population count			Population growth	
	1911	1921	1936	1911-1921	1921-1936
Johannesburg	237 104	285 519	493 787	20.42%	72.94%
Pretoria	70 282	73 561	129 317	4.67%	75.80%
Pietermaritzburg	30 555	35 160	47 410	15.07%	34.84%
Durban	70 710	95 541	260 539	35.12%	172.70%
Bloemfontein	30 971	41 787	53 037	34.92%	26.92%
Cape Town	160 943	202 023	304 762	25.52%	50.86%
East London	25 605	36 287	61 746	41.72%	70.16%
Port Elizabeth	37 063	46 094	113 796	24.37%	146.88%

Source: South Africa 1912; 1921, 1936

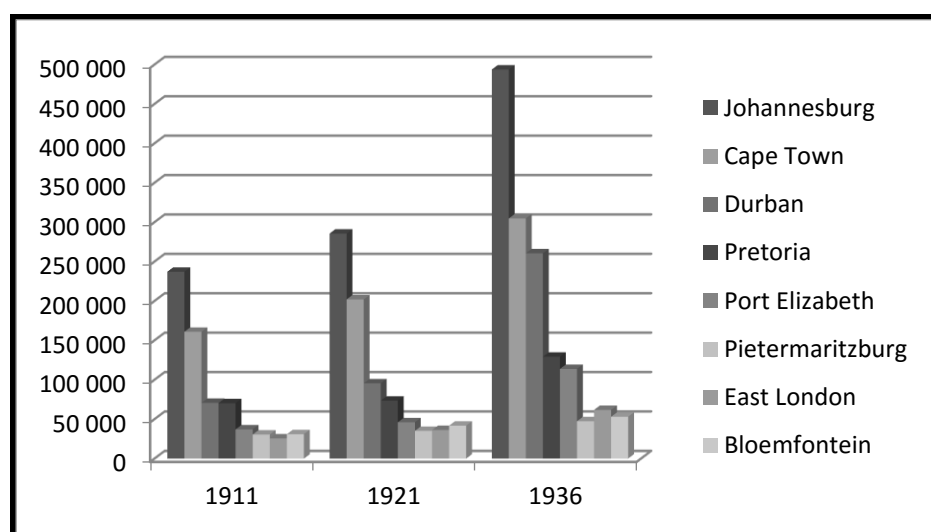


Figure 6: Urban growth between 1911 and 1936 for major urban areas

However, like most developing countries, South Africa is experiencing continuing urbanisation. According to the United Nations (UN) (2009), it is estimated that 71 percent of the South African population will live in urban areas by 2030, reaching nearly 80 percent by 2050.

Final remarks

Although census taking in South Africa can be traced back as far as the 18th century, it seemed that it was mostly fragmented, irregular and the coverage unsystematic. However, with the establishment of the Union of South Africa as a British dominion in 1910, census taking started to take its place as a legislated process, making it one of the most important pieces of legislation a country can have, embraced by the current Statistician General of South Africa, Pali Lehohla (2016) stating *“statistics are the most transacted knowledge outputs in communities, within and among nations”*. Further, with the introduction of technology into censuses means that the next evolutionary chapter will resolve around the advancement of technologies and the exponential growth of data derived from these technologies. Data will become more available, accessible and easily to collect and disseminate. Therefore, the responsibility for the next chapter will rest upon the 2021 census to take the story line forward. It should be noted that although the paper only scratches the surface, it does illustrate the importance of mapping censuses and is best described in a quote from Bhavesh Shhatbar *“Past is not for cursing, future is not for wasting; past is for learning, future is for implementing”* - to know the future is to understand the past.

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MOBILE TECHNOLOGIES FOR DATA COLLECTION IN SUB-SAHARAN AFRICA: AN OUTLOOK TO THE FUTURE OF MOBILITY RESEARCH

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Abstract: The ubiquity of ‘human sensors’ such as the mobile phone offers novel and innovative ways of collecting geospatial data on individual spatiotemporal behaviour. Cell Detail Records (CDR) and GPS technology embedded in smartphones, for instance, provide opportunities to passively collect high-resolution data that is otherwise difficult to acquire; even more so in the context of developing countries. This paper set out to briefly discuss some of the current mobile data collection techniques and their applicability for mobility research in an African context. Special attention is given to an experimental data collection in which 150 respondents from the University of Stellenbosch, South Africa, were passively tracked for two consecutive days by means of a purposefully designed smartphone application. It is argued that research using mobile technologies, such as smartphones, has great potential for complementing geographical research on travel behaviour. Notwithstanding the possibilities, mobile data collection techniques also introduce new methodological and empirical challenges. These challenges include harnessing the tools to obtain geo-referenced data (CDR, GPS, Smartphones), acquiring new skill sets for cleaning and interpreting these data, and ultimately embedding these new data streams in geographical-analytical frameworks.

Introduction

Sub-Saharan Africa is one of the fastest urbanising regions in the world and, as a result, demand for transport is rapidly increasing; estimates suggest that traffic volumes in urban areas grow with 15% to 20% per annum (Sietchiping, Permezel, & Ngoms, 2012). At the same time, major investments in public transport services are absent and the lion’s share of transport funding currently caters for private transport (Candiracci, Schlosser, & Allen, 2010).¹⁹ These trends, amongst others, have stimulated a shift from supply-side to demand-side urban transport planning (Behrens & Del Mistro, 2010). In South Africa, for instance, this is illustrated by the National Land Transport Act (Act 5 of 2009), which requires that municipalities formulate Transport Demand Management (TDM) strategies as part of their transport policies.

To effectively manage transport demand and design an effective transport policy, a good understanding of prevailing travel patterns and an accurate prediction of future travel demand is indispensable. Whereas this requires accurate travel data on a disaggregate level, collecting these data by means of traditional methods like paper-based travel surveys is a challenging undertaking as a result of common issues like the underreporting of trips, expensive administrative procedures and increasingly high non-response rates (Stopher & Greaves, 2007). Moreover, some have argued that the administration of travel surveys in cities situated in sub-Saharan Africa is even more difficult relative to their counterparts in other parts of the world (Behrens, Diaz-Olvera, Plat, & Pochet, 2006).

As a result of the administrative challenges of traditional survey instruments, researchers have started to experiment with new technologies for data collection. The ubiquity of ‘human sensors’ such as the mobile phone and the smartphone offer new and innovative ways of collecting geospatial data on individual spatiotemporal behaviour and, consequently, there is a vast amount of literature dealing with mobile technologies for collecting data on human mobility (see, for instance, Birenboim & Shoval, 2016; Rasouli & Timmermans, 2014; van der Spek, van Schaick, de Bois, & de Haan, 2009). However, few implementations of mobile technologies for activity-travel data collection have been documented in sub-Saharan Africa (notable exemptions are Krygsman & Nel, 2009; Siedner et al., 2013; van Dijk & Krygsman, 2015; Venter & Joubert, 2013, 2014).

This paper set out to briefly discuss some of the mobile technologies for activity-travel data collection and their applicability for mobility research in an African context. Special attention is given to an experimental data collection in which 150 respondents from the University of Stellenbosch, South Africa, were passively tracked for two consecutive days by means of a purposefully designed smartphone application. It is argued that research using smartphones has great potential for complementing geographical research on transport behaviour. Notwithstanding the possibilities, mobile data collection techniques also introduce methodological and empirical challenges as a result of a novel data supply chain.

¹⁹ There are some notable exceptions such as the bus rapid transit systems introduced in Cape Town (MyCiTi), South Africa, and in Dar es Salaam (DART), Tanzania.

Mobile technologies for collecting activity-travel data

Transport is crucial for the functioning of any city because of its foremost product: accessibility (Candiracci et al., 2010; World Bank, 2002). Accessibility is decisive for both economic and social development as it provides people with access to other people, goods, jobs, and urban amenities. However, transport systems and road networks are under pressure as a result of an unprecedented growth in private vehicle ownership as well as increasingly complex and fragmented travel patterns; particularly in urban areas (Gwilliam, 2013; Howarth & Polyviou, 2012). In South Africa's urbanised areas, for instance, these problems are exacerbated by, amongst other things, low-density housing, a concentration of employment in city centres, and the remnants of apartheid planning policies (Lucas, 2011). The results of these developments manifest themselves in daily congestion and traffic gridlock (Gwilliam, 2003). For instance, Cape Town is currently the most congested city in South Africa with a travel time increase of 70% in the morning peak hour and a travel time increase of 62% in the evening peak hour (TomTom International, 2016).

It is not just South Africa that faces a tremendous transport problem; throughout the developing world urban areas struggle with matching supply and demand. The formulation of answers to these problems are not only hindered by financial constraints, but also inhibited by a lack of reliable data on activity and travel behaviour. Despite the fact that the use of household travel surveys and activity-travel diaries is well-established in the transportation research field, the high respondent burden and the costly administrative processes, amongst other things, make obtaining disaggregate travel data a complex endeavour (Behrens, 2004; Nitsche, Widhalm, Breuss, Brändle, & Maurer, 2014; Stopher, Clifford, Swann, & Zhang, 2009); even more so in the context of cities in sub-Saharan African. Not only administrative issues such as acquiring a reliable sampling frame from which to draw a representative sample, but also a diversity of languages, cultures, and levels of education add to the complexity of data collection in the region (see Behrens et al., 2006; Taylor, 2016).

Despite the complexities associated with instruments such as household travel surveys, many studies have managed to collect detailed data on human spatial behaviour. The introduction of mobile technologies, such as mobile phones, and, more recently smartphones, however, has spurred the developments of new and innovative ways of acquiring and collecting geospatial data on human spatiotemporal behaviour. Some have argued that the ubiquity of location-aware technologies, deeply rooted in daily life, has led to a new paradigm in human mobility research capitalising on the so-called 'big data'; huge volumes of data that are continuously being generated (C. Chen, Ma, Susilo, Liu, & Wang, 2016; Kwan, 2016; Kwan & Schwanen, 2016).

Social media such as Twitter, Flickr, and Instagram, but also services such as Uber, Taxify, and Lyft, generate geospatial data at an unprecedented pace; data that are actively exploited for research purposes. The geo-location of photographs posted on Instagram, for example, have been used to shine light on social-media inequality in New York city (Poon, 2016), and geo-located Tweets in combination with pictures on Flickr are being used to map tourist behaviour in big wildlife parks in South Africa (Tenkkanen, Järvi, Di Minin, & Toivonen, 2016) as well as to get insight in global mobility patterns (Hawelka et al., 2014). When it comes to studying urban mobility at a disaggregate level, however, two data collection techniques stand out: the usage of Cellular Data, Call Detail Records (CDR) in particular, and the usage of information acquired through GPS. Table 1 gives a non-exhaustive overview of some of the available techniques to collect activity-travel data, with some estimations of their accuracy and ease of implementation.

Cellular positioning data are passively recorded by telecom providers and consists of Call Detail Records (CDR) and handover between different cell towers (Silm & Ahas, 2014). If available to researchers at low cost, cellular data are extremely attractive. As Kwan (2016, p. 278) argues:

(...) researchers can have cost-effective access to very large numbers of communication records (e.g., over 1 billion) from a large number of users (e.g., several million users) that cover a high proportion of the population over large areas and long periods of time (e.g., six months or one year).

Although the data do not have attributes such as trip origin, destination and purpose, there have been successful attempts to infer these trip attributes directly from the data (see, for instance, Alexander, Jiang, Murga, & González, 2015). Research using cellular data has not only been implemented in the developed world, but there are also examples in which mobile phone traces have been used to analyse internal migration in Rwanda (Blumenstock, 2012), understand migration episodes in relation to climate change in Bangladesh (Lu et al., 2016), and map poverty in Côte d'Ivoire (Smith, Mashhadi, & Capra, 2013).

Table 1: Transport data collection techniques

Technology	Accuracy/Coverage	Ease of method
Household Travel Survey	Accuracy depends on respondents, in-depth data, limited coverage area	Difficult. Costly and time consuming.
Vehicle Intercept Survey	Accuracy depends on respondents, in-depth data, limited coverage area	Difficult. Costly and time consuming.
License Plate Survey	Reasonably accurate, limited coverage area	Difficult. Costly and time consuming.
Bluetooth	Accuracy depends on number of Bluetooth devices, limited coverage area	Medium. Timely, equipment and installation required .
Cellular Data	High accuracy, largest sample size and coverage available	Easy. Timely, no equipment needed. Data processing required.
Global Positioning Systems (GPS)	High accuracy, large sample size, coverage area limited by cost. Smartphones offer some benefits.	Medium. Timely, equipment and installation required. Smartphones offer some benefits. Data processing required.

Source: Adapted from Airsage (2013, p. 8) and Shafique and Hato (2015)

Whereas cellular data is passively collected and can give valuable information when analysing aggregated mobility patterns, GPS data are collected in a more active fashion often with a higher spatial resolution (Shafique & Hato, 2015). Since the seminal work of Jean Wolf (2000), researchers have started to use GPS data in transport and mobility research (c.f. Bohte & Maat, 2009; Chai, Chen, Liu, Tana, & Ma, 2014; X. Chen & Kwan, 2012; Feng & Timmermans, 2013; Meloni & Sanjust, 2014; Nitsche, Widhalm, Breuss, & Maurer, 2012; Shen & Stopher, 2013; Shoval, Kwan, Reinau, & Harder, 2014). GPS sensors have the potential to accurately record data on trip origin, trip destination, trip duration, trip timing, and route choice. In addition, GPS devices can be used to corroborate the quality from other data sources such as activity and trip diaries (Kelly, Krenn, Titze, Stopher, & Foster, 2013; Wolf, 2000). Although the use of GPS in the context of acquiring data on individual travel behaviour still has to deal with a number of drawbacks, the techniques show a lot of potential for (partially) substituting for the conventional paper-diaries (Bohte & Maat, 2009; Du & Aultman-Hall, 2007; Nitsche et al., 2014; Schuessler & Axhausen, 2009).

Nowadays GPS receivers are not limited to dedicated GPS devices, but are usually integrated into smartphones. Accordingly, Nitsche et al. (2012) argue that there is a lot of potential to automatically reconstruct trips from data collected by means of a smartphone application. One of the major advantages of collecting data by means of smartphones is situated in the fact that:

People habitually carry their mobile phones with them much of the time as this pervasive technology offers its users to a means of constant and available communication as well as personal entertainment (Horanont, Phithakkitnukoon, Leong, Sekimoto, & Shibasaki, 2013, p. 1).

The possibility to gather highly accurate space-time data on both travel patterns and activity locations can seriously enrich the current geographic body of literature whilst keeping respondent burden to a minimum (Shoval et al., 2014). Where some go even as far as stating that smartphones and tablets gave rise to a new paradigm of data collection with ‘human sensors’, at very least smartphones have the potential to become invaluable tools in studying spatiotemporal behaviour (Birenboim & Shoval, 2016; Kwan, 2016).

The availability of mobile technologies offers opportunities all across the globe. “In February 2012, more than 50 percent of the phones in the United States were smartphones; today, the numbers are significantly higher — and not only in the most developed countries (Birenboim & Shoval, 2016, p. 284).” In fact, it is estimated that also in sub-Saharan Africa more than three-quarters of the urban population has access to a cellular phone (Porter, 2015). In the Census of 2011 in South Africa, for instance, it was found that 88.9% of the South African households has a cell phone in working condition and, although it is still lacking behind, 16.3% of the households has access to the internet through a cell phone – indicative of some ‘smarter’ mobile device. Mobile technologies, thus, not only belong to the developed world, yet research in the developing world seems to treat mobile technologies as the object of

research rather than as an instrument to do research with (see for a recent contribution regarding the impact of mobile phones on travel behaviour in rural Malawi and Tanzania, Porter, 2016). As shown in Table 2, a non-exhaustive search for relevant peer-reviewed publications using Web of Science with regard to mobile technologies and human mobility in sub-Saharan Africa yielded a disappointing number of articles.

Table 2: Searches made using Web of Science (2000 – 2016)

Keywords	Publications (#)
GPS AND Africa AND (Mobility OR Transport*)	8
Mobile Phone AND Africa AND (Mobility OR Transport*)	7
Smartphone AND Africa AND (Mobility OR Transport*)	0

Not only is there scant research using tracking technologies in sub-Saharan Africa, the research that has been carried out around the globe is characterised by a striking absence of geographers; only 13 percent of peer-reviewed research using these new technologies is published in geographic journals (Shoval et al., 2014). Whilst geographers have had a prominent role in the development of Geographic Information Systems (GIS) and whilst spatial information is at the core of the discipline, tracking technologies have been mostly employed by health and transportation researchers (Birenboim & Shoval, 2016). To break with that trend, the following section showcases a smartphone-based data collection effort in Stellenbosch, South Africa for the purpose of gathering individual spatiotemporal data on travel and activity behaviour from a geographical perspective.

Using GPS-enabled smartphones in Stellenbosch, South Africa

During September and October 2015, a data collection exercise took place at Stellenbosch University, South Africa, in an effort to better understand mobility behaviour of staff and students at the university. Besides a traditional household travel survey and a trip diary, the research was augmented by a smartphone based GPS-application for a two-day tracking exercise. Participants could download and install the smartphone application, Tracklog (Google Play Store) and Tracklogging (Apple App Store), on eligible devices running either iOS or Android. Tracklog, as shown in Figure 1, allowed the passive recording of its user's positional information using the GPS location registered by the smartphone. This information included the geographical coordinates as well as the timestamp of each measurement. This information was automatically uploaded over the GSM network to a back-end server from where the information could be accessed, viewed, and subsequently downloaded by the research team; a snapshot of the back-end interface is given in Figure 2.

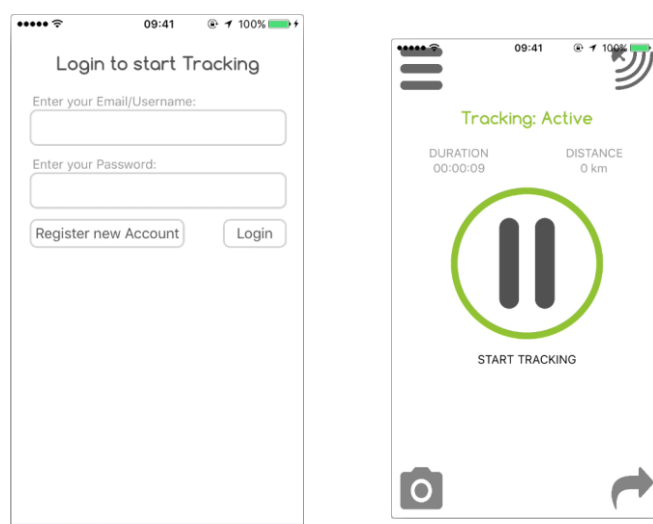


Figure 1: Tracklog on iOS

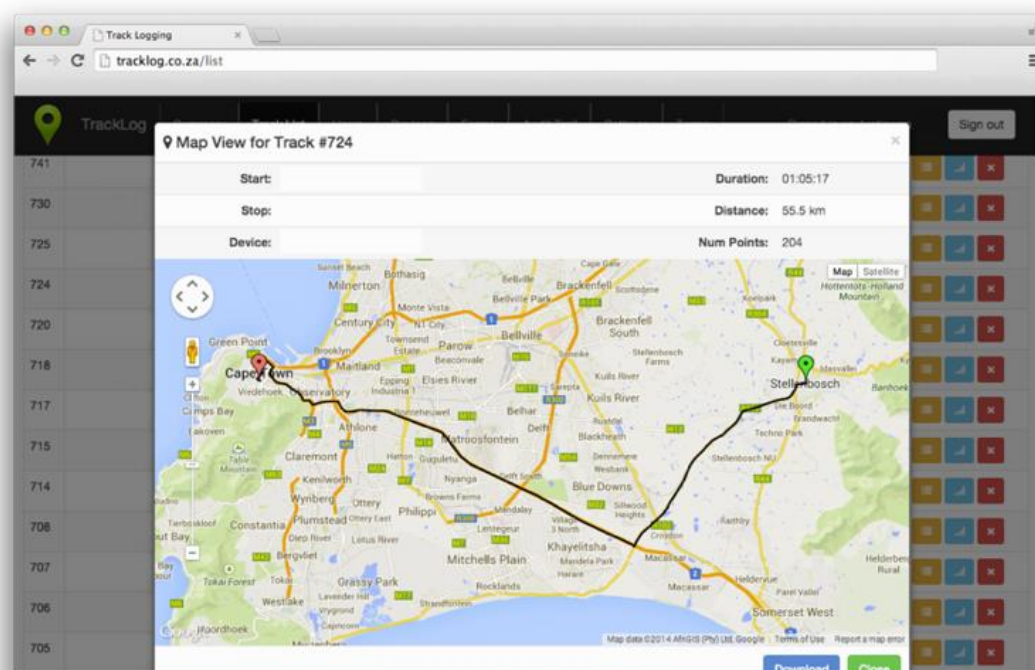


Figure 2. Interface server back-end of Tracklog application

A total of 176 participants registered onto the Tracklog system and this yielded 153 unique tracks on the first day of tracking against 143 unique tracks on the second day of tracking; a significantly lower number than the number of responses gathered with the accompanying the household travel survey ($n = 1,130$). Although there was some variation in the quality of the collected tracks, a number of suitable tracks was recorded in which the respondent's movements were captured in great spatial and temporal detail. In addition, because smartphones were used rather than dedicated GPS-devices, collected information on individual space-time paths was available immediately – providing unmatched opportunities to incorporate these data in a time-geographical analytical framework. Besides providing insight in spatial interaction and travel behaviour, disaggregated spatial footprints may shine new light, for example, on neighbourhood effects when it comes to individual accessibility to urban amenities as well as environmental exposure (see, for example, Perchoux, Chaix, Cummins, & Kestens, 2013).

Where the high-quality tracks signify the potential of the method, a number of weaknesses come to light. As outlined in previous work regarding the Tracklog system, these weaknesses can pertain to the: (1) user (e.g. user switching off the tracking application), (2) technology (e.g. continued use of the GPS has a major impact on battery life), and (3) methodology (e.g. only individuals with smartphones can participate) (van Dijk & Krygsman, 2015). It is, however, important to keep in mind that the usage of mobile technologies for data collection is complementary to current data collection techniques and, therefore, it should be considered as such (Shoval et al., 2014). As Kwan (2016, p. 276) states:

“Although activity-travel diary data sets are costly and time consuming to collect, they contain highly detailed information about participants' sociodemographic attributes and activity-travel behavior (e.g., activity purpose and location, start and end time of activities, travel mode, and travel route) that enables rich description and analysis of their mobility pattern.”

Not all this information can be inferred from passively collected spatial dataset. The same applies to, for instance, research that is more qualitative in nature. Highly relevant research on mobility experiences, such as Lucas' (2011) account of social exclusion and transport in Tshwane, South Africa, simply requires a qualitative research design.

Notwithstanding the opportunities for high-quality spatiotemporal data, mobile data collection techniques have also introduced a number of methodological and empirical challenges (Kitchin, 2013). These challenges not only include harnessing the tools to obtain geo-referenced data, but also acquiring new skill sets for cleaning and interpreting these data. Over the past years, a wide variety of methods has been employed to analyse GPS data, for instance, to

infer activity locations and impute trip purposes. Some examples are the implementation of Discrete Hidden Markov Models (e.g. Nitsche et al., 2014), Fuzzy Logic (e.g. Schuessler & Axhausen, 2009), and Kernel densities (e.g. Thierry, Chaix, & Kestens, 2013), but also supervised machine learning techniques such as Bayesian Belief Networks, Random Forest Classifiers, or Decision Trees (e.g. Feng & Timmermans, 2015); methods that may not necessarily be included in the geographical toolbox. Even relatively simple actions like importing, projecting and visualising GPS-locations, become more challenging when dealing with thousands of measurements are; the use of scripting languages that are well-integrated in the field of spatial analysis, such as Python and R, become essential.

Perhaps an even more pressing issue when discussing tracking technologies is found in the realm of research ethics; in particular the notion of privacy and anonymity are of crucial importance; see Taylor (2016) for an excellent contribution with regard to possible unethical outcomes of large passively collected data sets in low- and middle-income countries. Although in the Stellenbosch data collection exercise it was not specifically asked, it is likely that some participants who responded to the household travel survey were not comfortable with sharing their positional information and therefore did not participate in the tracking component of the study. This suggests that, especially when it comes to 'active' tracking technologies, additional attention should be paid when soliciting participants.

Conclusion

The past decade has witnessed a dramatic increase in geospatial data. Vast amounts of geo-referenced data are continuously being captured through (social) media such as Twitter, Instagram, Foursquare and OpenStreetMap. Not only is geospatial data becoming more and more available and accessible for researchers, but the ubiquity of 'human sensors' such as the mobile phone and the smartphone offer novel and innovative ways of collecting geospatial data on individual mobility behaviour. Cell Detail Records (CDR) and GPS technology embedded in smartphones, for instance, provide opportunities to passively collect high-resolution data that is otherwise difficult to acquire; even more so in the context of developing countries. This paper set out to briefly discuss some of the current mobile data collection techniques and their applicability for mobility research in an African context.

By discussing a variety of sources from the international literature and the example of a data collection exercise in Stellenbosch, it is argued that despite the scant attention mobile technologies for data collection have received in sub-Saharan Africa, mobility research in the region would likely benefit from an exploration of these techniques; especially considering the high penetration of mobile phones in both urban and rural areas in combination with the challenges of traditional survey methods. One has to be aware, however, that with the usage of mobile technologies for data collection a new data supply chain has emerged. Mobile techniques for data collection require a different approach than more traditional research instruments. One could say that in the era of 'big data' and passively collected data sets, the data collection is less linear and less static. Instead of a researcher designing a set of questions which is subsequently posed to the respondent, research is becoming more instantaneous and adaptable; in case of smartphones, it even becomes possible to directly interact with users over great distances, provide feedback, and ask additional questions. This requires a different approach from the research community, not just on the side of the data collection, but also in the subsequent analysis as this may require new skill sets.

To conclude, it has to be noted that this paper was not intended to provide an exhaustive and systematic assessment of the potential of mobile data collection in an African context; it was rather intended to accentuate its potential on the continent, draw attention to a number of its challenges, and point towards possible geographical applications. In addition, it should be emphasised again that mobile techniques for data collection are not a panacea and should not be the focus of all mobility and geographic research; data collection techniques should be tailored to the research question and research population. Therewith, mobile techniques for data collection should complement current data collection projects. It will be interesting to see to what extent geographers on the continent, and elsewhere, will engage in utilising these highly spatial data sources.

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A SCAFFOLDED SOIL SCIENCE CURRICULUM: A PRACTICAL PROJECT APPROACH

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Abstract: This is a case study of a scaffolded Soil Science practical curriculum in the context of a large second year class at a South African contact institution of higher learning. The practical in question aimed to consolidate and develop skills relating to teamwork, mapping, mathematical literacy, scientific vocabulary and scientific report writing within the context of a Soil Science module. Such a teaching intervention contributes to the literature as there is a gap regarding the support of second year students in terms of achieving epistemological access. A significant challenge facing the tertiary education community in South Africa is the teaching of practical scientific skills in the context of an under prepared student body, large classes, and a resource poor environment. Consequently this intervention represents an attempt to overcome these challenges. Accordingly, an active learning approach was adopted, alongside a heavily scaffolded ‘desktop’ soil modelling project. Wischmeier and Smith’s (1978) Universal Soil Loss Equation (USLE), a widely used soil erosion calculation model, formed the basis of this project. Details of the intervention, in particular, the manner in which it was scaffolded, are elucidated here. Lecturer reflections subsequently shed light on the process, achievements, challenges and shortcomings of such an approach. Nevertheless, such an intervention should rather be viewed as a complement to field and laboratory work, as opposed to a substitute for it.

Introduction

This is a case study of a scaffolded curriculum, of a second year level Soil Science practical module, delivered to almost 150 multiracial mixed-gender students at a contact-tuition university in South Africa. Importantly, the focus was on soil erosion; as degradation of soil, which according to some estimates is the case for more than 66% of arable soil worldwide, is an essential part of any Soil Science curriculum (Vitousek, 1997; Gibbs & Salmon, 2015). With the genesis of 1cm of soil taking a least 1 000 years, education on soil erosion is vital for the sustainable utilisation of this resource (Alexander, 1985; Wakatsuki & Rasyidin, 1992; Alexandrovskiy, 2007; Alewell, Egli, & Meusburger, 2015; Keesstra *et al.*, 2016). Therefore, the practical component of the Soil Science module was designed to do this. Importantly, the practical was scaffolded to foster academic access for success. Scaffolding as defined by St. Clair (2015, p.29) is “...a continuum from easier ideas and actions toward more challenging ones, so when they [students] have mastered simpler processes they can tackle the more complex ones that build on them.” For, despite these students being in second year – and who were registered for Geography in either the Arts, Education, or Science faculties– they still need assistance in terms of developing their academic self-confidence and acquiring learning agency. Generally such students also show - at best - emerging practical scientific skills such as taxonomic expertise; nomograph use; mapwork; understanding arithmetic relationships between variables; general scientific methods and mathematic literacy. This is in addition to having a limited scientific vocabulary and scientific report writing skills. Such students are described as being underprepared for tertiary education (Jacobs, 2007; Chokwe, 2013; Pineteh, 2014; McKay, 2016). While there is a significant body of literature on the underpreparedness of first year university students, particularly in the South African context, the literature is sparse on this issue at second year level (Topping, 1996; Dochy, Segers, & Sluijsmans, 1999; Struyven, Dochy, & Janssens, 2003; Govender, 2016). Thus, this study hopes to rectify this in part. In addition, the intervention took place within the milieu of massification of higher education. For this particular module the lecturer to student ratio was 1:150, triple what it had been less than a decade previously. While this may not be big by some standards, for a science module that requires hands-on activities such as field and lab based practicals, such a ratio is untenable (Jenkins, 1994). Coupled with a lack of resources to undertake field trips and no soil science laboratory, the intervention made use of a ‘desktop’ soil erosion model and adopted a group work approach to foster peer-teaching.

The universal soil loss equation (USLE) practical project

The entire module’s practical – of seven weeks in duration or 21 hours in total – involved task calculating both the controlled and uncontrolled rate of soil erosion using the Universal Soil Loss Equation (USLE) for a given dataset of hillslope data and drafting a scientific report. Firstly, in order to scaffold time management, the project unfolded in steps on a weekly basis, with small milestones required along the way (Carroll, 1963; 1989; Govender, 2016). Structuring students’ study time this way aimed to assist students to pace themselves through what was a large and complex project. Secondly, scaffolding of the content occurred by electing to use the USLE of Wischmeier & Smith (1978), as opposed to the revised but more complex (due to additional sub-factors and seasonal adjustments that have to be made) RUSLE model²⁰. Thus, the simpler model was deemed more appropriate for second year students.

²⁰ Renard, Foster, Weesies & Porter (1991) later updated the USLE equation as the Revised Universal Soil Loss Equation (RUSLE).

The USLE model predicts the rate of soil lost by erosion for a given slope (transect) in tons per hectare per year ($\text{t}\cdot\text{ha}^{-1}\cdot\text{a}^{-1}$). This is an empirically derived equation using field plot data, and is in wide use internationally. Due to its widespread adoption, the factors required for input into the model are obtainable for most regions and conditions, although data for site specific slope and soil variables must be added (Renard, Foster, Yoder & McCool, 1994; Yu, 1999; Kamuju, 2016). The USLE equation is defined as follows: $A = R \times K \times LS \times C \times P$, where: A = predicted soil loss ($\text{t}\cdot\text{ha}^{-1}\cdot\text{a}^{-1}$); R = rainfall erosivity; K = soil erodibility; LS = slope length and steepness factor; C = cover and land management factor and P = erosion control factor (Wischmeier & Smith, 1978). These six factors predict the annual rate of erosion on a given slope. The modular structure of the equation lends itself to scaffolding as the various factors can be broken down into basic tasks, and each of which lends itself to a type of show-teach-do type of approach to teaching and learning (Wood, Bruner & Ross, 1976). Thus, students were taught each factor and the steps taken to use it within the context of the equation. The tasks were then undertaken as a class and finally, by cumulatively generating the knowledge and skills required, students worked in groups to achieve mastery of the entire soil erosion modelling project (McKay, 2013). This is known as incremental learning. Incremental learning involves learning through working through various examples where one example builds on the other in a step-wise manner with the knowledge from one example supporting the acquisition of new knowledge until a complex problem is solved. It is commonly used teaching method within medical science context (Wiggins, Chiriac, Abbad, Pauli, & Worrell, 2016). Students had to work both individually to understand the USLE (taking notes as it was explained, and subsequently writing up their own methodology and results), as well as working collaboratively in groups to solve the dataset.

Thus, the third pillar of the scaffolded intervention was to adopt a group work approach, a common teaching intervention in higher education (Channon, Davis, Goode & May, 2016). To this end, the groups were compiled by the lecturer arbitrarily assigning students into 30 groups of five. Group work can be an effective method to foster active learning and is well suited to a hands-on approach (Hackathorn, Solomon, Blankmeyer, Tennial, & Garczynski, 2011; Arias, Scott, Peters, McClain, & Gluskin, 2016; Daouk, Bahous, & Bacha, 2016). In particular, it enables students to academically support one another by pooling knowledge and skills and peer-teaching (Stein, Frank, Roberts, Finkelstein & Heo, 2016). Importantly, working in groups can enable students to tackle complex authentic problems that, if undertaken individually, would be much more challenging (Prince, 2004; Makgato, 2012; Wiggins *et al.*, 2016). Orientating group work to a particular task with a well-defined start and end time also helps to motivate the students to work together creatively and efficiently as they all have a defined end-goal and a vested interest in the outcome (Burke, 2011; de Hei, Strijbos, Sjoer, & Admiraal, 2016). Adopting a group work approach was essential for this particular Soil Science practice as there was only a limited number of viable datasets that the lecturer could realistically develop, distribute and grade. In particular, for this practical project, 30 different datasets (comprising slope transects, orthophotos, rainfall, soil properties etc.) had to be meticulously generated so that each group could derive 30 unique results using the USLE. In order to ensure relevance to South African soil conditions, these 30 datasets were located spatially on 15 transects on two orthophoto maps in the Eastern Cape, South Africa (Nahoon and King Williams Town) where erosion is a regional problem.

The details of how these scaffolded tasks were presented to students, as requisite subordinate components of the USLE model, are now presented in terms of each factor of the USLE model. Thus, the process undertaken by the lecturer to scaffold each factor of the USLE is described.

The first factor of the USLE model that was explored was that of Rainfall Erosivity (R). Rainfall erosivity is a measure of the average summed kinetic energy of all annual rainfall events upon a soil surface as controlled by each rainfall event's maximum 30 minute intensity (Wischmeier & Smith, 1958, 1978). Alternately stated as an equation: $R = (E \times I_{30})/100$ Where: E = sum of storm's Kinetic Energy (Mj/ha) and I_{30} = max rainfall intensity in 30min (mm/hr). There is a direct linear relationship (controlling for other factors) between rainfall erosivity (R) and soil loss (Yu, 1999). Importantly, in terms of scaffolding and appropriate selection of tasks, the complexity and acquisition of the data for the above equation was beyond the scope of a second year class. Hence, a proxy calculation for R was used where $R = 0.5P$ Where: P = annual rainfall (as per Wu, Liu & Ma, 2016, following Roose, 1975 for the Africa Central Region). Thus, the area's annual rainfall is used as a proxy for rainfall erosivity. Nevertheless, the original full equation was given and discussed in brief so as to enable the students to see the direct relationship between rainfall intensity and erosion. Furthermore, as part of the scaffolding, the groups were provided with the annual rainfall of either Nahoon or King William's Town depending on their group so that students could derive R from P.

The second factor of the USLE model that was unpacked was that of Soil Erodibility (K). Soil Erodibility (K) is the propensity for a particular soil to erode. This factor accounts for multiple soil properties which determine erosion potential. These properties are: (1) soil texture, (2) soil structure, (3) soil organic matter (SOM), and (4) soil permeability (Wischmeier & Smith, 1978). For use in the USLE, each of these soil properties has either a value or description associated with it. In this instance, calculating the value of K was scaffolded by requiring students to first determine the value associated with each individual soil property. Each of these properties, and how their values had to be derived, was unpacked in detail with the class and described below.

Soil texture is the percentage of sand, silt and clay sized particles in a sample of sand (Schoonover & Crim, 2015). The lecturer first demonstrated determining soil texture by using of the United States Department of Agriculture's (USDA) soil texture triangle (USDA, 1993). In particular, how to read the triangle (the correlating values on each of the three axes - representing the percentage of sand, silt and clay) was demonstrated. Thereafter group was presented with a copy of the soil texture triangle (see Figure 1). Groups then had to determine the soil texture for their particular Nahoon or King William's Town dataset. Thus, students had to practice and understand classification which is "a fundamental exercise at the core of many scientific fields" (Groenendyk, Ferré, Thorp & Rice, 2015, p.2). Soil structure impacts on the relationship between water infiltration and erosion as structural characteristics determine how prone to erosion soils are (Wischmeier & Mannering, 1969). Thus soil structure is coded as (1) very fine granular; (2) fine granular; (3) medium or coarse granular; and (4) blocky, platy or massive. Groups were given a soil structure description for their database and had to read the key on the K factor nomograph (see Figure 2) to derive the K factor. The same was done for soil permeability where the groups were given an infiltration descriptor for their particular dataset: either (1) rapid; (2) moderate to rapid; (3) moderate; (4) slow to moderate; (5) slow; or (6) very slow. The activities were first modelled by the lecturer. In terms of soil organic matter (SOM), students were given an infiltration descriptor for their particular dataset (that is a percentage of soil organic matter), which they had to use to read the nomograph and derive the K factor. Once again, the activities were first modelled by the lecturer.

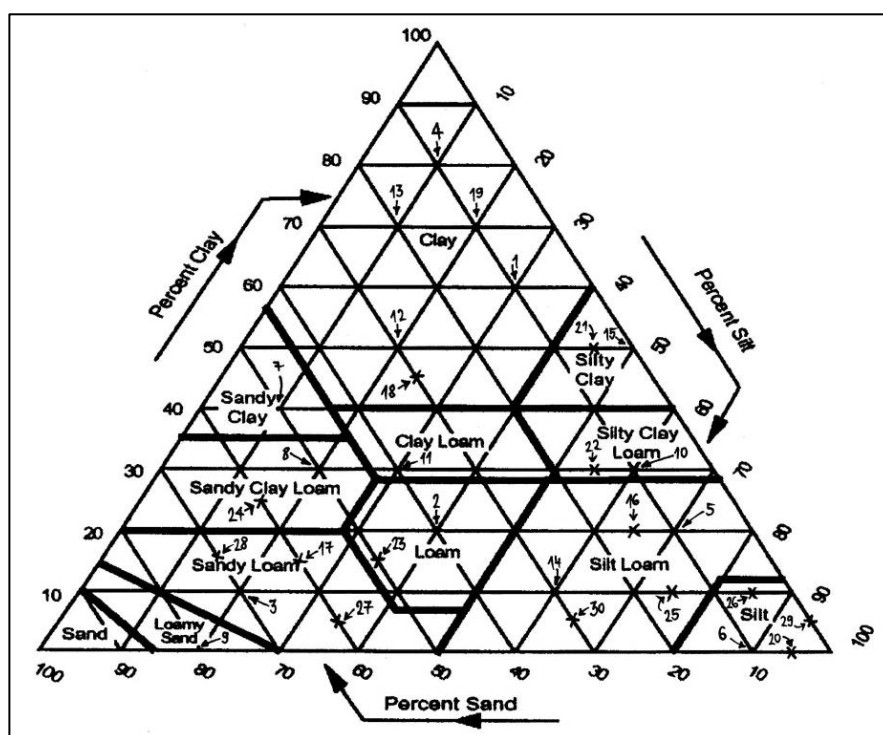


Figure 1: USDA soil texture triangle as provided to students, with group numbers indicated (USDA, 1993)

In terms of defining the K Factor, it was demonstrated to the students how to use the values (derived or given) of the four preceding soil properties against a K factor nomograph to determine the final erodibility (K) factor. Then, in groups, students had to follow the nomograph's procedure (see Figure 2) to arrive at a final K factor value. As the USLE equation has a direct relationship between each variable (i.e. each variable is multiplied by the other), the larger the erodibility (or any other) factor, the greater the resulting soil loss value in $t \cdot ha^{-1} \cdot a^{-1}$. In this manner an understanding of how each factor independently affects the final soil erosion value is acquired. The whole process took place over a number of practical contact sessions and the group work aspect was facilitated by both the lecturer and a number of student assistants who stayed in the venue to assist groups one-on-one.

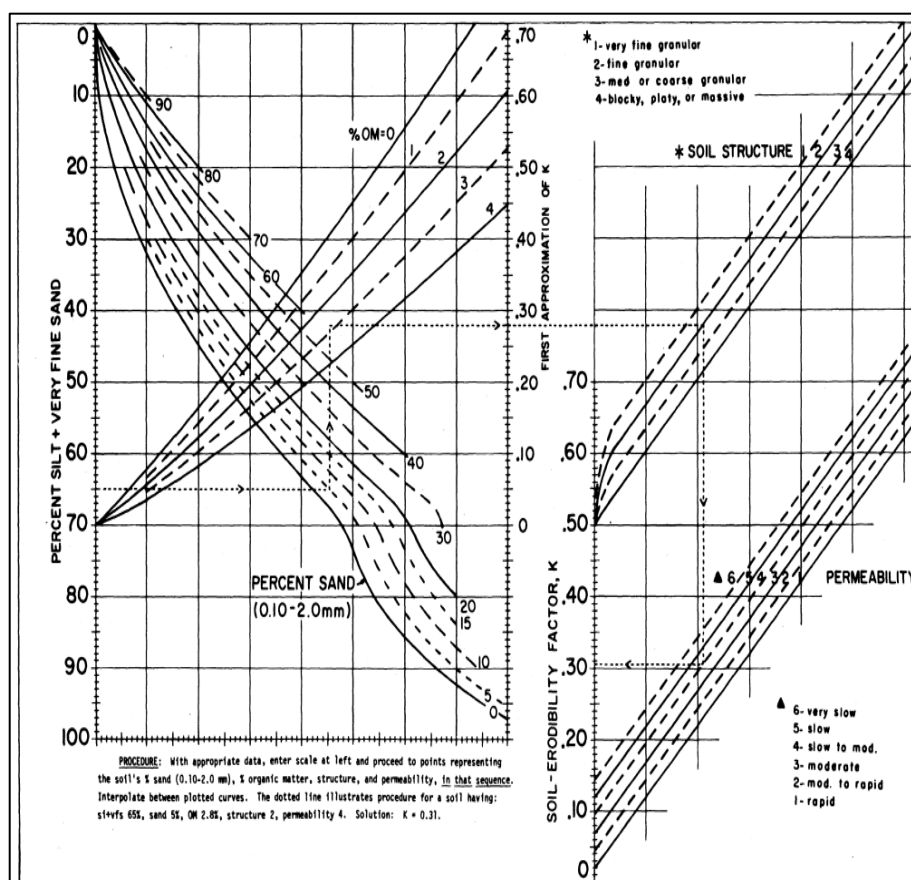


Figure 2: The K factor nomograph (Wischmeier & Smith, 1978).

Determining the K factor is only one aspect of the USLE model, however. Groups also needed to take slope length and steepness (LS) into account or the third factor of the USLE model. Slope length and steepness (LS) are variables that directly affect the rate of soil erosion (Wischmeier & Smith, 1978). That is, slope length and steepness affect surface runoff, the velocity thereof and, so, soil loss. This was explained to students in a class setting. Subsequently, students were shown how in the USLE equation these two factors combined using an LS factor graph (see Figure 3). How the LS factor, using a slope with a known length and gradient (in meters and a percentage respectively) is determined was first modelled by the lecturer. This scaffolding was therefore similar to that used to teach the K Factor. However, the task became more complex for the students as they had to, in their groups derive the slope length and gradient using orthophotos that came with their particular dataset (see Figure 4). Thus, the students now had to recall what they had learnt in their first year map work practical (calculate distance using a scale map, determine gradient from contour lines) and then apply these skills to a new situation so as to determine the length and the gradient of their particular group's transect. Having calculated these variables, students then needed to use the LS graph themselves and determine their group's LS factor. Students were assisted by the lecturer who ran a 'revision' session to 'remind' students how to calculate distance and gradient. Groups were also assisted by the lecturer and the student assistants to read the orthophoto and the LS factor graph.

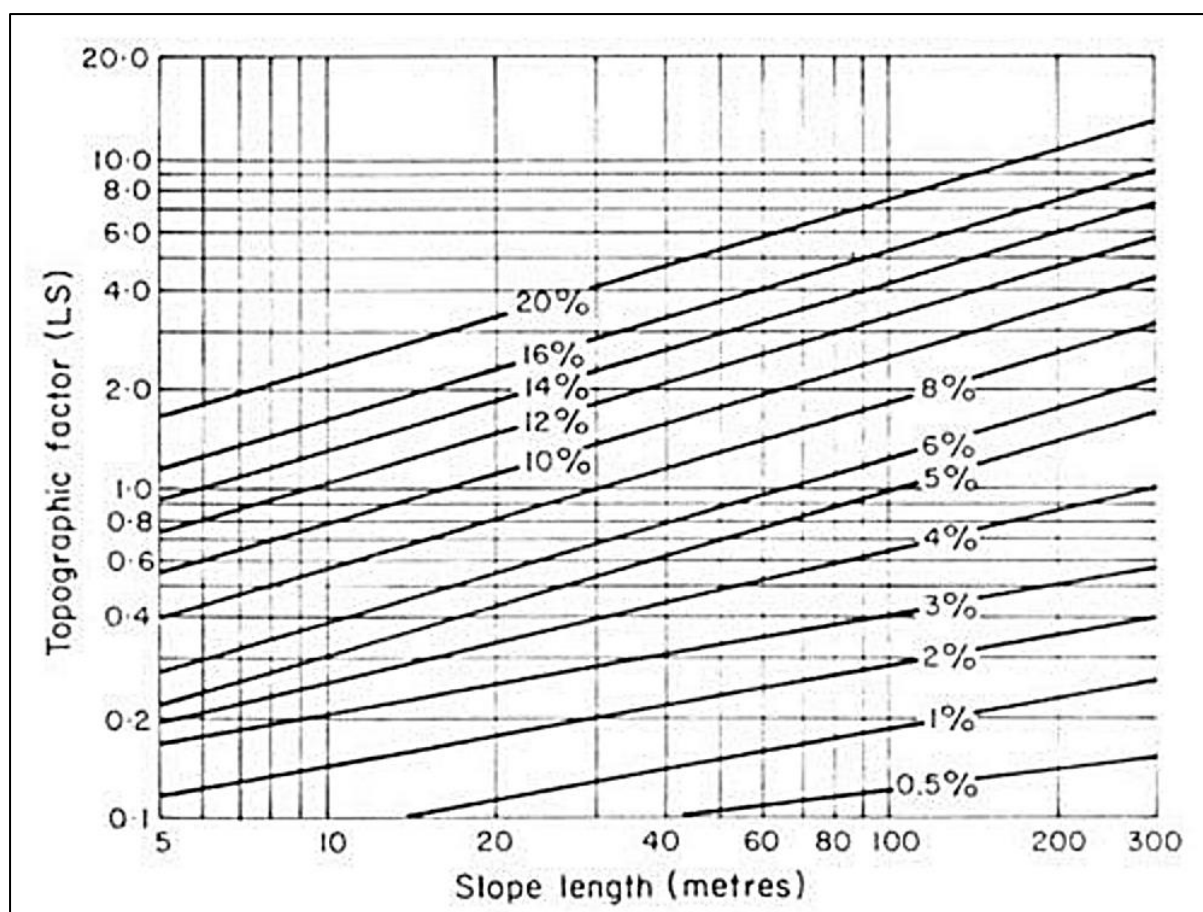


Figure 3: LS factor graph (Hudson, 1993, after Wischmeier & Smith, 1978)

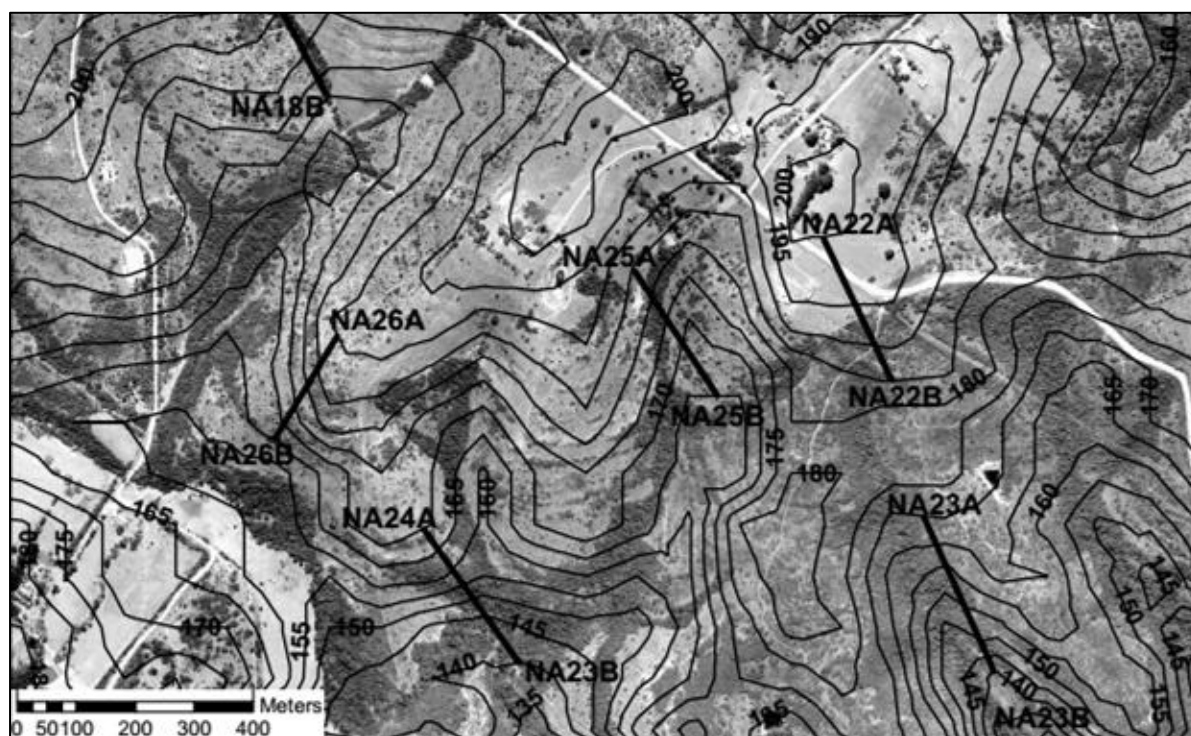


Figure 4: Portion of a 'to scale' orthophoto map of Nahoon, with 'group numbered' transects along sample slopes (Surveyor-General, 2004)

The practical then moved on to the Cover and Land Management Factor (C) and Erosion Control Factor (P). That is, having covered the climatic, topographic and soil properties which influence erosion rates, students had to be

taught that land cover and surface structures also affect erosion rates. That is to say, any cultivation or natural vegetation decreases rain splash intensity at the soil surface in comparison to clean-tilled continuous fallow soil (Wischmeier & Smith, 1978). This is accounted for by the C factor, which has been experimentally determined for different vegetation covers. The direct relationship was illustrated to students, in that a denser vegetation (lower index value) lowers the erosion rate; while accounting for bare soil in the equation (C factor value of 1), results in no minimisation of soil erosion due to land cover. Again, to adapt this task to one that was suitable for a second year class, only selected C factors were adapted from Morgan (2005) (see Table 1). Similarly, erosion control practices influence the rate of erosion by shortening the slope length, and decreasing runoff velocity (Wischmeier & Smith, 1978). The lecturer used photographs of different soil erosion control measures (such as benches and contour ploughing) to discuss and explain this to the class. Groups were given an erosion control measure and data (see Table 2). Importantly, some P values are influenced by the slope gradient, and students had to correlate this with the slope in their dataset, and account for it accordingly. Once again, the factors were selected to match the skills required to that of a second year student.

Table 1: C Factors for USLE (adapted from Morgan, 2005)

Crop/Landuse	C-Factor
Deciduous forest	0.001
Savannah or prairie grass in good condition	0.010
Golf course	0.015
Pasture	0.015
Bush fallow	0.020
Forest	0.020
Maize, sorghum or millet; high productivity, no or minimum tillage	0.02 - 0.10
Disturbed forest	0.040
Forest plantation	0.088
Overgrazed savannah or prairie grass	0.100
Wheat	0.10 - 0.40
Sugar cane	0.13 - 0.40
Maize, sorghum or millet; high productivity, conventional tillage	0.20 - 0.55
Maize, sorghum or millet; low productivity, conventional tillage	0.50 - 0.90
Opencast pit mine	0.800
Rock outcrop	0.800
Bare soil	1.000

Table 2: P Factors for USLE (adapted from Morgan, 2005)

Practice	Slope %	P-Factor
Up & downslope cultivation	any	1.00
Contouring	1 – 2.99	0.60
	3 – 5.99	0.50
	6 – 8.99	0.50
	9 – 12.99	0.60
	13 – 16.99	0.70
	17 – 20.99	0.80
	21 – 25	0.90
Bench terracing:		
Level	n/a	0.14
Reverse slope	n/a	0.05
Outward sloping	n/a	0.35
Level retention	n/a	0.01

In summation, students were guided through the practical, over a period of weeks, using a mixture of traditional lecture-style class teaching, along with applied exercises. The lecturer thus conducted the class through these practical calculations, such that students – by way of group work – had to immediately apply their new found knowledge and skill to solve a particular aspect of the USLE model. Although each task was initially broken down

into its smallest part, the work was cumulative as each new session and activity built on the preceding ones. Where possible, the groups were assisted one-on-one by the lecturer and the student assistants. Additional scaffolding took place in the form of providing students with given data (a summary of which is in Table 3) as requiring students to source such data themselves would have made the project far too time-consuming and complex for second year students.

Table 3: A selection of the grouped datasets provided to students

Data set number	Location	Annual Rainfall (P)	% Organic Matter	Soil structure description	Soil permeability description	Slope #	Crop management factor	Soil erosion control practice
1	King Williams Town	600	4	Very fine granular	Very slow	KW1AB	Abandoned land	Contouring
2	King Williams Town	600	2	Blocky, platy, massive	Slow to moderate	KW2AB	Bamboo	Strip cropping
3	King Williams Town	600	2	Blocky, platy, massive	Moderate	KW3AB	Bush fallow	Grass (buffer) strip - 10% cover
4	King Williams Town	600	4	Blocky, platy, massive	Rapid	KW4AB	Chilli	Bench terracing: outward sloping
5	King Williams Town	600	3	Blocky, platy, massive	Moderate to rapid	KW5AB	Cowpeas (upper limit)	Contouring
6	King Williams Town	600	4	Fine granular	Very slow	KW6AB	Disturbed forest	Strip cropping

From these resources, students had to determine their slope's annual erosion both with and without a soil erosion control in place. By requiring both answers, students could see how changing the value of the P factor from a fraction (i.e. erosion control measure in place) to a value of 1 (i.e. no erosion control in place) influenced their final answer of $t \cdot ha^{-1} \cdot a^{-1}$. What is more, where necessary the task was also simplified, not only by using the simpler USLE model, but also simplifying various aspects of the factors, as was described here. The report also had to include the USLE parameters (and explain them) as well as how they had derived the answers. This report followed the guidelines of a scientific report (Durrant, 2014). Thus, the final assessment assessed both process and product.

Reflections on the intervention

In many ways the teaching intervention could be described as a success. Each group managed to successfully submit a scientific report on time, and in each case, the lecturer felt that awarding at least a pass mark was justified. In addition, anecdotal feedback from students was enthusiastic. Each practical session was energetic, with students actively engaging in the task, engaging one another and engaging the lecturer or the student assistants. The sessions were dominated by the voices of students and the venue rearranged (where possible) by the students to facilitate the engagements. Overall it could be said that levels of student participation and engagement were high.

There are several caveats, however. There was evidence of 'free riding', where some students did not contribute. In other cases, the stronger students (academically or in terms of personality) 'took charge' and did all the work. For example, there was a complaint that one student alone did all the calculations; excluding the rest of the group claiming their work was "sub-par". These problems as well noted in the literature (Davis, 2009; Beard, 2016). In particular, overall the USLE model is complex (despite attempts made in the module to simplify it and teach it step-by-step manner) and compiling the scientific report challenging, but with group projects some students who should have failed passed because they benefitted from the group effort. Furthermore, where one student dominates, it cannot be assumed that all the students developed competency in using the USLE model. Thus, with group work projects there may not always be alignment between assessment and the module outcomes. Furthermore, the entire practical involved a great deal of work for the lecturer, not only in preparing the 'lecture' aspect of each session, but also generating the real world data for the 30 datasets, sourcing the orthophotos and then scaffolding the process. The groups and the time in the practicals also had to be managed, along with managing (and supporting) the student assistants, as well as marking the final projects. Lastly, as "fieldwork has been a central means of inducting and developing students' understanding of the values and practices of their discipline" (Jenkins, 1994, p.144) it must be stated that a desktop practical project not an ideal way to teach soil erosion.

Conclusion

In conclusion, the process of scaffolding a project to enable epistemological access to higher education is both labour and skills intensive. It requires a lecturer to not only have an 'enabling' mind-set – holding the view that enabling epistemological access is essential, but also have both the prerequisite scientific knowledge and teaching skills to put a scaffolded curriculum into action. Furthermore, the scaffolded project outlined here, details quite clearly the types of skills a second year student needs; yet, despite efforts made, it cannot be categorically said that each student

demonstrated competence because of the use of group work. Finally, while there are many advantages to group work and to a desktop study, it must be acknowledged that both were 'Plan B' in the context of 'massified' yet underfunded higher education. That is, classes are large and there is no budget for field work and no soil laboratory either, which means that while the session was 'hands-on' and active learning took place, it was not a Soil Science practical in the sense of field study or laboratory work. As such, these students, despite being successful, may not be well versed in dealing with soil erosion issues in the field.

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TOURISM GEOGRAPHIES

RECENT TRENDS IN SOUTH AFRICAN STUDENT TOURISM RESEARCH

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Abstract: The investigation focuses on South African postgraduate tourism research. It furnishes an analysis of the number, flow, institutional affiliation and themes of research among a range of variables. Thereafter the investigation provides a critical reflection on the completed postgraduate research, finally highlighting new avenues of exploration for future postgraduate, but also more general scholarly engagements, with the South African tourism system.

Introduction

This investigation is framed by the twentieth anniversary of the publication of the *White Paper on the Development and Promotion of Tourism in South Africa*, a significant policy document that greatly impacted the development of tourism in the country (South Africa, 1996). The explosive expansion of the South African tourism system since the 1990s was in large part a response to the significant policy prominence – the white paper being the starting point – the national government afforded tourism as a vehicle by which to achieve a range of post-apartheid developmental objectives (Visser & Rogerson, 2004). In response, an extensive academic literature has developed that tracked the development and growth of tourism in South Africa. Recently, a number of review papers have reflected on the contours of the South African tourism discourse (Hoogendoorn & C.M. Rogerson, 2015; C.M. Rogerson & Visser, 2014; Visser, 2016a; 2016b) along with analyses of the production and consumption of tourism knowledge in the academic press (C.M. Rogerson & J.M. Rogerson, 2011). In many cases the work draws heavily on research that was first presented as research degrees or part of postgraduate research programmes.

The task of this investigation is to analyse completed postgraduate tourism research along a number of variables and themes, as well as update a similar investigation undertaken by Visser (2004) more than a decade ago. These objectives are achieved through two main sections of description and analysis. The first section furnishes an analysis of the number, flow, institutional affiliation, themes of research among other variables. The second section provides a reflection on the completed postgraduate research, highlighting new avenues of exploration for future postgraduate, but also more generally academic engagements with the South African tourism system.²¹

General trends in graduate tourism research in South Africa

Echoing the development of tourism studies in the North American context (Gill, 2012; Meyer-Arendt, 2000), it was within the ambit of economic geography and regional studies that student tourism research entered the South African academic tourism discourse. The early history of how this discourse developed during the 1970s to the early 1990s is outlined in Visser (2016c). The key observation is that very little student research into the tourism system took place until recently (Table 1).

It is clear (Table 1), however, that following a period where there were on average around 15 projects completed annually during the late 1990s, this changed dramatically in the early 2000s. A number of issues were at stake. First, during the second half of the 1990s, the national government started to afford tourism significant policy prominence and the local tourism system was experiencing considerable growth (Visser, 2016a). The institutional (both academic and policy) lacuna of the apartheid era was finally addressed through the 1996 national *White Paper on the Development and Promotion of Tourism in South Africa* (1996) and the *Tourism in GEAR Strategy Document* (South Africa, 1998). Other influential policy contributions which followed framed much of tourism geography scholarship, including the former Department of Environmental Affairs and Tourism's *Unblocking Delivery on Tourism Strategy by Government Departments* (2000), *Responsible Tourism* (DEAT, 2002) and *Responsible Tourism Handbook: A Guide to Good Practice for Tourism Operators* (DEAT, 2003). It was recognised that tourism is a key activity for national economic development and a crucial stimulus for achieving the developmental objectives of the South African government (Visser & C.M. Rogerson, 2004).

²¹ The methodology employed in this study partly replicates aspects of Visser (2004), A. Wessels (2010) and K. Wessels (2008). The online versions of the National Research Foundations' NEXUS database system and the South African National (ETD) Portal were consulted to compile as extensive a listing as possible of completed dissertations and theses since 1960. A full description of the methodology can be found in Visser (2016c).

Table 1: Thesis and Dissertation Totals by Degree Level and Year

Date	Doctoral		Masters		Total
	Designated	White	Designated	White	
1971	0	0	0	1	1
1972	0	0	0	1	1
1974	0	0	0	2	2
1976	0	0	0	1	1
1977	0	0	0	1	1
1980	0	0	0	2	2
1981	0	0	0	1	1
1982	0	0	0	1	1
1983	0	0	0	1	1
1984	0	0	0	2	2
1986	0	0	0	2	2
1987	0	0	0	1	1
1988	0	0	0	3	3
1989	0	0	0	1	1
1990	0	0	0	6	6
1991	0	0	0	3	3
1992	0	1	0	7	8
1993	0	0	0	7	7
1994	0	1	1	3	3
1995	0	3	0		
1996	0	0	6	12	18
1997	0	1	1	8	10
1998	0	0	6	13	19
1999	0	1	13	8	22
2000	0	1	7	10	18
2001	0	2	8	11	21
2002	2	4	8	9	23
2003	2	0	14	19	33
2004	5	6	10	21	42
2005	2	4	22	20	48
2006	1	4	17	14	36
2007	3	1	17	27	48
2008	5	7	15	13	40
2009	3	6	25	18	51
2010	4	4	26	19	53
2011	6	4	18	19	47
2012	2	3	12	20	37
2013	6	3	11	13	33
2014	3	3	7	10	23
2015	1	1	0	1	1
Total	45	63	244	330	682

Source: Author's survey

In addition, a number of postgraduate coursework master's courses were introduced at various universities. Tourism-related research was, for the most part, not completed within postgraduate degree programmes under the heading of tourism studies or management (although increasingly so), but in business management, cultural and media, or development studies and geography, for example, in which students could (and did) select tourism related research projects for the research component of their degrees. From 2004, there was a marked increase in the number of dissertations – most often MAs and MComms – but also a number of MBA mini-theses, along with a discernible increase in doctorates. The award of hosting the Football World Cup in South Africa would appear to have bolstered interest in tourism-related research topics, if not so much the tournament itself.

Although most South African universities have produced theses and dissertations on tourism, six universities dominated the production of graduate tourism research during the 1980s and 1990s of student tourism research until 2002 and four since then (Table 2). Until 2002, Stellenbosch University produced the largest body of graduate

tourism research. More broadly, at that stage it was noticeable that a disproportionate number of students graduated from historically white Afrikaans universities (the Universities of Potchefstroom – NWU, Pretoria, Rand Afrikaans, as well as Stellenbosch), although other institutions, such as the University of Cape Town, have produced a steady stream of theses and dissertations on tourism since the 1970s.

Table 2: Tourism-related Master's and Doctoral Dissertations and Theses by University (1971–2014)

Institution	Masters	Doctoral	Total 2002	Total since 1971
Cape Peninsular University of Technology	3	0	3	26
Central University of Technology	0	0	0	7
Durban University of Technology	0	0	0	7
Milpark	0	0	0	3
Nelson Mandela Metropolitan University	4	1	5	23
North West University	16	4	20	112
Rhodes University	1	0	1	9
Stellenbosch University	26	3	29	72
Tshwane University of Technology	0	0	0	7
University of Cape Town	16	0	16	48
University of Fort Hare	2	0	2	10
University of the Free State	4	1	5	17
University of Johannesburg	15	1	16	40
University of KwaZulu-Natal	13	1	15	77
University of Limpopo	0	0	0	7
University of South Africa	0	1	1	18
University of Pretoria	11	2	13	56
University of Venda	0	0	0	2
University of Zululand	14	2	16	71
University of the Western Cape	3	0	3	17
University of the Witwatersrand	15	0	15	54
Vaal University of Technology	0	0	0	1

Source: Author's survey

Note: All amalgamated technikons and universities appear under their current university of technology name. For example, Cape Town Technikon under Cape Peninsular University of Technology

Until recently, there was an absence of graduate tourism research at the historically black universities. A noticeable exception was the University of Zululand which established a Centre for Recreation and Tourism in the late 1990s. A number of reasons have been suggested in the past: the primary one is that these institutions were created as teaching, and not research intensive institutions. As a consequence, there were far fewer postgraduate students.

The key observation is that since then there has been significant growth in the body of tourism focused research at South African universities. In terms of the recent past, there have been changes in where student tourism knowledge is produced. Stellenbosch, as have all South African universities, has been significantly overtaken by North West University, with the bulk of the tourism students in some or other way connected to the institution's Tourism, Research in Economic Environment and Society (TREES) unit and the Faculty of Economic and Management Sciences more broadly. It also underlines the fact that the relative position of research output is often closely related to particular personalities and their strategic research trajectories – in this case Andrea and Melville Saayman, as well as Elmarie Slabbert. Elsewhere, Christian Rogerson's impact was seen at the University of the Witwatersrand until he left and currently reflected at the University of Johannesburg. A further trend is that with the exception of the Cape Peninsular University of Technology – again connected to an individual in the person of Kamilla Swart – the various universities of technology have not made any significant contributions to the tourism discourse. Then again, many of these institutions are more focused on hospitality fields and are generally not research intensive in terms of their tourism programmes.

The databases provide indices that categorise theses and dissertations according to so-called subject areas (Table 3).²² It has to be highlighted that a whole range of disciplines are present spanning Accountancy to Zoology. To ease the analysis, "like disciplines" were grouped together into 26 broader categories, of which only the top ten of

²² The years prior to 2003 are discussed in Visser (2004).

the past decade are analysed here (Table 4). The earlier study dealing with student research (Visser, 2004) showed that Economics, Business Administration, as well as Geography and Environmental Management were the key disciplinary vantage points from which students approached researching the South African tourism system. Urban and Regional Planning was in a distant third place. At that stage Hospitality, Recreation and Tourism departments were seldom independent departments, research or teaching units at universities and did not register. However, this has changed notably over the past decade or so.

The earlier investigation suggested that a noteworthy trend was the entry of departments focused on recreation and tourism and their increased inclusion in this subject categorisation. The past decade has seen these entities grow considerably. Currently, the vast bulk of research is produced in departments dedicated to recreation and tourism, often within Schools of Hospitality, or Tourism Management sections within Management/Business Management departments. What is also noticeable is that Geography and Environmental studies has seen considerable relative decline to the Management and Business Administration, and Economics cluster. As a whole, the actual number of theses and dissertations produced in Geography and Environmental Studies contexts has not changed significantly over the past two decades but recently seems to be showing a downward trend from its peak in the early 2000s. It is also revealing that despite the very significant planning challenges and opportunities, the tourism system holds for any settlement type, Urban and Regional Planning is currently almost absent from the South African tourism studies discourse. Given the developmental potential of tourism, it is perplexing to see the very low rate of knowledge production from that vantage point. However, again the trend is intimately linked to these departments' recent and current staffing profiles.

In terms of the thesis and dissertation themes chosen by South African graduates, it is useful to momentarily reflect on international research and scholarly treatment of tourism over the second half of the 20th century. First, early studies featured mostly the economic prospects of tourism and accentuated its benefits (Gill, 2012). Second, this unilateral economic view then led to a wave of studies that focused on the socio-cultural aspects of tourism and brought the benefits of tourism under scrutiny (Pearce, 2004; Telfer & Sharpley, 2008). Third, when both the positive and negative outcomes of tourism had been formulated, research attention was drawn to those alternative forms of tourism development that were potentially sustainable, with minimal unwanted consequences. Finally, these research orientations together led to systematic research, and towards the formation of a body of knowledge on tourism (Butler, 2015; Gill, 2012; Jafari & Aaser, 1988). In many respects the shifting foci of South African students' research echoes this chronology.

Tables 5, 6, 7 provide a summary of the main themes and their spatial focus. In the 2004 study, it was shown that keenly pursued themes of investigation were related to tourism marketing strategies for development which often meant economic development. Studies focused on issues such as strategies to attract particular market niches – for example: Chinese, Dutch or German tourists – moving over time to how tourist niches see South Africa as a tourist destination and what products they truly want, to eventually the impact of those tourists on the destination region (Visser 2016c). Since the early 2000s, an area of interest that has seen dramatic growth in research interest was tourism facility or resource descriptions with these studies ranging the accommodation sector – spanning small, black-owned bed-and-breakfast establishments, second homes and time-shares, to the entire South African hotel sector (Visser, 2016c). These investigations as a whole were and remain largely located within the theoretical and discursive concerns of economic geography, business administration and management, although this is not surprising, seeing as these disciplines in the past and present account for more than a third of all graduate tourism research. This is a long-running trend with a steady stream of research completed in these fields since the 1990s. A further theme of investigation that has increased more rapidly than any other are investigations that track the actual development impacts of tourism enterprises through, for example, local economic development, an outpouring of interest in SMME expansion or challenges they face since the mid-2000s enabled through the tourism system and its expansion or decline. As a function of a maturing tourism industry, an increasing number of investigations have focused the management of aspects of the South African tourism system at a number of scales of analysis, ranging intra- to inter-enterprise management issues (Visser, 2016c).

Table 3: Dissertations and Theses on Tourism by General Disciplinary Category (2003–2015)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
African Studies	0	0	0	1	0	0	0	1	0	0	0	0	0	2
Agriculture	0	1	1	0	1	0	0	1	0	0	0	1	0	5
Anthropology	0	0	1	1	0	0	1	0	0	0	0	0	0	3
Architecture	1	0	1	0	0	0	0	1	0	0	0	0	0	3
Botany	1	0	0	0	2	0	0	0	0	0	0	0	0	3
Business Administration/ Management & Economics	8	7	11	7	13	11	9	12	9	10	4	2	0	103
Communication Studies	0	0	0	0	0	1	1	0	2	1	2	1	0	8
Development Studies & Public Administration	4	1	4	4	4	4	1	4	1	1	2	1	0	31
Education	0	0	1	1	0	1	1	0	3	1	1	0	0	9
Engineering	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Food Sciences	1	0	0	0	1	0	0	0	0	0	0	0	0	1
Geography & Environmental Studies/Science	12	15	5	8	8	5	10	6	9	4	5	5	1	93
History	0	1	2	1	1	1	0	2	0	2	1	3	0	14
Hospitality, Recreation & Tourism Management	6	11	12	9	15	15	24	23	20	17	13	8	2	174
Human Movement Science	0	0	0	0	0	2	0	0	0	0	0	0	0	2
Information Systems	0	1	2	0	0	0	1	1	0	0	0	0	0	5
Languages	1	0	0	0	0	0	0	0	0	0	0	1	0	2
Law	0	0	2	0	2	0	2	0	1	0	0	1	0	8
Performing Arts	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Philosophy	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Political Studies	0	1	2	0	0	0	0	0	0	0	0	0	0	3
Psychology	0	0	0	0	0	0	0	1	0	0	1	0	0	2
Sociology & Social Anthropology	1	0	1	1	0	0	0	0	2	1	3	0	0	9
Town & Regional Planning	0	0	1	0	0	0	0	0	0	0	1	0	0	2
Unknown	0	4	1	3	1	0	0	0	0	0	0	0	0	9
Total	35	42	48	36	48	40	51	53	47	37	33	23	3	496

Source: Author's survey

Table 4: Dissertations and Theses on Tourism by General Disciplinary Category (2003–2015)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Business Administration/ Management & Economics	8	7	11	7	13	11	9	12	9	10	4	2	0	103
Communication Studies	0	0	0	0	0	1	1	0	2	1	2	1	0	8
Development Studies & Public Administration	4	1	4	4	4	4	1	4	1	1	2	1	0	31
Education	0	0	1	1	0	1	1	0	3	1	1	0	0	9
Geography & Environmental Studies/Science	12	15	5	8	8	5	10	6	9	4	5	5	1	93
History	0	1	2	1	1	1	0	2	0	2	1	3	0	14
Hospitality, Recreation & Tourism Management	6	11	12	9	15	15	24	23	20	17	13	8	2	174
Information Systems	0	1	2	0	0	0	1	1	0	0	0	0	0	5
Law	0	0	2	0	2	0	2	0	1	0	0	1	0	8
Sociology & Social Anthropology	1	0	1	1	0	0	0	0	2	1	3	0	0	9
Total	35	42	48	36	48	40	51	53	47	37	33	23	3	454

Source: Author's survey

Table 5: Broad themes of dissertations and theses (all records since 1971)

Broad themes of dissertations and theses	Total
Challenges / threats to tourism	27
Community participation / perception and tourism development	52
Development impacts of tourism (including LED and SMME development)	105
Information systems	10
Management of the tourism system	90
Nature-based tourism and development	14
Tourism and policy / legislation / law	47
Tourism education	34
Tourism facility / resource description and development	162
Tourism marketing strategies for development	64
Tourism transportation	9
Tourism, culture, history development	16
Tourism, gender, and development	3
Tourists as consumers	49
Total	682

Source: Author's survey

Visser's (2004: p. 61) study noted that "it is a matter of concern that only ten studies have been completed in which the needs and perceptions of tourists themselves form the main thrust of the research enquiry." Over the past decade or so, this concern has been addressed through a range of investigations, focusing mainly on domestic tourists. In addition, it has been argued for some time that tourism education and skills development is fundamental to the successful expansion and development of the local tourism system. This field of tourism research has still not received that much investigatory interest. Over a span of two decades, just more than 30 studies broadly focused on tourism education have appeared. Prior to 2000, another key observation was that theses and dissertations focused

on nature-based tourism as a developmental tool, but this has not seen much interest in the recent past. As the South African tourism system has matured away from nature-based tourism to urban-based tourism products and services (see Rogerson & Visser, 2014), the former interest of the late 1990s has started to decline. It is also interesting to note that “sustainability” has for the most part disappeared from thesis titles (see related Hunt, Gao and Xue, 2014).

One broad theme of analysis that has received relatively little attention are issues that challenge or threaten the establishment and development of tourism enterprises or the tourism system. One of the challenges or threats so strongly felt by the tourism sector in South Africa recently was the implementation of new border control legislation. Over the past decade, there has been a relatively small vein of research into tourism-linked legislation and laws. However, in recent years this type of research is on the wane, probably owing the fact that no radically new national or provincial policy frameworks have been introduced. A theme that could have been included with tourism facility and resource descriptions are those works that focused on tourist transportation. Given that the tourism system is fundamentally premised on the mobility of people, it is perplexing to record that essentially no one within the tourism-focused research fields has considered the various modes of tourist transportations, the opportunities and challenges, and how they relate to different tourism products, services, and locational contexts.

Table 7 provides some insight into the spatial locations in which these investigations took place and pose a few surprises. Essentially, those provinces with the largest tourism resource base are the most commented upon by student researchers. The one anomaly is that of Gauteng, which has a vastly larger tourist offering than the Eastern Cape, yet still had fewer investigations dedicated to the analysis of its tourism system. Then again, it is one of the provinces that both holds extraordinary tourism development potential and is in desperate need for its potential development outcomes. In terms of dissertations and theses focused on places outside South Africa, the general reason for their production was that these students are usually resident elsewhere but completing degrees at South African universities.

Table 6: Dissertation and Thesis Themes (2003–2014)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Challenges / threats to tourism	3	3	2	2	3	0	5	2	0	0	0	0	0	20
Community participation / perception and tourism development	3	1	3	4	3	3	5	8	2	0	2	0	0	34
Development impacts of tourism (including LED and SMME development)	8	7	14	5	3	4	5	10	8	5	2	7	0	78
Information systems	1	2	1	0	0	0	0	2	0	0	0	0	1	7
Management of the tourism system	1	6	8	6	14	8	8	4	9	4	9	3	1	61
Nature-based tourism and development	2	1	0	3	0	0	2	0	0	0	0	0	0	8
Tourism and policy / legislation / law	7	3	5	1	7	4	5	0	1	4	0	2	0	39
Tourism education	2	6	0	0	0	2	4	2	4	0	2	1	0	23
Tourism facility / resource description and development	5	9	10	10	11	7	3	16	15	12	11	3	1	113
Tourism marketing strategies for development	1	3	2	3	1	4	8	0	4	3	2	1	0	32
Tourism transportation	0	0	0	0	0	1	1	1	0	0	0	1	0	4
Tourism, culture, history development	0	0	1	0	0	1	2	1	1	3	0	5	0	14
Tourism, gender and development	0	1	0	1	0	0	0	0	0	0	0	0	0	2
Tourists as consumers	2	0	2	1	6	5	3	7	3	6	4	0	0	39
Total	35	42	48	36	48	39	51	53	47	37	32	23	3	494

Source: Author's survey

Table 7: Main Spatial Focus on Dissertations or Theses

Location	Number
South Africa	
Country as a whole / no specific region	175
Various combinations of provinces	19
Eastern Cape	36
Free State	17
Gauteng	32
KwaZulu-Natal	146
Limpopo	32
Mpumalanga	18
North West	23
Northern Cape	6
Western Cape	109
International	
Antarctica	2
Belgium	1
Botswana	7
China	2
Congo	1
Ecuador	1
Eritrea	3
Finland	1
Germany	1
Kenya	2
Lesotho	12
Madagascar	1
Malawi	2
Mozambique	8
Namibia	6
Philippines	1
Rwanda	3
Seychelles	1
South and East Africa	1
Swaziland	2
Taiwan	1
Tanzania	3
Thailand	1
Uganda	2
West Africa	1
Zambia	3
Zimbabwe	2

Source: Author's survey

A question posed in the 2004 investigation was not only which themes are researched within the student tourism research discourse, but also by whom. Tourism research among graduates was a “whites-only” affair until the early 1990s. However, this has changed markedly in the past two decades, with the initial take-off of engagement in tourism studies by historically disadvantaged cohorts from 1996. It was significant that by 2002 roughly half of all theses and dissertations were produced by students who fell within the historically disadvantaged categories. This pattern has remained roughly the same. However, given that black participation in higher education has expanded significantly since 2002 it means proportionally fewer persons from the designated groups are in fact conducting research on tourism focused topics.

Table 8: Changes in racial composition of student researchers

Study focus	Black	White	Total
Challenges / threats to tourism	17	10	27
Community participation / perception and tourism development	37	15	52
Development impacts of tourism (including LED and SMME development)	41	64	105
Information systems	3	7	10
Management of the tourism system	35	55	90
Nature-based tourism and development	10	4	14
Tourism and policy / legislation / law	23	24	47
Tourism education	12	22	34
Tourism facility / resource description and development	70	91	161
Tourism marketing strategies for development	17	47	64
Tourism transportation	4	5	9
Tourism, culture, history development	6	10	16
Tourism, gender, and development	3	0	3
Tourists as consumers	11	38	49
Total	289	392	681

Source: Author's survey

Some critical reflections

Collectively, then, a broad range of tourism products, tourist types, policy needs and implications set in various locations and community contexts have been addressed. Some broad critical remarks should perhaps first be made, after which attention will turn towards future research paths that postgraduate students, or indeed scholars in general might want to engage going forward.

Epistemologically what qualifies as tourism knowledge has been relatively similar in orientation. Much of the reported research falls within the positivist traditions. The majority of the work entails some sort of structured and/or semi-structured questionnaire survey which is then statistically analysed, themed, and fed back to the disciplinary core from which the project was developed in the first place. Very little conceptual work really challenges current formats of knowledge beyond the descriptive or engagements with policy objectives, most often related to some form of economic development.

This is, however, not always the case and there are certainly instances when methodologies associated with postmodernism and the cultural turn in the social sciences such as participant observation, focus groups, text analysis, etc. was registered. In many cases, quantification has often become very formulaic. We continue to see repetitions of investigations that contribute relatively little conceptual knowledge. Some research students habitually change the location of the investigation, drawing on the same literature and the same statistical methods and models with the same findings over and over again, which deliver diminutive amounts of new knowledge. These very positivist approaches to science also restrict the types of questions that can be asked. The result is that much of these investigations speak past core disciplines' contemporary central concerns. South African tourism geography as a whole has been very productive in investigating pro-poor tourism ideas and their relevance and impacts on host communities and much has been seen in the development of a large body of work dealing with local economic development and small, medium, and micro-enterprise development (Visser, 2016a). But these tourism studies do not critically speak back to the more traditional sub-disciplines in which the investigators are institutionally located. For example, in what way do South African urban planners understand tourism as potentially fundamental to understanding the changing urban economies of South Africa, its meaning to various types of constituency, and how that impacts on the adaptation of planning theory?

Second, is the limited availability of completed summative book collections in the formal academic press of student research. Given the sheer bulk of information at hand, one would think at least some of the tourism scholars would synthesize the findings of these studies. Only a handful of books appear to have attempted to include thesis and dissertation results as part of larger edited collections around specific themes (for rare exceptions, see Rogerson and Visser, 2004; 2007; Tomaselli, 2012) in which (in part) the results of research student contributions were disseminated.

The spatial scope of completed research has widened but the general observation is that certain provinces, and even places within a province, have received substantial research attention whilst others have not. The bulk of research is focused on KwaZulu-Natal and the Western Cape which is hardly surprising given those provinces are key

destination areas in South Africa. However, there remains a dearth of research interest in Gauteng which is the base to a range of different tourism and tourist types.

Third, the need for this particular study highlights the fact that South African student tourism research is poorly captured on central databases. Some of the investigations in the current body of student research is very closely related. Should there have been a central repository of at least what investigations have already been undertaken, replication could be avoided or greater opportunity created for comparative investigations. It would appear, at least to me, that these types of investigations should in some way be more prominent.

Finally, student tourism research is maturing, the “low hanging” fruit have been addressed and there is a sense of growing maturity in this field of research. Taken together there is now a substantial body of tourism knowledge produced by postgraduate students, an increasing proportion which are not geographers.

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TOURISM GEOGRAPHIES OF THE PAST: THE UNEVEN RISE AND FALL OF BEACH APARTHEID IN SOUTH AFRICA

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Abstract: Tourism geography scholarship in South Africa has made major progress in the past two decades. One area of neglect in this expanding scholarship is historical research. This paper seeks to show the value of undertaking historical research to inform understanding of contemporary tourism landscapes. The rise and fall of beach apartheid in South Africa illustrates a marked geographical unevenness between the major coastal cities. It is concluded that tourism geography in South Africa can be enhanced by addressing the “present-mindedness” of current research and that tourism geographies of the past merit a place on the research agenda of South African scholars.

Introduction

Tourism research has been one of the most prominent and vibrant areas of scholarship in South African geography over the past 20 years (Hoogendoorn & Rogerson, 2015; Visser, 2016). The key directions of that body of research have involved engagement with the contemporary tourism economy and more especially of issues relating to tourism policy development at national, provincial and local scales (Rogerson, 2011). What is striking is the relative oversight of historical research in tourism studies as a whole and tourism geographical studies in particular. For tourism studies in general the works of Walton (2003, 2005, 2009a, 2009b) remind us of the underdevelopment of historical tourism research and offer a constant message of the need for scholars to engage more seriously with the past in tourism research. It is evident that the present tourism landscape “cannot be understood without reference to what has gone before; nor can we attempt to predict or preempt the future without achieving some understanding of where we, and others, have come from or of how relevant interested parties understand and appreciate their versions of the past” (Walton, 2009a, p. 115). The South African historian Albert Grundlingh (2006, p. 104) echoes these sentiments and argues “there is sufficient reason to believe that historians should not leave tourism for their summer holidays only”. The same might be said for South Africa’s community of tourism geographers.

The aim in this paper is to offer a small contribution to our understanding of tourism geographies of the past in South Africa. More specifically, the focus is to examine the case of the rise and fall of beach segregation in South Africa. At one level the racial zoning of South Africa’s beaches can be viewed as a contribution to an emerging international scholarship around tourism and racism (eg. Craggs, 2012; Dixon & Durrheim, 2003; 2004; Drew, 2011; Durrheim & Dixon, 2005; Mellinger, 1994; Munt, 1994; Sanchez & Adams, 2008; Stephenson, 2004; 2006; Stephenson & Hughes, 2005). In this article, however, the emphasis is simply to illustrate for geographers the value (and need) of pursuing historical research in South African tourism studies. The extraordinary chapter of the rise and fall of beach apartheid is a fragment of the historical development of South Africa’s economy of domestic tourism (Rogerson, 2015). It is one of many issues that can be researched by historical geographical students in tourism and turn the gaze of South Africa’s tourism geographers from the present to the past. Two sections of material are given. The first provides an overview of the state of historical research on tourism in South Africa. The second and major part of the paper provides a summary of the uneven pace and progress of the segregation and desegregation of beaches across the period 1953 to 1991. Arguably, it shows how distinct geographical variations can be seen in the unfolding of this neglected facet of South Africa’s tourism past. Overall, the paper draws upon a range of archival sources, most importantly newspapers. It should be noted that the discussion necessarily uses the racial terminology of apartheid in terms of the designated race groups of whites, coloureds, Indians and Africans.

Tourism historical research on South Africa: A brief overview

Historical scholarship on tourism in South Africa is limited (Wyllie, 2014). Indeed, Grundlingh (2006, p. 104) observes that the “history of tourism in South Africa has remained a largely uncharted field” and that the “paucity of the number of explicit historical contributions stands in contradistinction to the burgeoning work on the geographic patterns, economics and development of tourism in South Africa since 1990”. In particular the absence of historical investigations is evident in terms of looking at the rapid growth of urban tourism research in South Africa, much of it led by tourism geographers. As observed by Bickford-Smith (2009, p. 1763) “History matters, yet existing literature for South African urban tourism has focused largely on contemporary developments”.

In an overview of the tourism history of South Africa Saunders and Barben (2007) point out that the emergence and subsequent consolidation of the tourism industry in the country during the 19th and 20th centuries provides fertile territory for historical research. This said, only a limited number of historical studies have been undertaken. For the

colonial period one must note the group of rich investigations by Gordon Pirie variously on the emergence of the imperial aviation sector and appearance of what has been styled ‘incidental tourists’ (Pirie, 2009), the development of sea-rail cruise tourism during the 1920s and 1930s (Pirie, 2011) and the role of automobile clubs as important drivers of growth in the tourism economy (Pirie, 2013). Important rural-focussed investigations have appeared and centred in particular on the making of national parks and game reserves. Of particular significance are the studies by Jane Carruthers (1989, 1995) around game protection and the establishment of Kruger National Park. It is demonstrated that environmental protection cannot be viewed as a moral issue separate from political reality rather it forms a part of state strategies of resource management anchored on white self-interest, Afrikaner nationalism, ineffectual legislation, capitalism and the exploitation of the country’s African population (Carruthers, 1995). The colonial making of game reserves has also attracted the attention of South African historical geographers with the works of Brooks (2001, 2005) on the Hluhluwe and Umfolozi reserves in Zululand the most significant contributions. In terms of historical urban tourism research pre-apartheid Bickford-Smith (2009) draws attention to the construction of particular tourist gazes in Cape Town from the late 19th century onwards and of the emergence of the city’s infrastructure for tourism in terms of accommodation and transport terminals.

In research spanning the colonial to apartheid period Rogerson (2011) examined the development of the early accommodation services in South Africa and stressed the strong linkages between the alcohol sector and the emergence of the hotel industry. In another investigation on the wider accommodation economy of the Free State a longitudinal approach is used in order to investigate geographical variations and changes in the supply and character of tourism accommodation in this region of South Africa (Rogerson, 2013). In terms of the apartheid period arguably one of the most significant research papers in historical tourism is Grundlingh’s (2006) nuanced unpacking of the role of the tourism sector under apartheid. The geographer Ferrario (1978) provides a useful analysis of leisure tourism developments occurring in the apartheid period focusing on the 1960s and 1970s in particular (Ferrario 1978). During the apartheid years Ferrario (1988) shows there emerged only a small group of mainly urban Black dwellers with interests in holiday travel. This said, because of racial segregation policies limited options were available for Africans to experience leisure at a resort. Before 1962 there were no destinations for the more affluent groups of African teachers or businesspeople, potential consumers of holidays or desiring to stay the night in paid accommodation in South Africa. The study by Teversham (2013) chronicles how during the 1960s the state turned its mind to the provision of dedicated recreational spaces for the country’s African population with the establishment of specific coastal resorts and the opening in 1967 of the Manyeleti Game Reserve to serve as a dedicated leisure space for the emergent African middle class. In the so-termed Homelands areas the acceptance of independence created a new dynamic for the making and remaking of tourism destinations as is shown in the case of Coffee-Bay in (former) Transkei (Wildman, 2005).

Beach segregation and desegregation – Geography matters

Although leisure on South Africa’s beaches has attracted tourism scholars the question of beach segregation under apartheid mainly garnered the attention of sociologists concerned with theories of racial encounter (Dixon & Durkheim, 2003, 2004; Durrheim & Dixon, 2005). The rise and fall of beach apartheid so far has not been fully chronicled and remains one of the many investigatory voids in South African tourism history and historical tourism geography. As is shown below in the summary discussion this issue manifests a strong geographical component and not only in the racial-spatial divide of beach space. Beach segregation was part of the unfolding of apartheid in urban South Africa from 1948 (Simon, 1989). In 1953 the Reservation of Separate Amenities Act was passed and representing one of the cornerstones for petty apartheid. The legislation sought to reserve specific amenities for South Africa’s different racial groups. This said, the actual designation of separate beach space was not implemented, however, until the 1960s as new laws had to be passed and others amended in order to ensure that the beach and sea could be allocated to different racial groups along the South African coastline.

In the 1960s several commissions, committees and government investigations were launched to engage the complex exercise of planning for beach apartheid. Nevertheless, the pattern of unfolding beach segregation occurred at a varying pace and took different directions in different South African coastal municipalities. During the 1960s the country’s coastal municipalities had differing attitudes towards beach segregation. For example, Cape Town City Council was reluctant to zone its beaches according to race and postponed any decision in this respect. Nevertheless, during February 1964 the Cape Provincial Administrator compelled the Cape Town City Council to erect beach zoning notices for the various race groups within a period of 14 days. The Cape City Council requested an extension and pointed out to the Torlage committee that it opposed enforced segregation, and preferred instead to try and attract people to various beaches by providing facilities for them there, as it was considered that notices reserving beaches for specific groups merely caused “ill-feeling”. Similarly, the municipality in Port Elizabeth was adamant that it would not comply and post signs in terms of reserving beaches for specific groups. In common with Cape Town the Port Elizabeth municipality requested that the beaches traditionally frequented by Coloured bathers could continue. However, the Port Elizabeth authorities also were enforced by the Province to racially demarcate the city’s

beaches. In 1968 after joint inspections by the Provincial Administration and the Cape Town City Council, three beaches in the Council's area were allocated for the use of Coloureds. The Cape Town Council continued dissatisfied with the situation refusing to erect any beach apartheid signs and eventually the Provincial Executive put him the signs (Møller & Schlemmer, 1982).

Durban was a very different case (*Daily News*, May 12, 1982). Unlike the situation in Cape Town and Port Elizabeth, the municipal authorities in Durban readily embraced beach apartheid and went to great lengths to arrange beach zoning to ensure that there would be more beach space for the city's privileged White population. One notable instance of reallocation of beach space occurred in the early 1960s concerning an Indian beach which was located in close proximity to the White luxury hotels and flats with the consequence of many complaints voiced by the white residents. The outcome was that new zoning occurred with beaches for Indian and Coloured communities developed further north. The restructured beach landscape now included a stretch of five miles of beach reserved for Whites and only two small areas of 500 metres each allocated to Durban's Indian and Coloured beachgoers. The compliant attitude of Durban to apartheid legislation for beach segregation thus was a marked contrast to the situation in Cape Town and Port Elizabeth (*Daily News*, May 12, 1982).

Overall the 1960s and early 1970s were characterised by the stricter enforcement of beach apartheid on all beaches both in the major cities as well as smaller resort towns on the Natal and Cape coast. From the mid-1970s and into the 1980s, however, a policy about-turn occurred as more 'liberal' progressive views regarding the sharing of amenities and facilities were advanced. The question of opening beaches to all race groups now arose. The Cape Province, with more tolerant views on beach usage than Natal, led the way in opening up the beaches. By 1978, a large portion of the coastline was undemarcated and by 1979 much of the Cape Peninsula was opened to all population groups. Several critical beaches, however, remained racially exclusive spaces. These included the city's most popular White beaches as well as those beach spaces which adjoined either white residential areas or some coloured residential areas. These beaches remained reserved spaces. In the case of Port Elizabeth by 1979 a similar pattern is observed to Cape Town in that previously demarcated black beaches were declared open whereas the city's main tourism beaches remained whites only.

Once again Durban lagged behind Cape Town and Port Elizabeth in desegregating beach spaces. The first debate concerning the opening of Durban's beaches was only in 1977 when the City Council voted against a proposal to open the city's beaches to all races. Instead, it evaded the issue of desegregation by spending an amount of R500 000 to upgrade facilities on the new beaches to bring them up to the standards of those on the city's white's only beaches (Møller & Schlemmer, 1982). Eventually in 1982 after considerable public debate a site for a multiracial beach was selected and decided upon. The Council voted in favour of an open beach and towards the end of 1982 one beach in Durban was officially opened to bathers of all races (*Natal Post*, November 15, 1982; *Natal Mercury*, November 5, 1982).

The lagging of Durban in desegregating the city's beaches occurred at a time of strong public opposition to beach integration and resistance to open beaches which was increasingly vociferous by the early 1980s. Resistance to the opening of beaches took place in Natal and the Cape. This said, one notable difference was that resistance in the Cape often was precipitated by pay-beaches and the erection of fences whereas the resistance in Natal usually was linked to opposed to beach desegregation *per se*. Active participation by the authorities, the public and the commercial sector took on various forms of resistance such as public meetings, referenda, letters, polls and petitions.

Two major referenda took place, the first in Natal in 1983 and the second in Port Elizabeth during 1986. The Durban referendum was motivated by the City Council's decision to open all Durban's beachfront facilities to all races. The strongest reaction against these plans came from the Civic Action League. This rightwing organisation accused the city's "mouth frothing progressives" of being "responsible for upsurge in crime and lawlessness in the city by encouraging Black [African] people to ignore laws governing separate amenities" (*Natal Witness*, February 23, 1983). It was argued that the city should spend its energies on providing separate but equal facilities for all races rather than desegregating existing amenities (*Natal Witness*, February 23, 1983). A public referendum was later agreed to allow parliamentary voters to decide the issue of opening Durban's beachfront facilities to all race groups. At a public meeting attended by 1700 mainly white people plans to open the beach facilities to all races were overwhelmingly rejected (*Natal Mercury*, February 23, 1983). The major reasons given for rejecting the plans for opening of beaches are instructive of local attitudes. Specifically, these were that the local tourist industry would collapse, white women would be 'ogled' at by Africans and that petty crime would escalate (*The Star*, February 24, 1983). In Port Elizabeth the local referendum was also concerned with the opening up of beaches and triggered off by Council's decision to open up all of the beaches within a few months. The decision was widely welcomed by the majority of the population – in particular the city's foreign-owned car companies. Indeed, it was observed that it was "all these silly issues which keep us in the limelight overseas and are distorting the issues for the multinationals

working in Port Elizabeth. All of these small issues are responsible for the pressure from parent companies overseas to withdraw from South Africa” (Eastern Province Herald, March 24, 1986). In opposition to beach desegregation was the city’s right wing *Hersitgte Nasionale Party* which called for a referendum in order to allow the ratepayers a vote before any decision was made.

Another aspect of the unfolding of beach segregation was the growth of petitions. The most notable were two petitions drawn up respectively in Durban and Fish Hoek, Cape Town. In early 1983 the Durban Management Committee called for the opening of a small section of beach close to the downtown area. This move was strongly opposed by many Councillors and in particular the right-wing civic Action League which immediately organized a petition to protest against the move (*Citizen*, January 27, 1983). The Management Committee accepted the petition and the intended motion of opening the beaches was defeated. Once again the petition put forward in Fish Hoek highlights the geographical differences in attitudes between Natal and the Cape Province. Whereas the Durban petition was against the opening of beaches, the Fish Hoek petition was prompted by residents’ opposition to fenced beaches which restricted the flow of people. During August 1986 the Fish Hoek Town Council decided to fence the beach and make it a pay beach. An earlier unsuccessful fencing of Camps Bay beach in November 1985, however, prompted Fish Hoek residents to collect a total of 1300 signatures against the pay beach as they did not think that the fence scheme was “in the towns’ best interests” (*Star*, August 28, 1986). The fence was considered unsightly and unpleasant by the residents, and their strong negative reaction eventually led the authorities to remove the fence. The building of fences was rationalised ostensibly on grounds of control of “crowds” albeit underpinned clearly by the fears of white residents about multi-racial beaches and especially of concerns relating property prices were being depressed because of ‘anti-social behavior’ (*Cape Argus*, March 13, 1986).

Judged by the volume of press coverage about public resistance, Natal experienced most racial incidents surrounding beach desegregation (*Natal Mercury*, October 5, 1983; *Sunday Times*, April 8, 1984; *Natal Witness*, April 24, 1984). There were numerous reported incidents in terms of fights and arguments between the different race groups in many of the smaller resorts along the Natal coast. One of the worst instances was of a young black teenager who was swimming at a small coastal resort where he was almost drowned by an Afrikaans-speaking Transvaal holiday maker who stated that he “hated swimming with Blacks”. It was only because someone on the beach saw the incident and swam out that the young boy survived (*Sunday Times*, April 8, 1984).

It is not only public users of the beaches who express opinions on beach apartheid the commercial sector is also affected by beach integration and sought to protect its own interests. In Durban hoteliers had strong views about segregation or integration, dependent on how they perceived that their business would be affected. For owners of the small hotels and holiday flats on the beach-front which catered mostly for politically conservative ‘up-country’ visitors opposed to beach integration, hoteliers and owners feared that opening of beaches would cause them to lose the majority of their business (*Natal Mercury*, January 6, 1984). By contrast, the larger chain hotels, which catered to a multiracial clientele in the mid-1980s, welcomed the opening of all of the beaches. Beach desegregation would permit all visitors to enjoy the hotels and surrounds as opposed to the current situation that Africans were not permitted to walk across the road and swim in the sea at ‘Whites only’ beaches. The Liquor Amendment Bill passed in February 1986 permitted hotels to sell accommodation, food and drink to whomever they wished as the Act no longer contained any reference to race. This Act had been directly responsible for opening up an expanded tourist trade to larger hotels and restaurants in Durban (*Star*, February 11, 1986).

In Port Elizabeth the active role of the city’s large foreign-owned automobile companies was observed. The managing director of General Motors, Port Elizabeth’s largest private employer, offered legal and financial support to any its ‘non-white’ employees who defied segregation policy on the city’s ‘Whites only’ beaches. This was an intervention in local politics that obviously would enhance the company’s image both amongst the local population, for shareholders in the United States. The manager of General Motors stated that “reform could begin to look a good deal more real if other companies followed its bold lead” (*Star*, February 21, 1986). It was made clear that he found the law segregating beaches “abhorrent” and furthermore that the Port Elizabeth Council had the power to open beaches to all races but “collectively it seems the Council has neither the courage to do so nor the integrity to deal with the issue urgently and openly” (*Star*, February 2, 1986).

By the mid-1980s the demise of beach segregation already was in play. By 1986 Cape Town had opened its beaches without waiting for any necessary governmental authority. However, in Port Elizabeth a more cautious approach was taken and the city’s Coloured, Indian and African beaches were opened to all races whilst the white beaches remained segregated. Once more, Durban was the slowest at opening its beaches and by 1986 had only opened select beaches to all race groups. By 1989 beach apartheid was coming to an end as increasing numbers of beaches had been opened to all race groups and the notorious whites-only signs were being dismantled. In October 1989 it was reported that “the tide of change is steadily rising on the sands of South Africa’s holiday beaches” (*Sunday Times*,

8 October, 1989). During November 1989 the state president, F.W. de Klerk requested that local authorities desegregate all remaining beaches reserved for specific race groups with the outcome that by end 1989 all beaches were open (Cooper et al, 1990). The close of beach apartheid came with the repeal of the Separate Amenities Act in October 1990.

Conclusion

This paper has sought to demonstrate the utility of adopting a historical approach to understand the South African tourism landscape. It is argued that the understanding of the contemporary tourism landscapes of South Africa can be greatly enriched by the pursuit of historical investigations. Tourism geography scholarship in South Africa is characterised by what Walton (2009a, 2009b) calls “present-mindedness”. This brief examination of the rise and fall of beach apartheid shows that tourism geographies of the past merit a place on the research agenda of South African scholars.

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THE GEOGRAPHY OF FESTIVAL AND TOURISM DEVELOPMENT: THE CASE OF CAMEROON

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Abstract: In examining the significance of festival location in advancing tourism development in Cameroon, this empirical study focuses on the Limbe Festival of Arts and Culture (FESTAC). Specifically, the aim of the study was (1) to profile event attendees and (2) attendance motivators, as well as (3) to determine whether the choice of location influences attendance. A semi-structured questionnaire survey was used by trained fieldworkers on event days to collect the required data from the event attendees (non-locals) (n=324). Additionally, in this mixed-method study, interviews were conducted with resource persons from the Ministry of Arts and Culture and from the local municipal authorities, as well as event organisers. The study found a significant association between the event location and the attendance. Furthermore, the event attracted a diverse range of people, albeit mostly consisting of domestic visitors. The data reveal the tourism potential of the event, on which the local tourism authorities could capitalise in their promotion of tourism. The study underscores the need for the Ministry of Tourism and Leisure and for the Ministry of Arts and Culture to collaborate effectively in the joint planning, and for the mutual benefit, of the two sectors in the local Cameroonian economy.

Introduction

Generally speaking, festivals, as a typology of event tourism have come to receive an increased amount of attention from tourism researchers in recent times, both in the developed and in the developing contexts (Bracalente, Chirieleisen, Cossignani, Ferrucci, Gigliotti & Ranalli 2011; Loots, Ellis & Slabbert, 2011; Saayman & Rossouw, 2011; Mahika, Radelescu, & Aluculesei, 2015; Rogerson & Harmer, 2015; Getz & Page, 2016). Such interest has ignited the many debates that have mainly focused on analysing the cause and effects of such events for the host regions concerned. According to Thomas and Kim (2011), festivals are considered to play an important role in promoting the social life of communities, since the former have the ability to attract visitors, to generate positive tourism impacts, to create opportunities for social cohesion, and improve upon the image of host destinations. Consequently, as Loots et al. (2011, p. 122) observe, “the growth of festivals and events in numbers, diversity and popularity has been enormous”. Elsewhere, Park, Reisinger and Kang (2008) contend that such festivals and special events have grown at all destinations, and that they are the fastest developing sector in the tourism field. According to Thomas and Kim (2011), the special interest that has been expressed in festivals, specifically those that are intended for cultural preservation, for the experiencing of local foods and cultures, and for obtaining community involvement at a destination has led to an increased emphasis on the hosting of regional and local festivals.

The existing literature points to a number of useful studies that have been conducted on festivals and events, in terms of the many different advantages that they provide for communities (see Crompton & McKay, 1997; Saayman & Saayman, 2005; Stankova & Vassenska, 2015). However, according to Thomas and Kim (2011), many festivals are still in an early stage in regard to both practical management and theoretical studies. This particularly applies to festivals of arts and culture, which have increased in number by the year, leading to them drawing the attention of several destination marketing organisers and researchers.

As has been demonstrated by the works of Kim, Goh and Yuan (2010) and Park et al. (2008), appreciating travel motives is an important forecasting tool for determining travel patterns, with it also being a key precondition for creating desirable experiences. Despite the importance of festivals for the culture of the host economy, little research has, until now, been conducted in the Cameroonian context. The current study, therefore, examines the significance of festival location and attendance motives in advancing tourism development in Cameroon. The associated research draws on empirical evidence, in terms of investigating the Limbe Festival of Arts and Culture (FESTAC). Specifically, the aim of the study was (1) to profile event attendees and (2) attendance motivators, as well as (3) to determine whether the choice of location influences attendance.

Literature Review

In the available literature, festivals have been referred to as cultural events (Mahika et al., 2015) that are a notable expression of human activity and that contribute much to the social and cultural life of the communities in which they are held (Allen, O’Toole, Harris & McDonnell, 2008). The main narratives that are evident from previous empirically based research on festivals and events relate to the associated impacts for host destinations, as was stated in the introduction to the current paper. According to Saayman and Saayman (2005), one of the greatest advantages of festivals is that they can create a demand for tourism facilities in a time that might otherwise be regarded as being off-season. The authors contend that such festivals can generate income, increase community pride, strengthen local

traditions and values, provide an opportunity for the host community to work together and gain exposure, and improve stakeholder interaction, among other benefits that they provide. According to Mahika et al. (2015), it is for the aforementioned reasons that festivals have come increasingly to be used as instruments for regional and local economic growth, with them attracting investments and spending from both domestic and international tourists. Although the research in this field points to such economic benefits as job creation and business opportunities, Stankova and Vassenska (2015) acknowledge the need to recognise the related socio-environmental impacts (both positive and negative).

In the previous century, Crompton and McKay (1997) highlighted the importance of understanding the motives of festival attendees. Most notable is the factor that such an understanding provides the basis for the design and implementation of the festivals, with the comprehension of attendance motives, and of the close relationship of such motives to the related satisfaction and prioritising motives, serving as a way of coming to understand the visitors' decision-taking processes.

Festival site and location is an important component of the geography of festivals globally. Study of the phenomenon seeks to determine where festivals are located, and the consequences of such location. Getz and Page (2016) suggest that contemporary festivals come in all shapes and sizes, with location, consequently, being of paramount importance, in terms of it forming part of the motivating factor for the attendees involved.

Previous research that has focused on the motivation of attendees for visiting festivals has emphasised that gaining insight into their rationale is a critical step in the successful planning and executing of a festival (Crompton & McKay, 1997; Thomas & Kim, 2011). To this end, several models have been developed, and postulated as being appropriate, in terms of measuring the motivation to attend events or to travel in relation to festivals. Thomas and Kim (2011) acknowledge that the most important theory, in the current context, is that which was developed by Maslow in 1954. His hierarchical theory of needs depicts a pyramidal structure that categorises human motivation in terms of their needs, which are positioned in ascending order of importance. The lowest level category consists of physiological needs, including such basic human needs as food and shelter. The next level is comprised of safety concerns that relate to the human desire to avoid the unknown. The third level is concerned with the need for safety, which addresses the issue of socialisation, in terms of inter-relational requirements, with the fourth and fifth levels focusing on ego and self-fulfilment needs, respectively. Self-fulfilment is related to human needs for growth in cognitive and aesthetic areas, with the former including such areas as the gaining of knowledge and understanding, whereas aesthetic growth refers to a constant search for beauty and balance in the world (Thomas & Kim, 2011).

According to Thomas and Kim (2011), categories of motivation that require consideration in terms of reaching an understanding of festival attendees' behaviour include escape, excitement, novelty (novelty/regression), socialisation/family togetherness (gregariousness), nature appreciation, curiosity, cultural/historical factors, festival attributes, and the recovering of equilibrium.

Research Methodology

The research methodology considered: the study setting; the sampling technique; the instrumentation; and the data collection and analysis,

Study Setting

The current study was conducted during the hosting of the second FESTAC that was held in the coastal city of Limbe, in the South West Region of Cameroon (Fig 1). Limbe is one of Cameroon's most popular holiday destinations, attracting both local and international tourists. Its attractiveness as a destination owes much to its warm weather, its pristine beaches, its beautiful botanical gardens and wildlife centre, and its ecotourism products, among other phenomenal attractions. Of major significance is the backdrop of the southern slopes of Africa's second highest peak, Mount Cameroon.

According to Lenjo (2016), the birth of the Limbe FESTAC was a recommendation of the former Minister of Arts and Culture, who was impressed by a display of arts and culture during a celebration marking Limbe's sesquicentenary celebrations. The main objective of FESTAC is to promote cultural diversity and integration among Cameroonian people and those of such neighbouring countries as Nigeria, Gabon, Chad, and Niger. The event is characterised by the display of local arts, traditional dances, folklore, local food and wine events, and live performances featuring local artists.

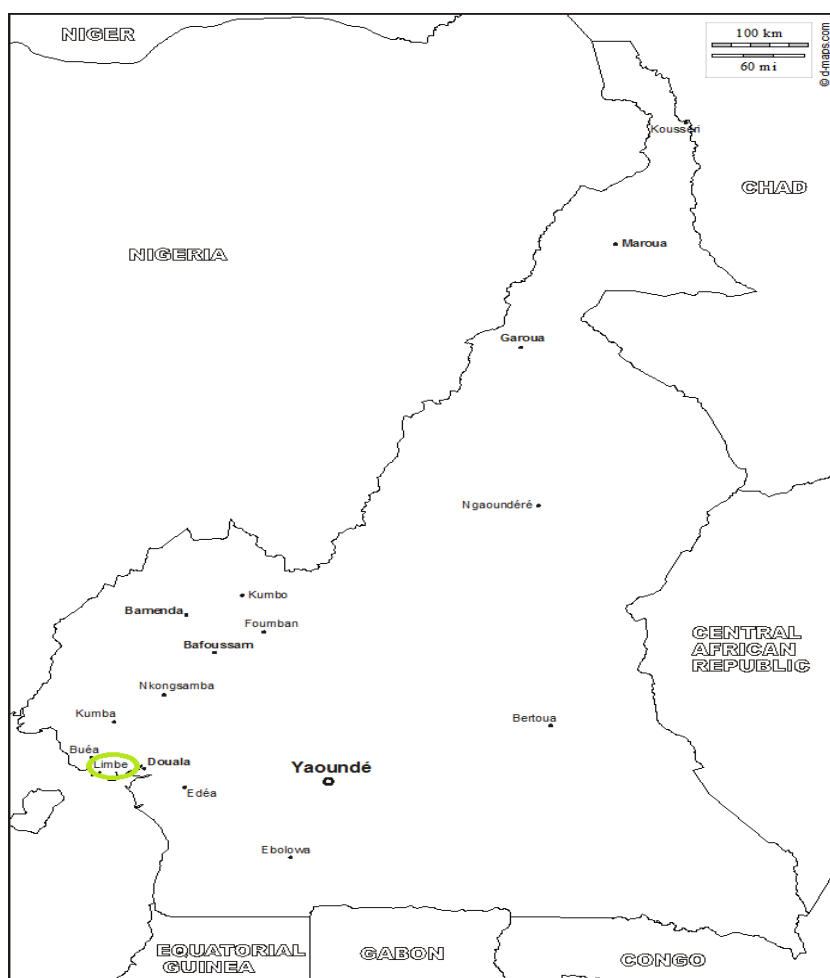


Figure 1: Map of Cameroon, indicating study area (Source: Modified from D-Maps.com)

In terms of the study design, the researcher employed a mixed-method approach, incorporating both qualitative and quantitative research data collection methods.

Sampling technique

The sample size of the population for the event was not known prior to the study, owing to the lack of previous event attendance figures. Consequently, a spatially-based purposive sampling technique was used to target the event attendees concerned. According to Jupp (2006), such a sampling technique is helpful in the case where the sample size of a population is unknown. Accordingly, such a method was adopted because the researcher concerned wished to use a sample of the population with the intention of assessing the perceptions of the festival attendees, and not of a random sector of the population.

Instrumentation

The current survey was used to establish the demographic profiles of the respondents and their motivations for attending the event in question. An intensive literature review was performed to help develop 16 motivational factors that were included for consideration in the survey. Additionally, to ensure the validity of the study, the survey was also based on a similar study that was conducted by Kim et al. (2010). Local tourism experts and stakeholders of the FESTAC event reviewed the draft instrument to determine its validity. The survey was then pilot tested to determine its reliability. The comments received were incorporated into the final survey instrument, which was validated by a statistician. The survey was divided into two sections, consisting of the sociodemographic characteristics of the respondents, and their attendance motives. A seven-point Likert-type scale ranging from “(1) totally unimportant” to “(7) extremely important” was used for the self-ranking, by the event attendees, of the level of importance that they attributed to the following factors: their self-actualisation by means of their festival attendance; the quality of the festival; the opportunity created by the festival for meeting with other people, and socialising; the overall cost of the event; the degree to which they appreciated festivals; the event location; the nature of the residents; the chance created by the festival for promotion and getaways; the weather at the time of the festival; the in-festival entertainment; the ability granted to relax; the sense of family togetherness created by the event; the

festive atmosphere promoted by the event; FESTAC's reputation; their previous experience of a similar event; and the food that was made available during the event.

Data collection and analysis

On the days of the event (2–9 April 2016), a semi-structured questionnaire survey was used by trained fieldworkers to collect the required data from the event's non-local attendees. The fieldworkers were positioned at various locations within, and outside, the event venue, so as to enable them to target the event attendees. A screening question was used to eliminate the local residents from the survey. By the end of the event, a total of 324 attendees had been surveyed. Additionally, interviews were conducted with resource persons from the Ministry of Arts and Culture and from the local municipal authorities, as well as with the event organisers. The quantitative data were captured and analysed using the Statistical Package for the Social Sciences (SPSS) software, version 24. The qualitative data and the interviews were analysed thematically.

Results and discussion

The results and discussion are dealt with below in terms of the following aspects: the demographic profile of the respondents; the reasons for the respondents being in Limbe at the time of the event; their place of origin; and their previous attendance at such an event; their motivation for attending the event.

Demographic profile of the respondents

Table 1, which presents the demographic characteristics of the respondents, shows that there were more women (66.6%) in attendance at the event than there were men (33.4%). The largest age group of attendees ranged from 18 to 24 years in age (54.0%), reflecting the presence of a largely youthful population, which might partly have been influenced by the location of two major universities within the nearby South West Region's capital city of Buea. Accordingly, a very large proportion of the sample (84.6%) were unmarried. Almost half of the respondents (46.2%) reported having an annual household income of below CFA 1 million, reflecting the presence of a society in which the income levels are considered as being low. According to Tichaawa and Bob (2015), many households in Cameroon have an income of less than USD 2 per day. Many (39.2%) of the respondents had attained a university qualification, with the next highest percentage in terms of educational qualification having attained a high school qualification (35.6%).

Reasons for attending

In terms of their primary reason for attending the FESTAC event, a large percentage (64.5%) of the respondents indicated that the event itself had served as their main attraction, with some (23.8%) stating that they were present in Limbe on business. Others noted that they were on holiday (8.6%), or else visiting friends and relatives (3.1%), in the area. The average number of nights spent in the city was calculated at 13.09, with a standard deviation of 11.394.

Of the respondents, 69% were second-time visitors to the event, compared to 31% who were first-time attendees at the event. The event also attracted a very large number of domestic attendees (97.3%), compared to international attendees (2.7%). Many of the domestic attendees came from other parts of the South West Region, and from the neighbouring regions (the Littoral and North West regions).

Motivation for attending

Table 2 shows the mean and the standard deviation scores of the 16 motivators as single items. Item 14, consisting of FESTAC's reputation, can be seen to have attained the highest mean score (3.49), reflecting that the event attendees were much concerned about the reputation of the FESTAC festival living up to their expectations, which were based on experiences of the inaugural event. Such a finding is consistent with the findings of the related research that was previously linked to other types of festival events and to other instances of attendance (see, for example, Park et al., 2008). As was the case with a study conducted by Thomas and Kim (2011), the promotion of the event, and giveaways related to it, by the event organisers and sponsors were ranked as the least important motivator, with the lowest mean score being attained in this respect (2.60).

The interviews that were conducted with the key informants indicated that the decision to locate FESTAC in Limbe was mostly due to the positioning and the reputation of the city. The decision was based on the premise that such a city would appeal to the prospective attendees. In clarifying the above, a senior official at the Ministry of Arts and Culture asserted:

What led to the decision to endorse and support the organisation of the first FESTAC event in Limbe was because the city is known to be well-positioned to attract visitors, and [it] has related facilities

that are [i.e. were] required to host [i.e. for the hosting of] the event. We consider Limbe ... as a strategic city, and there is much to enjoy there besides the event.

Furthermore, the interviews also revealed that both the event organisers and the local authorities enthusiastically attributed the successful hosting of FESTAC on both occasions to date as having largely been due to the choice of the host city involved. A local municipal official, who was intimately involved with organising the event, noted the following in connection therewith:

I can guarantee to you that the masses of people we see filling up this stadium is [i.e. are] mainly because we chose to host this event in our city. Many people I have spoken to and gave them [i.e. to whom I have given] a welcome told me that they came here because of our friendly city. The first edition was very impressive, too, with [i.e. in relation to] the attendance, and we plan to double the figures during the next FESTAC.

The above quote clearly shows that the attendance levels at the event were impressive, although no figures were presented by the event organisers to this effect. However, given the attendance figures suggested by the current study, and the personal observations made during the fieldwork, it is evident that the event tends to attract a wide range of people, leading to the possible extension of tourism activities and benefits to the local citizens in future.

In response to a Pearson chi-square test of independence that was conducted between the event location and the motivation to attend the event, the results obtained reveal that there was a significant association between the two: $\chi^2(2, n = 324) = 6.110, P = 0.047$. Such a result implies that the choice of Limbe as the host city for the FESTAC was an important component of the attendees' decision to attend the event.

Table 1: Attendees' demographic profile

	Percentage (%)
Gender (n=324)	
Male	33.4
Female	66.6
Age (n=324)	
18–24	54.0
25–34	27.8
35–44	6.2
45–55	1.9
55 and older	10.1
Marital status (n=324)	
Widowed	1.9
Single	84.6
Married	12.0
Household income (n=324)	
Less than CFA 1 million	46.2
CFA 1.1 million to CFA 1.5 million	15.4
CFA 1.6 million to CFA 2 million	6.9
CFA 2.1 million to CFA 2.5 million	9.2
CFA 2.6 million to CFA 3 million	8.2
CFA 3.1 million to CFA 3.5 million	4.3
CFA 3.6 million to CFA 4 million	3.9
4.1 million or more	5.9
Education (n=324)	
Less than high school	9.0
High school	35.5
Apprenticeship/trade certificate	4.0
College	12.3
University	39.2

Table 2: Mean and standard deviation scores for motivator items

	Motivation	N	Mean	Std Deviation
1	Self-actualisation (understanding & knowledge of festival)	324	3.36	.627
2	Quality of festival	324	3.27	.834
3	Meeting people / socialising	324	3.24	1.000
4	The overall cost	324	2.68	.977
5	The appreciation of art festivals	324	3.53	.601
6	The event's location and area	324	3.27	.603
7	The nature of the residents	324	2.94	.976
8	Promotion and giveaways	324	2.60	.989
9	Weather	324	3.25	.780
10	In-festival entertainment	324	3.22	.962
11	Relaxation	324	3.28	.738
12	Family togetherness	324	3.15	1.057
13	Festive atmosphere	324	3.30	.730
14	FESTAC's reputation	324	3.49	.715
15	Previous experience	324	2.70	1.005
16	Food	324	2.94	.975

Conclusion

Festivals of arts and culture are an important thematic point of focus in much tourism and event literature. The purpose of the current study was to investigate the significance of the festival location in advancing tourism development in Cameroon. Specifically, the aim was to profile event attendees and attendance motivators, as well as to determine whether the choice of location influences attendance. The study found that the event appeared mostly to attract relatively young single female attendees, who were largely repeat domestic visitors living in a household with an income of less than CFA 1 million per annum. The reputation of FESTAC was an important factor in their decision to attend the event. Additionally, the study has shown that the geographic location of the FESTAC in Limbe is important in attracting attendance. Consequently, FESTAC event planners in other regions in Cameroon should consider the factor in question when deciding about the venue for the event.

Promoting FESTAC beyond Limbe and other parts of Cameroon could be a significant way of igniting and promoting tourism in the region. However, such events must be leveraged in a manner that will result in the granting of opportunities for residents and businesses in the host region. Since domestic visitors tend to dominate FESTAC attendance, focusing on the international attendees involved is essential to the ongoing success of the venture.

The data obtained in the current study reveal that the tourism potential that exists in relation to the FESTAC event could be capitalised on by the local tourism authorities in Cameroon, in their quest to promote tourism in the country. An event, irrespective of its typology, has been proven to be a tool that can be used to position the country, both locally and internationally, with the view to gaining associated tourism benefits and imaging (Getz & Page, 2016). For this to happen, the need for collaboration between the Ministry of Arts and Culture and the Ministry of Tourism and Leisure is critical. The tourism potential that emanates from the FESTAC event can only be harnessed through such joint stakeholder collaboration, as emphasised by Loots et al. (2011). The present status quo, in terms of the current very limited involvement of the Ministry of Tourism and Leisure, could represent a missed opportunity for tourism in the country, and it should be corrected.

The amount of research that focuses generally on tourism and events in the Cameroonian context is, currently, very limited and unexplored, despite the high rate of interest and degree of recognition that it is presently being given by the government. This study, which makes a useful contribution to the body of literature in this field, represents a departure point for the analysis of a range of festivals in Cameroon. Future research is planned in terms of analysing the stakeholder perceptions of the impacts of the festival, which will include the views of the local host residents, since they form a primary stakeholder group.

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GOVERNANCE OF TOURISM IN KWAZULU-NATAL, SOUTH AFRICA

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Abstract: Tourism scholars acknowledge that an emerging but currently still weakly developed research theme relates to detailed investigations into the manner in which provincial government structures and institutions directly assist, not only in terms of tourism policy and guidelines, but in the development of local and regional tourism systems and local economic development (Rogerson, 2002a; Binns & Nel, 2002; Marais, 2008, Rogerson & Rogerson, 2011; Visser & Hoogendoorn, 2011). The lack of tourism governance research has led to the absence of knowledge about advantages and disadvantages of different local tourism governance approaches, and this has led to many tourism destinations experimenting with different modes of local tourism governance (Beaumont & Dredge, 2010). The challenges of tourism governance and coordination are pervasive in South Africa but the province of KwaZulu Natal has established tourism coordinating structures. The national government has acknowledged the progress made by KwaZulu-Natal in governing and coordinating tourism in the province and recommended that all provinces adopt this model. KwaZulu-Natal is however, experiencing challenges with implementation as the model has many structures and requires participation by multiple stakeholders.

Introduction

Tourism is a cross cutting activity whose development requires the involvement of different business subsectors; comprising accommodation, transport, catering, and others (Pulido-Fernández, López-Sánchez, & Pulido-Fernández, 2013, p.1). The sector hence requires collaboration of the public sector, given that a large part of the resources to be used are publicly owned; of the private sector, as different business subsectors intervene; and of the inhabitants of the tourism destination, their participation being essential in the planning of this activity (Velasco, 2008 in Pulido-Fernández et al., 2013). The tourism activity occurs in a defined geographical space termed a tourism destination. A tourism destination is an important unit albeit difficult to define (Haywood, 1986) but may be considered as a cluster of interrelated stakeholders embedded in a social network. Baggio & Cooper (2010) suggest that such a network of stakeholders interacts, jointly meeting visitor needs, and producing the experience that the travellers consume. These destination stakeholders include accommodation businesses, attractions, tour companies, and others providing commercial services; government agencies and tourism offices as well representatives of the local community. KwaZulu-Natal is one such tourism destination, a coastal province in the eastern seaboard of South Africa, and has developed the KwaZulu-Natal Tourism Governance Model with a myriad of structures at a provincial and municipal level. In February 2013, the National Department of Tourism hosted a local government conference themed 'Tourism Development: Why Local Government Matters' (Rogerson, 2013), with a subsequent conference in 2015. Amongst the objectives of the conference was to streamline tourism coordination and planning in order to boost the developmental impacts of tourism, a critical economic sector for the South African economy. One of the conference outcomes was a recommendation by the National Department of Tourism (NDT, 2013) to other provinces in South Africa to adopt the KwaZulu-Natal Tourism Governance Model. KwaZulu-Natal is however experiencing challenges with implementation of their institutional frameworks in the model. Complications with implementation are nevertheless not unique to KwaZulu-Natal as implementation has long been recognised as being a significant issue in tourism policy, planning and management (Baud-Bovy & Lawson, 1977; Jenkins, 1980; Getz, 1986; Inskeep, 1991; Pearce, 1992; Hall, 1994; Hall & Jenkins, 1995; Hall, Jenkins & Kearsley, 1997; Tosun & Jenkins, 1998; Bramwell & Lane, 2000; Jefferies, 2001).

Governance and coordination in tourism

The lack of coordination and poor governance of tourism at national, provincial and local levels have been recognised as a pervasive concerns by the government and the Parliament of the Republic of South Africa (Gumede, 2013; Parliamentary Monitoring Group [PMG], 2015). This is not unexpected as there has been an endeavour by several scholars over the years to unpack the concept of governance in tourism (Nordin & Svensson, 2005; Dinica, 2006; Bramwell, 2010; Fernandez et al. 2013, Kolo, 2014). The role of government in developing and implementing public policy in tourism has also been widely recognised, (Dredge & Jenkins, 2011; Hall, 2011; Hall, 2014). Scholars such as Visser & Rogerson (2004) assert that in the wake of the policy importance placed on tourism development; local tourism research has developed considerably over the past decade. However it must be acknowledged that the features of this emerging tourism research is a weakly developed research theme relating to detailed investigations into the manner in which provincial government structures and institutions directly assist, not only in terms of tourism policy and guidelines, but in the development of local and regional tourism systems (Nel & Binns, 2002; & Rogerson, 2003). The challenge is with research that has been conducted to record coordination endeavours of government, as Vrahimis & Visser (2006) argue that the research concerning the role

of different spheres of government that are less directly linked to local communities, particularly provincial governments, in facilitating tourism development is basically absent in local scholarship. In addition, Vrahimis & Visser (2006) further argue that the current South African tourism and development discourse, as well as international tourism debates, have largely omitted to provide insights into the inner workings of the government institutions.

In tourism, governance is almost synonymous to coordination. The concept of coordination can be viewed as formal institutionalised relationships among existing networks of organisations, interests and/ or individuals d'Angella & Go (2009). A related attempt by George (2007) at describing coordination considers coordination as the formal institutionalized relations between existing networks of organizations. It is therefore noticeable that the governance aspects of the established tourism coordinating structures are important, and require intelligible coordination interventions. With regard to tourism governance, an assortment of approaches have been conceived from innovation (Moore & Hartley, 2008), complexity science approach (Baggio & Cooper, 2010), sustainable tourism (Dinica, 2006 & 2009; Bramwell, 2010; Alipour, Vaziri, & Ligay, 2011; Bramwell & Lane, 2011), network approach (Beaumont & Dredge, 2010), environmental management (Duffy, 2006). In this paper, coordination means an integrated approach to interventions implemented by the public and private sector institutions and stakeholders in determining policy, planning, developing and managing matters of common interest in a tourism destination.

Complexities of governance in tourism stakeholder coordination

Throughout history, tourism coordination has been a challenge amongst different organisations and it is imperative to note that this coordination demands collaboration amongst various stakeholders to achieve cooperation and inter-organisational stakeholder solutions (Hardy, Lawrence & Grant, 2005; Lemmetyinen & Go, 2006). Padurean (2012) warns that most of the governance models over the years have taken a narrow view of the appropriate participants, focussing primarily in the business owners of the destination, and typically excluding the interests of the local residents which overlooked the need for stakeholder involvement in the management of tourism. In providing solutions to this narrow perspective, Yang (2006) encouraged creating a common management mode where stakeholders' participation is fully enabled and reciprocal mechanism exists between destination and stakeholders to facilitate effective and sustainable development of the destination. The acceptance of the notion of heterogeneous communities in tourism brings with it the realisation that the planning and management of tourism is a more complex and yet even more necessary task (Middleton & Hawkins, 1998; Mason & Cheyne, 2000). The global phenomenon, as argued by Telfer & Sharpely (2008) is that through various government ministries or state sponsored tourism development corporations, governments establish the framework, policies, plans and regulations to both attract and control tourism development. It is widely recognised that it is governments that possess the potential power to control, plan and direct the growth and development of tourism, and at the local level, plans typically focus on local development, allocation of resources, conservation measures, zoning of land use, densities, coordination and implementation of policies, (Mowforth & Munt, 1998 & 2016; Telfer & Sharpely 2008; Nelson, 2012). Furthermore, governments may attempt to regulate tourism, but they also have a role in marketing tourism (Mason & Mowforth, 1995; Seaton & Bennet, 1996). It must however be noted that the ability of government to regulate the tourism industry is relatively restricted. This emanates from spheres of government operating at different levels, culminating to national, regional or provincial, and local government bodies that regulate tourism (Swarbrooke, 1999; Sharma, 2004; Sinha 2005; Pender & Sharpley, 2006; Telfer & Sharpley, 2008). The end of apartheid in 1994 in South Africa ushered a new era of tourism with the government recognising the importance of the sector and making tourism one of the key economic sectors (Nzama, 2010; Magi, 2012; Qongo, 2013; Tassiopoulos, 2014). However, inclusive citizen involvement in tourism plans is inadequate and community participation could be described as "tokenism" (Tosun & Timothy, 2001; Coghlan & Brydon-Miller, 2014). However Nzama (2010) highlights that the South African government has become aware of the potential for tourism to play a meaningful role in contributing to the economic development of the country, particularly in rural areas. The importance of tourism as argued by (Ashley, 2006 & Kimbu, 2012) underscores the necessity for coordination as the catalytic role of creating partnerships between local tourism stakeholders. It is therefore not surprising that the role of tourism in driving local economic development and importance of coordination amongst various stakeholders in South Africa is captured in a number of studies (Binns & Nel, 2002; Khuzwayo, 2002; Rogerson, 2002b; Binns & Nel, 2003; Nel & Rogerson, 2005; Lourens, 2007; Rogerson, 2007; Viljoen & Struwig, 2010; Ntonzima & Binza, 2011; Nzama, 2010; Khuzwayo, 2012; Rogerson, 2013).

Policy, legislative and strategic frameworks on tourism governance in South Africa

Governance of tourism in South Africa is engrained in the prescripts of the Constitution (Act 108 of 1996) which provides guidance to different spheres of government. Chapter 3 of the Constitution constitutes South Africa as a unitary state consisting of national, provincial and local spheres of government (Khalo, 2013). With regard to jurisdiction, tourism is a concurrent competence of the national and provincial spheres of government, and local tourism is the competence of local government, (NDT, 2015). Part A of Schedule 4 of the Constitution lists tourism as a functional area of concurrent national and provincial legislative competence, and Part B bestows powers and functions of local tourism to local government. Other tourism enabling functions of local government include municipal airports, planning, health services, and public transport. In this regard “municipalities must *inter alia* provide democratic and accountable government for local communities, promote social and economic development; and undertake developmentally-oriented planning”, Van Wyk (2011). This warrants a coordinated approach to the governance of tourism amongst the spheres of government. At a policy level, “one of the critical success factors listed in the White Paper on the Development and Promotion of Tourism in South Africa is the requirement for appropriate institutional structures”, (Van Wyk, 2011, p.51). The latter entails collaboration amongst different spheres of government and stakeholders to harmonise tourism policy, planning, marketing and development in South Africa. At a legislative level, the preamble of the current Tourism Act (Act No.3 of 2014) alludes that this legislation was enacted since there is need of governance and coordination of tourism; tourism in South Africa has grown considerably since the country’s first democratic elections; and since there is inadequate, uncoordinated, inconsistent and fragmented tourism planning and information provision is the most pervasive challenge facing the development and growth of tourism in the Republic; and since transformation is vital to ensure the sustainable growth and development of the tourism sector’ and since these challenges are best addressed through a concerted effort by all spheres of government and the private sector to work together to create an environment that is conducive to sustainable growth, development and transformation of tourism (RSA, 2014). One of the objects of the Act is to enhance cooperation and coordination between all spheres of government developing and managing tourism. In putting a legal framework of enhancing governance and coordination of tourism in South Africa, Section (4) (i) of the Act provides that the Minister must by Notice in the Gazette and after following the consultation process, adopt a National Tourism Sector Strategy to promote the objects of the Act. The governance requirements of the Act are spelt out in Section 4 (2) where it is stipulated that the national tourism sector strategy must at least make provision for strategies, objectives, indicators, targets, plans, guidelines, procedures and institutional arrangements and intergovernmental coordination with provincial and local spheres of government relating to the promotion, development and transformation of tourism.

Properly conceptualised institutional arrangements are crucial for the success of the destination. This is collaborated by the observation made by Geels (2004) in interpreting institutional arrangements as different (in)formal regimes and coalitions for collective action and inter-agent coordination, ranging from public-private cooperation and contracting schemes, organisational networking to policy arrangements.

The KwaZulu-Natal tourism governance model

The KwaZulu-Natal Tourism Governance Model is based on the White Paper on Development and Promotion of Tourism in South Africa (1996); and the White Paper on Development and Promotion of Tourism in KwaZulu-Natal (2008). The model is also a provincial adaptation of the tourism institutional arrangements espoused in the National Tourism Sector Strategy (2011); and the KwaZulu-Natal Tourism Masterplan (2014). These policy blueprints are not mutually exclusive as they propose institutional frameworks, roles and responsibilities of various public and private sector stakeholders at all spheres of government. The province of KwaZulu-Natal, including 10 district municipalities, 1 metropolitan city (eThekweni Metro), and 51 local municipalities were studied to understand the implementation of the KwaZulu-Natal Tourism Governance Model.

Types of governance and coordinating structures in KwaZulu-Natal

The tourism governance structures in KwaZulu-Natal have been developed for both the public and private sector. These structures are established at a provincial, metro, district, and local government levels. The leadership of these structures is provided by political leadership and captains of the industry. It was noted that there are academics, including professors, serving in the boards of provincial tourism institutions, such as the KwaZulu-Natal Tourism Authority and Ezemvelo KZN Wildlife, and none at local government level. It was also noted that a lot of research is conducted at a provincial level with limited inroads made at a local level. Figure 2: depicts the tourism governance model of KwaZulu-Natal with a myriad of tourism coordinating structures at all three spheres of government.

The provincial tourism committee (PTC)

The Purpose of the Provincial Tourism Committee (PTC) is to allow the Member of Executive Council (MEC) for Economic Development, Tourism and Environmental Affairs in the province, Districts Municipalities together with eThekweni Metro, and other stakeholders to deliberate on tourism related issues. The PTC focuses mainly on

tourism policy issues at a provincial level, and reflects on matters referred by committees at a lower level as processed and prioritised by the Provincial Tourism Forum. The PTC is duly constituted and fully functional with quarterly meetings convened by the MEC who is also its chairperson. The structure comprises the district mayors, and district municipality managers. In addition to district municipalities, the MEC has co-opted local municipalities of tourism strategic importance throughout the province and other agencies such as South African Local Government Association (SALGA) and South African Police Services (SAPS) to deal with pertinent tourism matters at a provincial level. The PTC is therefore a highly effective committee as it equips the provincial MEC with strategic and policy issues to prioritise at MinMec meetings chaired by the national Minister of Tourism. The structure has processed and adopted a number of tourism policies, including the White Paper on the Development and Promotion of Tourism in KwaZulu-Natal; the KwaZulu-Natal Tourism Masterplan; the KwaZulu-Natal Beach Tourism Policy; and KwaZulu-Natal Community Tourism Organisations Strategy. The PTC has also adopted a number of tourism interventions at a provincial level, including the nature and types of business and leisure events supported through the provincial cabinet and funded by the provincial Treasury. Various tourism training and capacity building programmes, such as Tourism Buddies, have also been implemented in various municipalities through the interventions of the PTC. This has ensured the geographical spread of tourism in the province, especially benefiting off the beaten track inland municipalities.

The provincial tourism forum (PTF)

The mandate of the Provincial Tourism Forum (PTF) includes advising and guiding municipalities in developing, marketing and promoting local tourism or sub destinations in their respective jurisdictions. Section 25 of the KwaZulu-Natal Tourism Act (Act No.2 of 2002) requires the KwaZulu-Natal Tourism Authority (KZNTA) to establish a forum with municipalities to facilitate co-operation between its' activities and municipalities, and the Provincial Tourism Forum (PTF) was established for that purpose. The PTF is constituted by the Chief Executive Officer of the KZNTA who also chairs the meetings, general managers from KZNTA, senior officials from the provincial Department of Economic Development, Tourism and Environmental Affairs, senior tourism officials from municipalities, chairpersons of Community Tourism Organisations (CTOs) from all eight destinations in the province, Chief Executive Officers of Development Agencies from district municipalities, and other agencies. There are concerns with poor attendance of meetings by stakeholders. Another weakness is that the agenda items of meetings are proposed by the KZNTA and the provincial department with limited contributions from municipalities. There is also poor coordination of marketing activities between KZNTA and municipalities. Nonetheless, the PTF is functional and fulfils its mandate and prioritises matters for consideration by the Provincial Tourism Committee.

District and local tourism forums (DTFs and LTFs)

The conduit for tourism matters is the Local Tourism Forums (LTFs) which deliberates on tourism matters at a local municipality level and refer for further processing to the District Tourism Forums (DTFs). The DTFs refer policy and strategy related matters to the PTF which then refer them to the PTC. These structures are composed of district and local municipality mayors respectively who also chair meetings, senior personnel responsible for tourism, chairpersons of CTOs, and other agencies. All nine district municipalities, including eThekweni Metro had established their district tourism forums. All the district tourism forums were functional. A challenge was observed with regard to LTFs wherein only twenty nine percent (29%) of local municipalities had established their forums. Forty percent (40%) of the formalised forums were functional and twenty percent (20%) were not functional. However, this depicts a distorted trend as municipalities implement varying models. For example, Ugu District Municipality uses a tourism entity named South Coast Tourism which doubles up as a CTO and LTF. Other two municipalities, ILembe District Municipality and UMkhanyakude District Municipality, use a Chamber of Commerce and Development Agency Approach respectively. There is therefore no uniform structure of tourism coordination at a local government level. The administrative and financial motives were cited as reasons for not establishing LTFs. At an administrative level, most staff members serving in the LTFs are also representatives in the Community Tourism Organisations (CTO). Local Municipalities therefore opt to forego the establishment of the LTFs in favour of the CTOs. With regard to financial affordability, some local municipalities have limited budget allocated to local tourism and optimise impact of their activities through the CTOs.

Community tourism organisations and community tourism association

The CTOs are autonomous organisations, established by the local municipality but owned and managed by the private sector. According to the KwaZulu-Natal Community Tourism Organisations Strategy, each municipality is expected to endorse one CTO that will represent the private sector interest in that municipality. All legally recognised CTOs must be registered with the provincial Community Tourism Association (CTA) which is operated by the private sector but funded by the province which also provides secretariat services. The province has a total of fifty one local municipalities including eThekweni Metro, which entails that there should be a reciprocal number of Community Tourism Organisations. However, Ugu District Municipality has one CTO for all its six local municipalities and eThekweni Metro has established nine CTOs within the Metro. There is therefore a potential of

fifty four (54) CTOs in KwaZulu-Natal. Of this potential number, only thirty nine CTOs are operational comprising seventy two percent (72%). Fifteen CTOs comprising twenty eight percent (28%) are non-functional.

Discussions and conclusions

The interaction with various tourism stakeholders in KwaZulu-Natal revealed that the province has a well-structured tourism coordination model with clear governance modalities at a provincial and local levels. These governance structures are highly credible as they are legislated and established in consultation with tourism stakeholders within the destination. It is noteworthy that the provincial department is taking a lead in ensuring effective tourism coordination. The various stakeholders in the province are contented with the nature and composition of these structures. However, some municipalities in the province did not strictly follow the model proposed by the province but tailored theirs according to local circumstances. The notable findings of the paper is that there is limited academic research on tourism governance, especially at local level. There is also limited participation of academics at local level compared to provincial level rendering local governance structures poor platforms for knowledge sharing. This necessitates a focussed research on tourism governance at local level, including implementation modalities. There is also a requirement for policy shift at a local level, and municipalities should honour their constitutional obligations and consider tourism as a funded constitutional mandate.

Despite the efforts of coordinating policy, strategy and operational matters in the province, municipalities still experience a number of challenges. The common challenges include 54.9 percent of municipalities with no budget allocated to tourism. The lack of funding is attributable to some municipalities considering tourism as an unfunded mandate leading to inadequate capacity to perform tourism functions. A total of 27.5 percent of municipalities do not have dedicated tourism personnel. Some municipalities do not have tourism strategies and tourism by-laws. There is poor planning at a local level with 11.8 percent of municipalities having no tourism strategy, 13.7 percent currently reviewing their tourism strategies, and 15.7 percent indicating that their strategies are outdated and not aligned with the National Tourism Sector Strategy. The major concern is that 15.7 percent of municipalities indicated that there was a lack of tourism understating by senior officials and councillors. This is seen a root cause for all other challenges aforementioned.

The recommendation by National Department of Tourism for all provinces to adopt the KwaZulu-Natal Tourism Coordination Model is therefore justified and commendable. This paper however concludes that it is premature to recommend provincial institutional arrangements to be implemented countrywide without a full appreciation of implementation modalities with inherent challenges. On one hand, the lessons from the KZN model include that tourism coordination improves if there is political will at both provincial and local level with the participation of private sector being central to streaming activities. On the other hand, the shortcomings of the KZN model is the many structures at a local level rendering implementation cumbersome. These structures could be consolidated to optimise personnel participation and ensure financial viability. The model could however be replicated to other provinces if adopted and adapted to local circumstances. The implications for the KwaZulu-Natal provincial government is that, in cases where tourism coordinating structures are not established, there should be a proactive approach to engage relevant authorities to establish such structures. The implication for the country is to explore the implementation of the institutional arrangements promulgated in the National Tourism Sector Strategy to coordinate tourism at a local level. For the provinces considering the KwaZulu-Natal model, it should be acknowledged that this model is not perfect and uniformly implemented in the province and may have varied iterations throughout the country.

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THE UNEVEN GEOGRAPHY OF SOUTH AFRICA'S ADVENTURE TOURISM SECTOR

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Abstract: Whilst many sub-sectors of the South African adventure tourism sector have been operating for decades, the body of academic scholarship on adventure tourism in South Africa is still in the emerging phase. Consequently, the body of knowledge is limited, as this study will reveal. What is more, it may be that in some instances idiocentric interests drive what has been studied instead of a systematic investigation to understand the sector as a whole. Thus, this study sought to first deepen the understanding of the sector by identifying the thematic interests of those scholars who have undertaken adventure tourism research. In particular, the stark failure of the literature to explore the sector as a spatial manifestation is revealed. This is unsurprisingly expected, as the international literature is also remarkably silent on the geographical nature of the adventure tourism industry. The study then moves to provide a geographical overview of the role booking agents play in the adventure tourism industry, as well as exploring the sector geographically in terms of specialised or generalist type adventure operators. Lastly, some recommendations for future academic studies of the adventure tourism industry as a whole is made.

Introduction

Tourism has been designated by the South African Government as a catalyst for economic growth, and so it has attracted considerable attention from scholars and government alike (Cornelissen, 2005; Rogerson & Visser, 2011, Visser, 2016). Indeed the South African tourism sector has grown by 32% between 2009 and 2013, as its 2009 value was estimated at R210 billion (with direct impact rated at 3.2% of GDP or R45.7 billion p.a.) and by 2013 this had increased to R103.6 billion or 2.9% of GDP (SA Yearbook 2009/10; Stats SA, 2015). Rogerson (2011) argues however, that much of this would have been generated by niche or special interest tourism. Thus, if South Africa is to continue to foster economic growth through tourism, then specific niche tourist markets will have to drive new tourism growth (Rogerson & Visser, 2004). One such market segment or niche area is adventure tourism, which is a relatively new sector of the tourism industry with considerable potential for growth (Rogerson, 2007a; Swart, 2010; Rogerson & Visser, 2011). This is in part because South Africa's physical features lend themselves to adventure tourism due to the abundance of exotic, outdoor, physically beautiful locations. Data concerning the value of this sector seems to bear this out with the 'sports and recreational services' category [category number 96590.1 – risk sport and adventure] which incorporates adventure tourism recording a sum of R3.021 billion spent by domestic tourists and R5.592 billion spent by international tourists (or 6.5% of total tourist spend) for 2012 (McKay, 2016). This study will unfold as follows. Firstly a definition of adventure tourism is provided. Secondly the South African literature is laid out and categorised into emerging themes. Thirdly, the findings of an analysis of a national adventure tourism dataset with respect to booking agents, generalists and specialist operators are presented. Lastly some conclusions and recommendations are made.

What is adventure tourism?

Although what constitutes adventure tourism is highly contested, most scholars agree that risk is at the heart of the industry (Buckley, 2000, 2005, 2006; Swarbrooke, Beard, Leckie & Pomfret, 2003; Kane & Zink, 2004; Stanbury, Pryer & Roberts, 2005; Fletcher, 2010). Cloke and Perkins (1998:185,189) place adventure tourism in the category of niche, green or alternative tourism, where tourists actively seek out "participatory experiences" that involve "doing active and physically challenging things in the outdoors". In terms of a definition, it can be said that adventure tourism is the sale of a guided adventurous trip or activity where there is some risk, uncertainty and challenge involved. Clients are actively and physically involved and most people experience strong emotions, such as fear and excitement, whilst participating. The industry is also commonly divided up into three main categories: hard, soft and nature-based adventure with varying degrees of physical activity and risk, as well as being dependent upon whether or not the participant interacts with a wild animal (Buckley, 2010).

The academic exploration of the South African adventure tourism sector

Using broad strokes the key themes that emerge from an analysis of the academic work that has been undertaken on adventure tourism in South Africa is now presented. One the most important observations of the South African adventure tourism literature is that most of the scholarly work represents isolated studies focusing on small sub-sectors of the adventure tourism sector. Studies that fall into this category would include trekking/hiking (Hill, Nel, & Trotter, 2006; Linde & Grab, 2008; Geldenhuys, van der Merwe & Saayman, 2016); shark fishing (Dicken, Smale & Booth, 2006); the Berg River canoe marathon (Tseane, 2006) and tiger shark diving (Dicken & Hosking, 2009; Du Preez, Dicken & Hosking, 2012).

A second important observation is that only a few represent (in totality) an overview of a particular sub-sector. This includes studies on surfing, backpacking, the sardine run, SCUBA, bungee jumping and white water rafting. Thus, there are significant gaps in the body of knowledge on the adventure tourism sector as a whole. Some of the earliest work undertaken in South Africa on adventure tourism is that of surfing by Thompson (2001, 2008, 2011a, 2011b, 2015, 2016); Preston-Whyte (2002) and Ntloko (2006). The exploration of adventure tourism from the perspective of hospitality and the tourist accommodation sector have been undertaken by scholars such as Visser & Barker (2004); Visser (2004a, 2005); Rogerson (2007b) and Sixaba (2013) who have all explored backpacking. The sardine run has also been investigated by a number of authors (see Manana, 2009; Dicken, 2010; Hutchings et al 2010; Myeza, Mason & Peddemors, 2010) to the extent that Van Der Lingen, Coetzee & Hutchings (2010) were able to produce an overarching overview synthesising the work of these scholars. SCUBA dive tourism has attracted a number of scholars too (see Schleyer & Tomalin, 2000; Walters & Samways, 2001; Sjursather, 2006; Mograbi & Rogerson, 2007; Seymour, 2013; Lucrezi, Saayman & van der Merwe, 2013a, 2013b; Dicken, 2014; Geldenhuys, van der Merwe & Slabbert, 2014). The bungee jumping industry has been subject to some investigation (see McKay 2013; McKay 2014a; McKay 2014b), as has the white water rafting industry (see Greffrath & Roux, 2011; 2012; McKay 2013; 2014c; 2015).

A third observation is that few of the studies are rooted in the adventure tourism literature. In this regard, the cross over or intersection between adventure tourism, adventure recreation, sports tourism and ecotourism is evident. For example the bodies of work on surfing focus on surfing as a community, the surfing culture and surfing history, and so take the form of studies on adventure sport or adventure recreation rather than on what would be typically considered adventure tourism. Although international perceptions of backpacking are that it is as a type of adventure tourism (see Cave & Ryan, 2005), the South African literature has explored backpacking as an mainly as an accommodation type with additional work on who the typical backpacker is, the relationship between backpacking and public transport, as well as the geography of the backpacking economy. As for surfing and backpacking, the lens of the adventure tourism literature has not been used to interrogate the sardine run, rather the issue has been viewed from a local economic perspective (Manana, 2009; Dicken, 2010; Myeza et al 2010) or from a zoological/marine science perspective (Hutchings et al 2010). In this regard the work on SCUBA, bungee jumping and white water rafting are substantially different as much has been argued from an adventure tourism literature base, such as who is the participant (SCUBA diver, white water rafter), what their motivations are, the size of their economic impact and/or managing environmental impacts or resource use conflicts.

Fourthly is the emergence of a body of knowledge undertaking a more regional examination of the sector, but this is still characterised by a narrow geographical scope, usually confined at best to one province. At a regional level, much of the work has taken the form of student dissertations, such as that of Lightbody's (1994) study on how to promote active tourism in the southern coastal regions of the Cape; Chili's (1999) regional study adventure tourism in the Valley of a Thousand Hills; Govindasamy's (2012) regional study of adventure tourism in KwaZulu-Natal and Chigamba, Rungani & Mudenda (2014) of how to foster entrepreneurial skills in adventure tourism businesses in the Eastern Cape. Fitting into a regional approach is also that of Bosch (2015) which explored the types of adventure tourism demands of visitors to South African National Parks and Tshipala (2013) who draw up a list of indicators for sustainable adventure tourism destinations. Another regional level study is that of Swart (2010) which and looked at the challenges facing the adventure tourism industry in the Western Cape.

Fifthly is the more recent emergence of exploring particular themes such as motivations and human-environmental impacts. All, however, are limited in geographical scope. Within this body of work is that of Saayman, Slabbert & Van der Merwe (2009) and van der Merwe, Slabbert & Saayman (2011) both of which explore the motivations behind the purchase of a trip to specific coastal destinations such as Jeffery's Bay and other small coastal towns. It also includes the studies by Lötter, Geldenhuys, & Potgieter (2014), on the motivations and profile of adventure tourists in Greater Pretoria and the work of Giddy (2014) and Giddy & Webb (2016) who explored what motivates people to undertake an adventure activity in the Tsitsikamma area. Taking a more economic lens are the works of Oberholzer, Saayman, Saayman & Slabbert (2010) on the economic impacts of tourism to the Tsitsikamma Marine Park; Tshipala & Coetzee (2012) on an adventure tourism development framework for Thathevondo and Tshipala, Coetzee & Potgieter (2014) on the role of stakeholders in adopting sustainable tourism indicators in Waterval Boven. The exploration of adventure in Tsitsikamma has been continued by Giddy (2016) with an examination of how local operators manage their environmental impacts and raise environmental awareness with their clients. Terblanche's (2012) study on the motivations driving adventure tourism trip purchases in Magoebaskloof is similarly small in scale. In terms of student work, the Nthuli (1999) study of crime and tourism in St Lucia; the Reynish-Esterhuysen (2008) study on the adventure tourism potential of Muizenberg; the Tshipala (2010) on developing a strategy for the development of an adventure tourism industry in Thathevondo also represent a thematic approach but highly localized in geographical nature.

In terms of broader national studies the work of Aucamp (2006) and Rogerson (2007a) stand out in stark contrast to the fragmented and highly localised studies detailed above. However, while the Aucamp's (2006) study was national in geographical scope, it was severely limited in terms of being a very small non-representative sample (of 25) operators, skewed towards those operating in the Western Cape and KwaZulu-Natal and offering horse riding and hiking activities. The main findings were that South African Tourism has limited awareness and knowledge of the adventure tourism industry and links to the private sector adventure tourism operators are weak. The work of Rogerson (2007a) is broad in geographical scope, but limited in depth.

It represents an important study however, especially as it presents a profile and experiences of the operators. It found that the adventure tourism market was dominated by KwaZulu-Natal and the Western Cape. In this regard, the work of McKay (2016) contributes to the understanding of the national spatial distribution of adventure tourism in South Africa as it is the first of its kind to have a truly national geographical reach. That study found that the adventure tourism industry is geographically highly polarised. The Western Cape is by far the most important province in terms of adventure, followed by KwaZulu-Natal and then, surprisingly, Gauteng. Density and distribution of operators was linked to both population size and disposable incomes and to some extent the legacy of apartheid tourism planning. The study also suggests that the positive relationship between race and ability of a province to support adventure tourism operators is an indication that pre-1994 racialized consumption patterns still prevail in the adventure tourism sector. There was also a positive relationship between the size of the adventure tourism industry and the number of National Parks, Marine Protected Area (MPA) or World Heritage Site (WHS) on a provincial basis. Coastal provinces are also far more able to support the sector than inland provinces (with the exception of Gauteng). This indicates that the natural resource base of the country is an important asset to the adventure tourism industry. Building on what is already known about the adventure tourism industry is the analysis which follows, which explores the sector in terms of its ability to support 'middle men' or booking agents and the extent to which the adventure tourism industry is specialised. This is done using a dataset of adventure tourism operators collected by the author.

The role of booking agents in the South African adventure tourism industry

This study now analyses the nature of the adventure tourism offerings by determining the role of booking agents in the adventure tourism sector. Booking agents are operators who do not directly provide the adventure tourism activity that they sell to clients. Booking offices or agents are usually a visitor centre of some type or a local tourist information office. The value that booking agents offer is the social interaction with clients, whereby they can personally recommend activities or operators, giving tourists a type of 'word of mouth' experience or 'personal touch'. They may be viewed as valuable by the tourist in that they can share their knowledge with the potential adventure tourist and or help a tourist who either cannot or will not spend time looking for operators, either physically or on the internet (Lubbe, Endres & Ferreira, 2006). It may be that tourists feel they can trust a booking agent more than they can trust an impersonal website (Bogdanovych, Berger, Simoff & Sierra, 2006). For the direct operator, the value of entering into a relationship with a booking agent would be to have the booking agent do marketing on their behalf and sell the product to the tourist. It may be that for a small operator, the cost of doing this in-house is higher and the reach of the booking agent greater. It also may be necessary if the operator is far from source markets. Normally the cost of the booking agent is hidden in that the direct price and the booking agent price will have to be the same, with reconciliation between the direct supplier and booking agent taking place only once the tour is booked and paid for. This means the client is often unaware of how much of their trip cost was shared with the booking agent.

For their services, booking agents are usually paid a commission of between 10 and 20 percent. For example, a tour costing R180 would be sold for R200. In this instance the tourist is paying the commission. Alternatively, the sale price to the customer is R180 and then the direct operator pays the commission from the R180 to the booking agent. As the booking agent is a cost of sales for the adventure tour operator, they must add value by increasing the number of sales the direct operator makes. However, in an environment where the direct operator has to compete on price, it is possible that increased volumes may not, in the long run compensate for the commission that is required to drive the sales in the first place. Furthermore, customers who shop around can potentially circumvent the booking agents which could have negative financial consequences for the booking agents (Carey, Kang & Zea, 2012). This is especially true if direct operators are able to make effective use of websites to make sales.

Table 1: Direct operators versus booking offices (2011-2012)

Province	Number of booking offices	Percentage of total operators
Western Cape	19	7.4
KZN	15	7.7
Gauteng	10	6.7
Eastern Cape	6	9.1
North West	4	10.3
Limpopo	2	10.5
Mpumalanga	2	4.2
Free State	2	6.1
Northern Cape	1	5

Source: author

In terms of the South African adventure tourism industry, only a small percentage of operators (7.4%) were booking offices (see Table 1), that is 61 in total or 6.8 per province. This could be an indication of how the World Wide Web has reduced the need for such services (Lubbe, 2000, 2005). Potential clients can now simply look up ‘things to do’ in any particular locality, using a search engine such as Google and find information and contact details either directly from online information/advertising sources [such as www.sa-venues.com; www.tripadvisor.co.za; www.getaway.co.za; www.travelstart.co.za; www.timeout.com and www.lonelyplanet.com] or from the adventure tourism operator’s own website or even Facebook. What is more, almost all cities, towns and regions in South Africa have their own local website which will direct tourists to tourist activities/sites and ‘things to do’ in the area. Many also have their own (or several) tourist information centres that tourists can approach for information or book tours, accommodation or transport. Consequently if these booking agents are to survive they will have to focus on offering a personalised service that people perceive to be of high enough quality that warrants a professional fee (Viljoen & Roberts-Lombard, 2016).

Overall the Western Cape, followed by Kwa-Zulu Natal had the most number of booking agents. As both these provinces have a large adventure tourism sector, it may be that the larger the industry and the more complex it is, the more booking agents it can support. However, in terms of percentage, the North West and Limpopo, both of which have a rather underdeveloped adventure tourism industry have the most relative to the size of the industry in those provinces (McKay, 2016). While this may seem somewhat of an anomaly it may be that the same booking agent is also supporting other non-adventure activities such as accommodation providers, and thus, are only marginally supported by the adventure tourism industry in these two provinces.

Types of operators: Specialist operators versus generalists

A specialised operator focuses on offering only one type of adventure activity compared to a generalist who has a suite of activities on offer.

Table 2: Single activity operators versus multiple activity operators

Province	Single activity operators	Multiple activity operators
Western Cape	59	41
KZN	59	41
Gauteng	74	26
Eastern Cape	55	45
North West	64	36
Limpopo	59	41
Mpumalanga	58	42
Free State	42	58
Northern Cape	60	40
Average	59	41

Source: author note: Data presented as percentages

Across the country 59% of operators only offer one type of adventure activity (see Table 2). Thus, the industry is highly specialised, perhaps an indication of the kinds of skills, knowledge and capital investment required to get such a business up and running. Of all the provinces, Gauteng is home to the most number of specialised operators (74%), perhaps an indicator of how the strength of the Gauteng market. The Free State is the province with the most number of multiple offerings by one operator. That is, operators in the Free State are either able to or need to manage the risk of doing business in that province by offering multiple adventurous activities.

It is posited here that offering multiple adventure activities could be ascribed to a number (of not necessarily interlinked) reasons. Firstly it could be a way for an adventure operator to diversify risk. For example, should there be poor sales in one area, having multiple activities could mitigate for the loss of income. Secondly, it could be a way of expanding the business and build the brand, especially in terms of product bundling. That is, one activity becomes the main income earner, but other smaller activities become secondary income streams, enabling the operator to get multiple sales from the same customer base and promote repeat sales. Thirdly, it may be that not all the members of the group want to participate in what they perceive to be a high risk activity, but still want to participate in some way. In cases like this, some group members can purchase the more ‘adventurous trip’ while others of the group purchase less adventurous or less risky or less physical trips. This is increased market segmentation helps to increase profitability. In addition it can help to reduce seasonality.

Diversification does not come without cost however. For some adventure tourism operators the need to remain specialised in order to manage risk and be able to retain profits to reinvest in the business is essential. For example, water based activities require a great deal of capital (boats, engines) which an operator may not have if they are using profits to expand their product line or market additional activities. There is also the chance of a loss of focus, which could endanger the clients in a high risk adventure activity. Specialisation has a number of advantages: Firstly the operator is able to focus on offering the best possible product, paying attention to detail. As such, this operator can then change more because the service is more professional and tailored. Secondly it could enable the operator to create a specialised niche for them within the sub-sector, reducing the possibility of direct or price competition. Thirdly it can help an operator run a cost efficient organisation, increasing profits by managing costs down.

Recommendations

In terms of opening up our understanding of the South African adventure tourism sector it is clear that scholarly studies need to be undertaken in a more systematic manner. This will entail a move away from highly localised, small scale studies with small sample sizes. Instead more in-depth, longer term explorations of hitherto neglected sub-sectors of the adventure tourist economy such as quad biking (All-Terrain Vehicle) and hot air ballooning, to mention but two of multiple neglected sectors, are required. In addition, studies should be more regional in scope, such as at the level of province and national. In that respect it is notable that the adventure tourism sector of some provinces has been almost entirely neglected, Gauteng being a case in point. In order to tease out the overlaps between adventure tourism, adventure recreation, sports tourism and ecotourism, it is necessary to also ensure that the sector is explored through the lens of the international adventure tourism literature. In particular, the vast majority of South African studies to date do not address the interface between risk and safety/fun and danger that lies at the heart of adventure tourism. Adventure tourist motivations perhaps represent one of the most popular themes in the South African literature, and although further studies may still be necessary, it should not be at the cost of continued neglect of important issues such as: The perspectives and views of the operators (including the nature of entrepreneurship within the sector); the views, experiences and nature of work as an adventure guide or employee in the sector; the legal framework that governs the sector (governance – policies and laws that support the industry such as protection of resources, rule of law, safety rules and regulations, as well as medical insurance); the challenges (nationwide) that the sector faces; environmental impacts; the role of social media and urban adventure. Furthermore the relationship between adventure tourism and accommodation resources (especially backpackers; camping and caravan parks) deserves attention. In addition, factors essential for adventure tourism such as: (1) medical services (paramedics, compression chambers, sea rescue services, hospitals, clinics and medical professionals) and (2) the image, brand and marketing of South Africa, the various provinces or regions or urban areas as ‘adventure centres’ or a places of adventure also warrant exploration.

Conclusion

In terms of the findings presented here, it is clear that at a national level, the bulk of adventure tourism suppliers are direct operators and a substantial number of them are specialised in that they only provide one type of adventure activity. In this regard, buyers of an adventure tourism product can generally expect the operator who sells them the activity to provide it to them and have a significant amount of capital, time and energy invested in providing a highly specialised product. This study also set out to review the nature of the South African body of work on the adventure tourism sector, and, in particular to tease out common themes that emerge from it. Importantly, it found that there is still much academic work to be done in terms of collecting empirical data and analysis thereof due to the proliferation of highly localised, idiocentric and often once off studies that have been undertaken. Importantly, the adventure tourism sector still needs much scholarly attention, especially in terms of the geography thereof, but also to unpack sub-sectors and aspects (such as the guides and legal framework) that have hitherto been neglected.

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THE INFLUENCE OF WEATHER ON SOUTH AFRICAN TOURISM EXPERIENCES: AMERICAN PERSPECTIVES

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Abstract: Climate has been repeatedly shown to influence tourist perceptions of a destination, consumer behaviour, and their overall satisfaction. However, day-to-day weather has a greater impact on the experiences of tourists during their travels. South Africa, marketed for its favourable climate and dependent on outdoor tourism activities, provides an interesting case in which to investigate some of these concepts. Using data obtained from questionnaires administered to Americans who have visited South Africa in last 10 years, this paper demonstrates that climate is not an important motivation for visiting South Africa. The results also show that isolated negative experiences with weather do not impact overall perceptions of the climate of the region during their holiday. However, weather did appear to impact the ability of a significant number of respondents to participate in specific activities. Therefore, the significance of weather in the motivations, perceptions, and satisfaction of international tourists to South Africa needs to be considered, due to the threat that this will likely pose to tourism in the country under climate change projections for the next half century. Considerable future research is needed on the interplay between weather, climate and tourism in South Africa in order to accurately assess the current and potential future impacts of changing weather conditions on the tourism industry.

Introduction

It has been widely acknowledged that climate has a significant impact on the tourism sector (Martín, 2005; Matzarakis, 2006; Smith, 1993). Climate can influence the competitive identity of a given destination, and seasonal weather patterns are critical determinants for a variety of tourism experiences (Day, Chin, Sydnor, and Cherkauer, 2013). Furthermore, negative experiences with weather have the potential to impact on the ability to take part in an activity, and the overall satisfaction of a tourist's participation in specific activities, influencing the satisfaction of the trip or destination as a whole (Becken and Wilson, 2013). The dependence of the tourism industry on favourable weather and climate, therefore, warrants an improved understanding of current and potential future impacts of increases in extreme weather patterns and impending climate change on tourism.

The context of South Africa is of particular relevance, due to the dependence on outdoor and nature-based tourism (Giddy and Webb, 2016; Hoogendoorn and Fitchett, 2016). The most common sites visited by international tourists in South Africa and the most popular activities are largely weather dependent. Research has shown that visit to national parks, the top tourism attraction in South Africa, is in jeopardy under a range of climate change scenarios (Preston-Whyte and Watson, 2005), and particularly sensitive to the impacts of droughts and floods (Fitchett, Hoogendoorn and Swemmer, 2016). Beaches are under threat of both sea level rise and changes in thermal comfort levels (Fitchett, Hoogendoorn and Grant, 2016), and many adventure based tourism offerings take place outdoors and require calm weather conditions (Giddy and Webb, 2016). The perspectives of American tourists to South Africa are significant as they are the third largest incoming international tourism market, and have a proportionately high high expenditure on international tourism (Statistics South Africa, 2016). In addition, American tourists are particularly driven towards outdoor and activity-based tourism. The purpose of this paper, therefore, is to examine the relative significance of weather and climate on American tourists' motivations to visit South Africa and the impact of weather on their experiences and overall perceptions of the destination.

Weather, climate and tourism in South Africa

Tourism is currently one of the most significant contributors to the South African gross domestic product (GDP), and one of the few economic sectors that have seen significant growth in recent years (Statistics South Africa, 2016). Tourism also has potential to contribute to South Africa in the form of pro-poor initiatives, environmental conservation efforts and local economic development. It is, therefore, important to understand the various challenges and potential threats to the tourism industry. Weather and climate are both particularly significant in discussions of South African tourism. South African tourism is particularly susceptible to the impact of changing climatic patterns due to its dependence on outdoor tourism and its relatively low adaptive capacity (Hoogendoorn and Fitchett, 2016). However, little research has specifically assessed the impact of weather or climate on the motivations and experiences of international tourists in South Africa. Some previous research has touched upon the importance of climate indicating, that it is a factor in drawing visitors to South Africa (Kim, Crompton, and Botha, 2000; Saayman and Saayman, 2008). In addition, some research has focused on the potential impact of future climate change on the tourism industry (Fitchett, Grant, and Hoogendoorn, 2016; Koch, Vogel, and Patel, 2007; Steyn, 2012; Steyn and

Spencer, 2012). These studies have demonstrated that tourism stakeholders understand the potential threats of future climate change, but are not currently taking adaptive measure to minimise its impact (Hoogendoorn, Grant, and Fitchett, 2016).

The impact of climate on tourism includes potential tourists' perceptions of a destination, motivations to seek out specific tourism experiences, while weather influences the ability of tourists to participate in certain activities, tourist satisfaction with a tourism experience or destination, and in turn these factors affect the overall success of tourism operations (Becken, 2010; Becken and Wilson, 2013; Hübner and Gössling, 2012; Smith, 1993). The climate of a destination, and perceptions of favourable weather, often influence destination image. Destinations dependent on beach tourism, adventure activities, or extended nature experiences are more likely to succeed if tourists perceive the destination as having a favourable climate. However, research has also shown that perceptions of weather and climate can also influence potential tourists' perceptions of destinations that do not rely on outdoor activities (Day *et al.*, 2013). Furthermore, negative experiences with weather are likely to not only impact overall satisfaction with a destination (Becken and Wilson, 2013), but have also been shown to resonate with tourists and impact their likelihood of returning to the destination in the future. This can become problematic as travel experiences are now frequently shared through social media, and travel websites, which could, in turn influence future potential visitors (Jeuring and Peters, 2013).

Poor weather conditions can prevent tourists from partaking of activities which necessitate favourable weather conditions, including clear skies, low wind speeds and thermal comfort. However, weather also has the potential to indirectly impact tourism experiences. For example, increasing temperatures might not prevent tourists from taking part in all items on their itinerary, but lead to heat exhaustion during long days (Becken, 2010). In addition, a single flooding event might not directly affect the experiences of visitors who avoided the flood, but the damage to infrastructure might have long-term effects on the industry, preventing access to attractions and reducing the number of beds available at accommodation establishments within the region affected (Fitchett, Hoogendoorn, and Swemmer, 2016).

Due to the impact of weather on tourist perceptions and satisfaction, there is concern within the tourism industry regarding the potential impact of climate change. Mean increases in temperature caused by climate change result most notably in a greater probability of warmer weather on a given day, and overall warmer conditions in a location than were previously experienced (Easterling *et al.*, 2000). This, in the long run, is likely to compromise outdoor tourist attractions as the thermal comfort threshold will ultimately be exceeded. Climate change projections indicate changes in precipitation amount, frequency and distribution. These projections are thus highly location specific, but both increases and decreases in temperature have the capacity to detriment outdoor activities. Moreover, these changes in the precipitation regime in most cases are associated with an increased probability of extreme events, such as flooding and droughts (Easterling *et al.*, 2000). The effects of these events are more long lasting, often resulting in considerable infrastructural damage, particularly in countries with a low adaptive capacity (Fitchett, Hoogendoorn, *et al.*, 2016).

Research has shown that country of origin can influence tourists' perceptions of weather and climate (Scott and Lemieux, 2010). The American tourism market is the third largest incoming international tourism market in South Africa (Statistics South Africa, 2016). In addition, American tourists are unique due to their diversity and the fact that they are largely activity-driven (IPK International, 2014). South Africa is an ideal tourist destination for Americans due to the number and range of activities available throughout the country. As a long-haul tourism destination, Americans are important contributors to the South African tourism industry. Furthermore, Americans have the second highest expenditure, globally, on international tourism (The World Bank, 2016).

Methods

This study used a mixed-method approach to research. The primary data source was questionnaires, which included both fixed-response and open-ended questions. Fixed response questions were primarily nominal and ordinal. Several questions were also multiple response. The information elicited in the questionnaires included basic demographic information, the travel patterns and characteristics of respondents within South Africa, the significance of weather and climate in the travel decisions, their experiences with weather while in South Africa and the impact of weather on future travel to South Africa. Questionnaires were distributed, online, to Americans who had travelled to South Africa in the past ten years (2006-2016). The questionnaire was distributed to American visitors to South Africa known to the research, after which snowball sampling techniques were used by means of referrals.

A total of 57 complete and usable questionnaires were obtained. Data from the questionnaires were analysed in a number of ways. Basic counts were generated for quantitative data included in the questionnaire due to the fact that data were primarily nominal and ordinal. Open-ended questions were analysed using qualitative data analyses

techniques. Responses were analysed, themes extracted and information was categorised. Some of the information was then quantified based on categorisation. When applicable, specific quotations are included to demonstrate specific perceptions and experiences.

Results

The profile of respondents demonstrates that they are primarily young (38 of 57 were between the ages of 20 and 29), female (46, $n = 57$), well-educated (all held a tertiary degree, 29 with postgraduate qualifications) with a range of incomes. The majority were from the Northeast and Southern regions of the country. Most were leisure travellers (21), although a significant number were exchange students (16) and several were visiting friends and relatives (10). The majority of respondents have only visited South Africa once. The most common season for travel among this sample was during summer months (20, $n = 57$), though nearly as many respondents visited over multiple seasons (18), demonstrating that Americans tend to travel to South Africa for longer durations. Nearly all respondents travelled by car while in South Africa (55, $n = 57$). All participants engaged in multiple tourism activities. The most common activities were safari/game drives ($n = 34$), hiking ($n = 27$), visiting cultural/historical sites ($n = 27$), and wine tasting ($n = 25$). It is worth noting that three of the top four activities in which respondents participated are either directly or indirectly dependent on favourable weather. In addition, although cultural and historical sites are not ordinarily considered weather dependent, one of the most popular, Robben Island, can only be reached by boat and therefore trips are often cancelled due to poor weather conditions.

The importance of climate on the decision to visit South Africa and future potential travel to South Africa is shown in Figure 1. The vast majority of participants ($n = 43$) felt that climate was, at most, only moderately important in the decision to visit South Africa, while a significant number ($n = 26$) felt that it was of little importance or not at all important. Interestingly, respondents were more likely to find climate slightly more significant in future travel than it was in the original decision to visit the country.

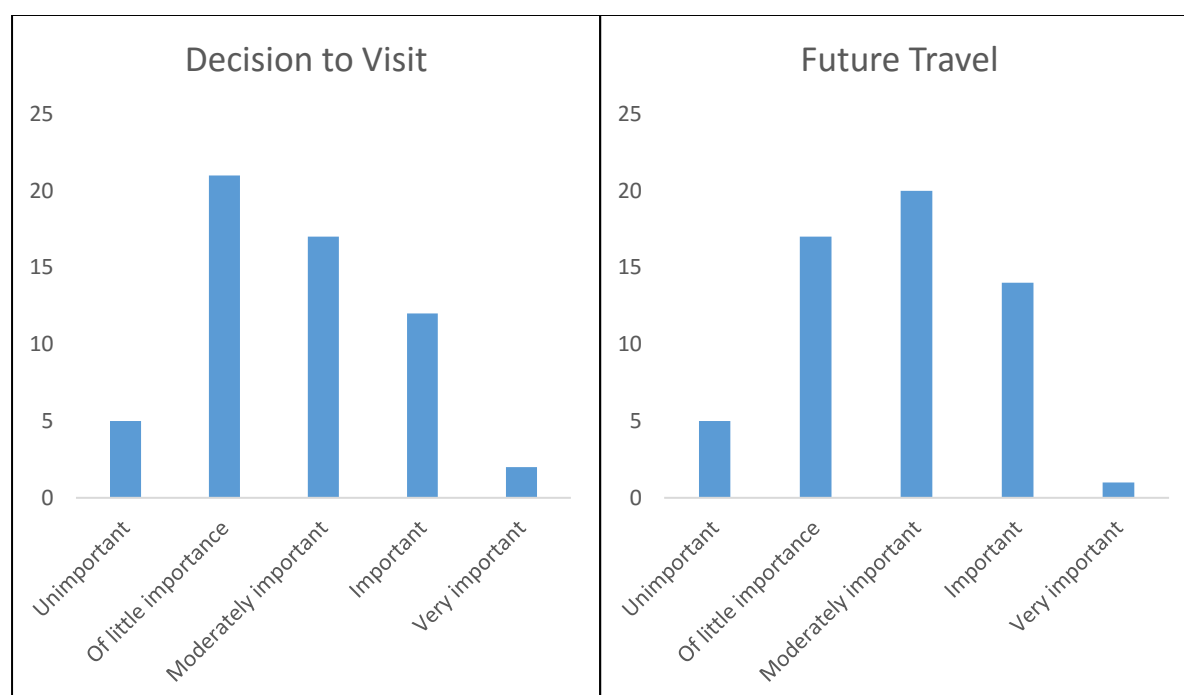


Figure 1: The importance of climate on travel to South Africa.

Of the 57 respondents, 40 indicated experiences with poor weather. The most common weather phenomena experienced were excessive wind (21, $n = 57$) and very hot temperatures (20, $n = 57$) (Giddy, Fitchett, and Hoogendoorn, 2016). The two most common weather phenomena experienced are unlikely to impede the ability to participate in activities, but they could arguably make participation unpleasant. Other noteworthy experiences with weather were constant rain, rough seas, very high humidity, and very cold temperatures (Giddy *et al.*, 2016). Many of these weather phenomena, by contrast, do have the potential to impact many of the activities in which respondents participated.

A number of respondents (21, $n = 57$) stated that the weather did prevent them from participating in specific activities. However, many respondents repeatedly stated their overall satisfaction with the weather, despite a few

negative experiences. One respondent mentioned experiences with excessive rain but indicated that it did not affect their trip or their overall satisfaction with the weather, specifically stating: *“We had terrible rain for a while but it didn't stop us from doing much. Mostly amazing weather.”* Furthermore, when asked if the weather impeded participation in planned activities, one respondent did not feel this impacted their trip at all, and might have even created opportunities for exploring other locations which were not on the original itinerary. *“...I wanted to swim with seals but the weather didn't cooperate, but we just chose another activity instead and it ended up being a blessing in disguise because I got to go to the Tsitsikamma.”*

These results are noteworthy, as they demonstrate that even in cases where bad weather was experienced and even impacted the ability to participate in activities, it did not affect their overall satisfaction with their experience nor impact their perceptions of South African weather and climate.

Another important aspect of the study was determining how weather might impact travel plans. Respondents largely indicated that they would not alter travel plans based on bad weather conditions. Of the 57 respondents, 25 stated that they would not change their plans and return to the U.S. due to poor weather conditions. Many stated that the time, effort, planning and primarily the cost taken to get to South Africa, means that it is not likely that visitors would cancel their trips completely. Of those who did say they would change their trips to return home, for 20 (n = 57) it would take at least a week of persistent bad weather. When considering changing plans within South Africa, most respondents stated that it would take at least four days of consistent poor weather conditions, however several (n = 11) stated they still would not change their plans because of weather.

Respondents were also asked to indicate changes in weather conditions or specific weather phenomena that would discourage and encourage future travel. The most common weather patterns that would discourage future travel were constant rain, flooding, tropical cyclones, and air pollution (Giddy *et al.*, 2016). Although there are some periods of constant rain in specific regions of the country during certain times of year, the other weather phenomena that respondents would find problematic are not common in most parts of South Africa. However, these results should be considered in future tourism planning, as they have all been cited as potential weather patterns under climate change projections (Hoogendoorn and Fitchett, 2016). When considering changes in weather patterns that would encourage future travel, most respondents stated they would not change anything, and were satisfied with the weather. Comments were made such as *“The weather was wonderful the whole time I was there, so I would hope for the same weather”* and *“No changes; I thought the weather was pleasant most of the time.”* Statements such as these demonstrate that overall, respondents had positive experiences with weather while visiting South Africa.

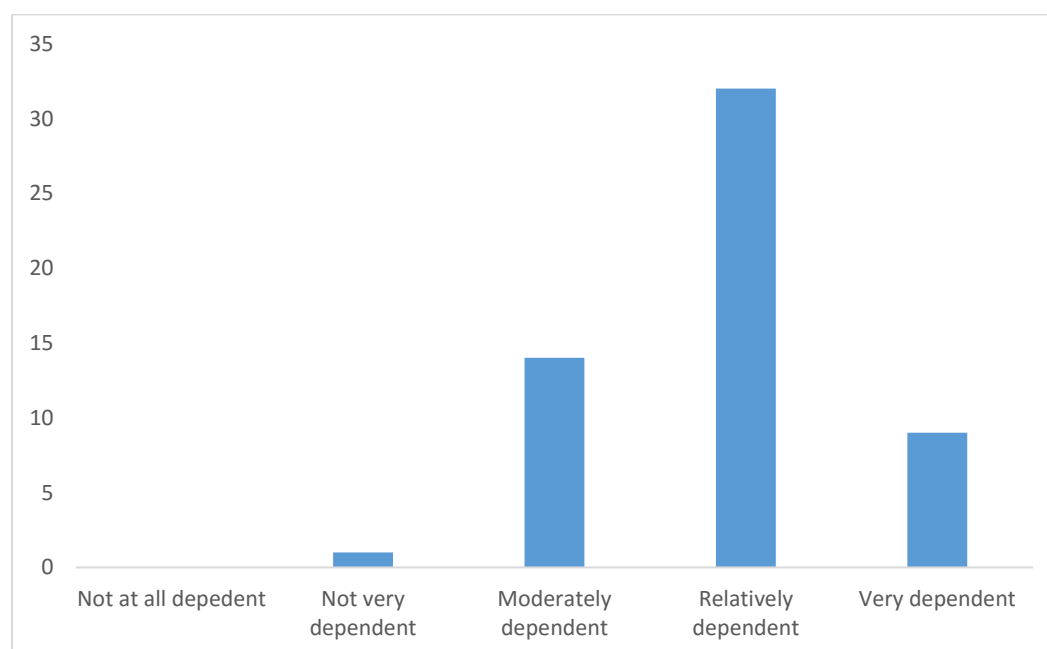


Figure 2: Tourist perceptions of the dependency of South African tourism on good climate.

However, Figure 2 demonstrates that respondents did feel that the South African tourism industry is at least relatively dependent on favourable weather conditions. The positive experiences noted here, are likely due to the fact that overall weather conditions were generally favourable. However, changes in weather patterns in the future could affect these experiences if there is an increase in poor weather conditions in the future.

Conclusions and implications

The results of this study provide valuable initial insight into the impact of both weather and climate on incoming international travel to South Africa. A great deal of research has demonstrated that weather can have both positive and negative effects on tourist perceptions of a destination and their overall satisfaction with a tourism experience (Becken, 2010). In the case of South Africa, some studies have implied that climate is an important factor in attracting incoming tourists (Saayman and Saayman, 2008). However, the results demonstrated here question the significance on the climate, itself, on drawing international tourists to South Africa. The climate of South Africa was not found to be an important motivation for visiting the country, nor is particularly important in the potential of these respondents to visit South Africa in the future. Furthermore, although a number of negative experiences with weather were noted by respondents, it did not appear to impact their overall satisfaction with the destination. This implies that a few instances of bad weather, even when they impacted the respondents travel itineraries, do not create an overall negative perception of weather and climate at the destination. In addition, likely due to the nature of South Africa as a long-haul destination, particularly for Americans, the probability of respondents shortening trips due to bad weather is unlikely. The fact that most travel by car, and there is considerable heterogeneity in the climate within South Africa, allows people to move relatively freely within South Africa and therefore alter plans within the country in response to changing weather patterns.

Although not a primary draw for visiting the country, respondents did acknowledge the dependence of the South African tourism industry on good weather conditions. In addition, weather did appear to impact the ability for a large number of respondents to participate in specific activities. This is cause for concern as the South African tourism industry is so heavily dependent on activity-based tourism, the majority of which takes place outdoors. Although it does not yet appear to be negatively impacting visitor experiences, future increases in extreme and unfavourable weather has the potential to negatively impact the tourism industry.

These results, however, should be seen as exploratory. They are based on a relatively small sample of a specific population. A great deal of additional research is needed regarding the impact of weather and climate on the South African tourism industry. A similar approach to research on additional populations would be particularly beneficial. In addition to other international populations, it would also be interesting to examine the perspectives of domestic South African tourists with regards to weather and travel within South Africa. Furthermore, due to the dependence of South African on outdoor activity-based tourism, another important research focus would be to examine industry perspectives on the impact of weather and climate.

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PEOPLE AND CLIMATE

UNDERSTANDING PASTORALISTS' KNOWLEDGE OF CLIMATE CHANGE AND VARIABILITY IN ARID NAMIBIA AND SOUTH AFRICA

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Abstract: Understanding indigenous knowledge that pastoralists possess regarding the environmental and climate change is very important for the agricultural sector in arid Namibia and Southern Africa. Thus, the integration of indigenous and scientific knowledge is important for better planning and decision-making among southern African pastoralists. This study explores the extent to which pastoralists in the arid Namibia know and use indigenous knowledge to cope and adapt to the changes in climate and environment. Qualitative approach using in-depth interviews, focus group discussions and seasonal calendars was employed to gain an in-depth understanding of farmers' knowledge of climate change and variability. Farmers have been applying their indigenous knowledge on the changing climate together with the scientific information that they receive from the Government line ministries and the media as early warning system. The indigenous indicators that they use for forecasting are mainly from information or knowledge that was passed down to them by their elders. In the last decade, pastoralist's knowledge and indicators that they use to predict seasonal forecasting are becoming unreliable. The diminishing usefulness of this traditional early warning system contributes to the vulnerability of pastoralists in arid Namibia.

Introduction

The IPCC fifth assessment report confirms that temperature increase and variations in rainfall are most likely and some changes have already been observed. Climate change has brought about new environmental conditions at a rate faster than what has been experienced before by humankind. This recent phenomenon has been well studied in arid southern Africa (Kruger & Shongwe, 2004; Engelbrecht, McGregor & Engelbrecht, 2009) but there is limited knowledge on how climate is being perceived at a local farmer level (Ziervogel, Bharwani & Downing, 2006). Furthermore, with climate models only being able to project change at larger spatial scales, it is important to know how climate change has been affecting pastoralists in drylands. This is because pastoralists are important producers of livestock products to the local and national markets both for subsistence and export and thus their concerns and challenges should be understood from their perspectives (Chanza & de Wit, 2016; Kempton, 1997;).

According to Enock (2013) and Orlove, Roncoli, Kabugo & Majugu (2010), the concept of indigenous knowledge had captured interest amongst researchers since the 1970s and had grown to studies that include agriculture, land degradation and vegetation change (Katjiua & Ward, 2007) and recently on climate change perceptions, adaptation strategies and vulnerability (Muller & Shackleton, 2014; Wiid & Ziervogel, 2012). Chanza & de Wit (2016) and Maware (2015) define indigenous knowledge as knowledge that is acquired locally through community observations and that is transferred orally within generations and inter-generationally. This has served as the basis for decision-making within both semi-arid and arid pastoral communities in Namibia and South Africa (Newsham & Thomas, 2011). The term indigenous knowledge is also sometimes used interchangeably with related terms such as local knowledge, traditional knowledge and indigenous technical knowledge among others.

The literature also indicates that there is a link between indigenous knowledge and perceptions of climate change (Kaundjua, Angula & Angombe, 2012; Wiid & Ziervogel, 2012). Wiid & Ziervogel (2012) noted that perceptions of climate change are strongly determined by public opinion and personal experience. Perceptions and indigenous knowledge based on observed changing climate as well as pastoralists' experiences are important for community-based adaptation planning and strategies that would reduce the risk of climate change impacts on farming. In this paper, indigenous knowledge refers to local pastoralist knowledge based on their perceptions of change in the environment and climate, their experiences of these changes and traditional methods that they apply to forecast weather and local climate.

The value of indigenous knowledge has been acknowledged by many authors (Kreike, 1995; Lendelvo, Angula & Mfuno, 2015; Mundy & Compton, 1991; Verlinden & Dayot, 2005) and these authors noted that the culture, natural resources management and sustainable agricultural practices at local level are embedded in the indigenous

knowledge systems. Indigenous knowledge has been used in the Sahel for soil conservation and management, in preserving bio-diversity and agroforestry (Nyong, et al., 2007). Nyong et al. (2007); Wiid & Ziervogel (2012) and Shackleton & Muller (2014) have noted that farmers from the Sahel, South African commercial farmers and Eastern Cape pastoralists have developed several coping and adaptation measures that have enabled them to reduce vulnerability to climate change and variability. In Uganda, indigenous knowledge and use of indicators as predictions about onset of rains had been particularly important for longer cycle crops such as maize and potatoes (Orlove et al., 2010). However, in the face of climate change, farmers in Uganda had lost faith in these traditional methods as the effectiveness and confidence in indicators to forecast climate has decreased over the years (Orlove et al., 2010).

Mandleni & Amin (2011) quantified climate change awareness responses among South African farmers. They found that awareness on climate change and perceptions of change are differentiated by gender, marital status, level of education and access to meteorology and climatic information. Other studies (Dressa, Hassan & Ringler, 2010) have found that male farmers are more aware and more responsive to adapting to climate change. This implies that pastoralism is a cultural phenomenon that is also under threat from climate change (Adger, Barnett, Brown, Marshall and O'Brien, 2013). Adger et al., (2013) argues that culture affects adaptive pathways and this helps to explain differences in responses across populations to the same environmental risk. Therefore, effectiveness of indigenous knowledge based on perceived changes is also affected by cultures either positively or negatively. This could act as barrier or enabler to climate change adaptation for pastoralists in arid environments of Namibia and South Africa.

The study conducted by Wiid & Ziervogel (2012) found that the changing rainfall season trend observed from climate records seems to be in agreement with farmers' perceptions of change. Muller & Shackleton (2014) found that perceptions of commercial farmers regarding slight increase in rainfall over the last two decades matched recorded rainfall data that showed significant increase since 1990. However, Wiid & Ziervogel (2012) further concluded that it is hard to pinpoint when farmers started to notice changes in temperature and rainfall. Nevertheless, there seem to be an agreement between scientific and farmers' dialogue. This implies that the perceptions of farmers although not highly scientifically accurate, they agree with overall trend in data records.

Furthermore, perceptions also offer further explanations in occurrences of extreme events and seasonality in local rainfall patterns, which may be hard to detect in recorded climate data.

Indigenous knowledge is also thought to be useful when it is complementing and integrated with scientific climate knowledge. The interest to integrate this knowledge emerged recently, where it is used to fill climate data gaps in Australia to provide a more comprehensive dataset which could be useful for decision-making (Green et al., 2010 cited in Leclerc, Mwongera, Camberlin & Boyard-Micheau, 2013).

Indigenous knowledge is thus useful in facilitating communication, dissemination and utilisation of climate change mitigation and adaptation options (Ajani et al., 2013). To broaden this argument, Wiid & Ziervogel (2012) established that experiences and accumulated knowledge of local climates shapes perceptions of risk and how risk is viewed. The experience and perception of risk ultimately guides how response measures are decided and designed. However, the authors further argue that relying only on indigenous knowledge only is not sufficient as it has been found in Risbey, Kandikar & Dowlatabadi (1999) that farmers who used seasonal climate forecasts as well generally experienced better yield than those who relied only on traditional and indigenous knowledge.

Farmer's understanding of climate change is important for them to have views on the matter and to reduce their vulnerability in terms of management decisions (Kempton, 1997). This paper assesses (1) farmer's understanding of climate change and variability and (2) understanding of the indicators pastoralists' use to monitor change in their rangeland.

Research methodology

This paper is based on two objectives from a larger study, "Assessing ecological knowledge and adaptations to climate and environmental change amongst rural communities along an aridity gradient from Namibia to South Africa". Livestock supports many people in the communal areas in the seven study sites where this study was conducted. The seven sites chosen for the study include two in South Africa and the other five in Namibia (Figure 1).

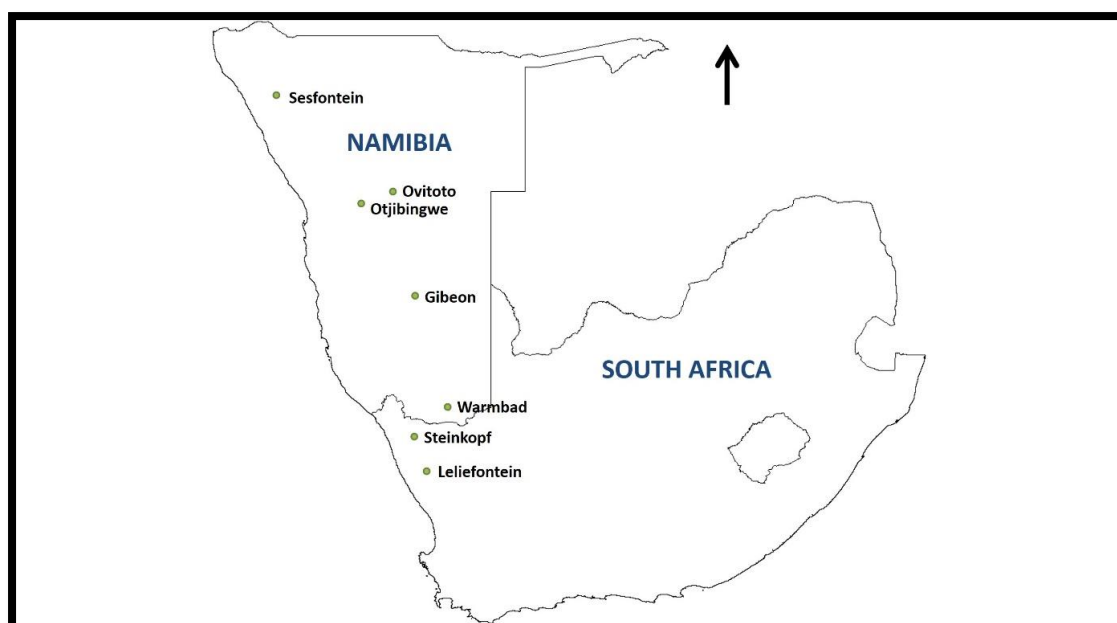


Figure 1: Location of the seven sites along a north-south gradient from Namibia to South Africa.

Arid Namibia is sparsely populated due to its harsh environmental conditions and is home to pastoralists that farm with small stock (sheep and goats) and, to some lesser extent cattle. Namaqualand is known for its extreme climatic conditions and home to the present-day descendants of the pre-colonial Nama-speaking Khoikhoi pastoralists, with small livestock farming being the main land use. In all the study sites livestock farming fulfils a multipurpose function ranging from economic functions (e.g. food supply or cash income) to social (e.g. status, power relationships, culture). The Namibian sites have different rainfall regions with the southern sites receiving a mixture of winter and summer rainfall and the central and north-western Namibia receiving almost exclusively, summer rainfall. In the Namaqualand sites there is predominantly winter rainfall but Steinkopf receives both summer and winter rainfall.

The study was conducted between March 2014 and March 2016 where each of the seven sites were investigated using a case study approach whereby qualitative methods were applied to assess in depth understanding of farmers' experiences and knowledge of environmental and climate change. Qualitative method triangulation is advocated as a strategy to achieve more comprehensive understandings of a phenomena. Thus in order to gain a comprehensive understanding of ecological knowledge and adaptations to climate and environmental change amongst the pastoralist a combination of focus group discussion and in-depth semi-structured interviews were undertaken. During the focus group discussions, a historic and seasonal calendar technique was applied to capture information from the past 30 years as well as current climatic conditions.

Focus group material is frequently limited to its very general information level and is used to support other types of analyses. Bloor et al. (2001) regard the material from focus groups as an auxiliary source of information to individual interviews. Although focus groups and individual interviews are independent data collection methods they are advantageous as it can also generate complementary views on a phenomenon. The decision to combine the methods were not only done because it was more practical or pragmatic for a study of this nature but also proved useful as it allowed individual interviewees (pastoralist) who were unable or unwilling to attend a focus group to choose the method that is most convenient for them. This also lead to fewer refusals or withdrawals from the participants.

A total of 48 males and 43 females participated in focus group discussions and 54 males and 22 females were selected through a snowball sampling method to participate in the in-depth semi-structured interviews. The majority of the participants interviewed were between the ages of 41 to 51 (Table 1). The age range between 52 to 62 constituted the second largest proportion of participants. The years of farming experience between the above mention groups and those that are above 62 years old (i.e. pensioner) reflects a group of farmers that have a vast amount of farming experience and knowledge about their respective surrounding environments.

Table 1: The age structure of the interviews who participated in the study

Age	STEINKOPF		LELIEFONTEIN		OVITOTO		OTJIMBINGUE		GIBEON		WARMBAD		SESFONTEIN		TOTAL
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
30 to 40	3	1	-	2	1	-	-	-	-	-	-	-	-	-	7
41 to 51	7	1	2	3	2	-	3	-	2	1	2	1	4	4	32
52 to 62	5	-	5	2	-	-	-	-	2	3	2	-	2	-	21
63 to 73	2	-	3	-	-	-	-	-	2	2	1	1	-	-	11
74 to 84	1	-	2	1	-	-	-	-	0	0	1	-	-	-	5
	18	2	12	8	3	0	3	0	6	6	6	2	6	4	76

Semi-structured interviewing has been demonstrated to be a valuable method for gaining interpretive data. The interviews with pastoralist were semi-structured but those discussions were guided by predetermined areas of inquiry. In depth semi-structured interview were also preferred above structured interviews as a more standardised and structured approach may run the risks of overly imposing the researcher's framework of meaning and understanding onto the consequent data (Mason, 2002). Mason (2002) further cautions that a more structured approach might also risk overlooking events and experiences that are important from the interviewees' point of view, that are relevant to the research but have not been anticipated, or that are particular to interviewees' own biographies or ways of perceiving. All interviews were conducted in local languages and recorded and later translated into English. It must be stated that semi-structured interviewing alone can produce only partial interpretive understandings and can be usefully supplemented by other methods. Therefore, the integration of the two methods assisted in increasing the rigour of method combination. All interviews were conducted in local languages, recorded (Nama, Afrikaans, Herero) and later translated into English.

Pastoralists' awareness of climate change

Pastoralists' awareness vary across study sites and countries. In Namibian sites 19% of the participants heard about climate change from various media platforms and schools and 81% of the participants never heard about climate change (Figure 2). In South Africa 31% heard about climate change from media platforms and school. Others relied on various sources, most notably, is the intergenerational sharing of information from parents or grandparents as well as among farmers at informal and formal gatherings or meetings. More recently a number of ecological researchers and Conservation NGOs have also contributed in creating awareness among the communities in South Africa. However, this has been restricted to Leliefontein which is of conservation concern due to its plant diversity and endemism.

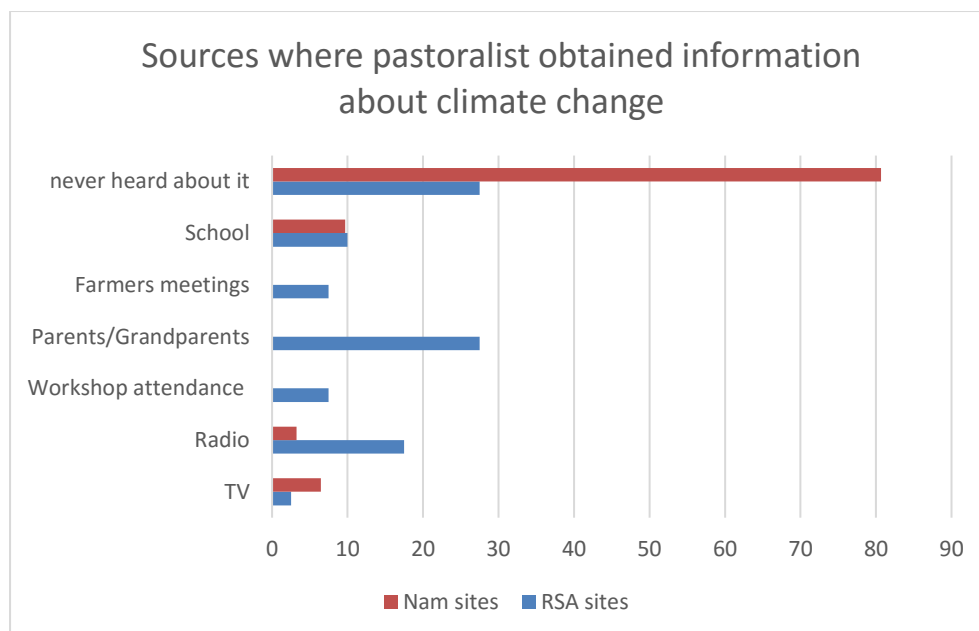


Figure 2: Sources of information that created awareness on climate change amongst pastoralists

Some of the responses by pastoralists when asked about their awareness on climate change were:

"I have heard of it, El Nino effects etc. People say that temperatures will increase, but I will not say I have a firm understanding of it. Yes rainfall changes, but that has been the case all the time." -Steinkopf farmer

"Yes many people talk about climate change on the TV about what must be done, but I do not know what it is, or how to explain it." -Leliefontein pastoralist

There is limited awareness of climate change as a scientific concept among Namibian farmers. The younger focus group discussion participants were more aware compared to the older generation.

Pastoralists' understanding of climate change

When farmers from both the South African and Namibian study sites were asked to explain their understanding of climate change, their explanations were based on observed changes in climate variables experienced in their lifetime. Even though the pastoralists' individual definitions differed amongst each other, their understandings had a shared idea of reported or experienced seasonal or yearly changes in temperature and rainfall. The pastoralists' definitions captured some but not all of the core components of the international definition as described by the IPCC. Both definitions focus on changes in climate variables over time.

A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forces, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. IPCC (2014)

"Climate change is when temperature varies from the normal. Areas that use to be cold can become dry. Vice versa. Rainfall also varies; it can rain a lot or less." -Leliefontein pastoralist

"It does not rain too much like it used to in the past. Rivers no longer flow now" -Sesfontein pastoralist

In general, pastoralists that have an understanding of climate change and refer to it as "seasonal shifts" they have been experiencing over the past years. The local as well as international definitions of climate change include variations in climatic variables either over seasonal scales (local) or over much longer temporal scales ranging over decades and longer (international). Another difference includes the amount of variation needed to establish whether it could be termed 'change'. The local definition does not state when it is a significant variation from the normal weather they have received. Variations in rainfall from mean annual rainfall often results in drought but pastoralists' definition of drought encompasses more than just a reduction in rainfall.

Pastoral perceptions on changes in climatic variables

Wiid & Ziervogel (2012) conclude that it is hard to pinpoint when farmers started to notice changes in temperature and rainfall. This study also found that it was difficult to obtain the exact year that farmers started to observe changes in climate. However, narrations of observed changes amongst Namibian and South African pastoralists are confined to the period between 1980 and 2015 and these memories are linked to their ages. Mostly pastoralists recall changes since 1990 and they compared the 90s and 2000s as current climatic conditions to the past, which is the 1980s and earlier periods.

Temperature

All pastoralists agreed that summer temperatures had become hotter than in the past. However, only pastoralists from Warmbad in Namibia and all pastoralists in South Africa have noted a decrease in temperatures during the winter periods. South African pastoralists' observations and indigenous knowledge of change is consistent with climatic records that indicated a slight increase in average monthly summer temperatures for both Steinkopf but more particularly in Leliefontein (Figure 3). This might have influenced the pastoralists' perceptions to say that temperatures have increased over the years during dry summer season. Namibian pastoralists have witnessed hotter summers and moderate winters. The seasonal calendar exercise revealed that Namibian pastoralists perceive that although summer months had become hotter, the length of this period had shortened from August till January to September till January. Pastoralists did not mention variability in temperatures over the years and their perceptions

might have been influenced by the low variability in temperatures during the hottest and coldest months since 1990s (Figure 4).

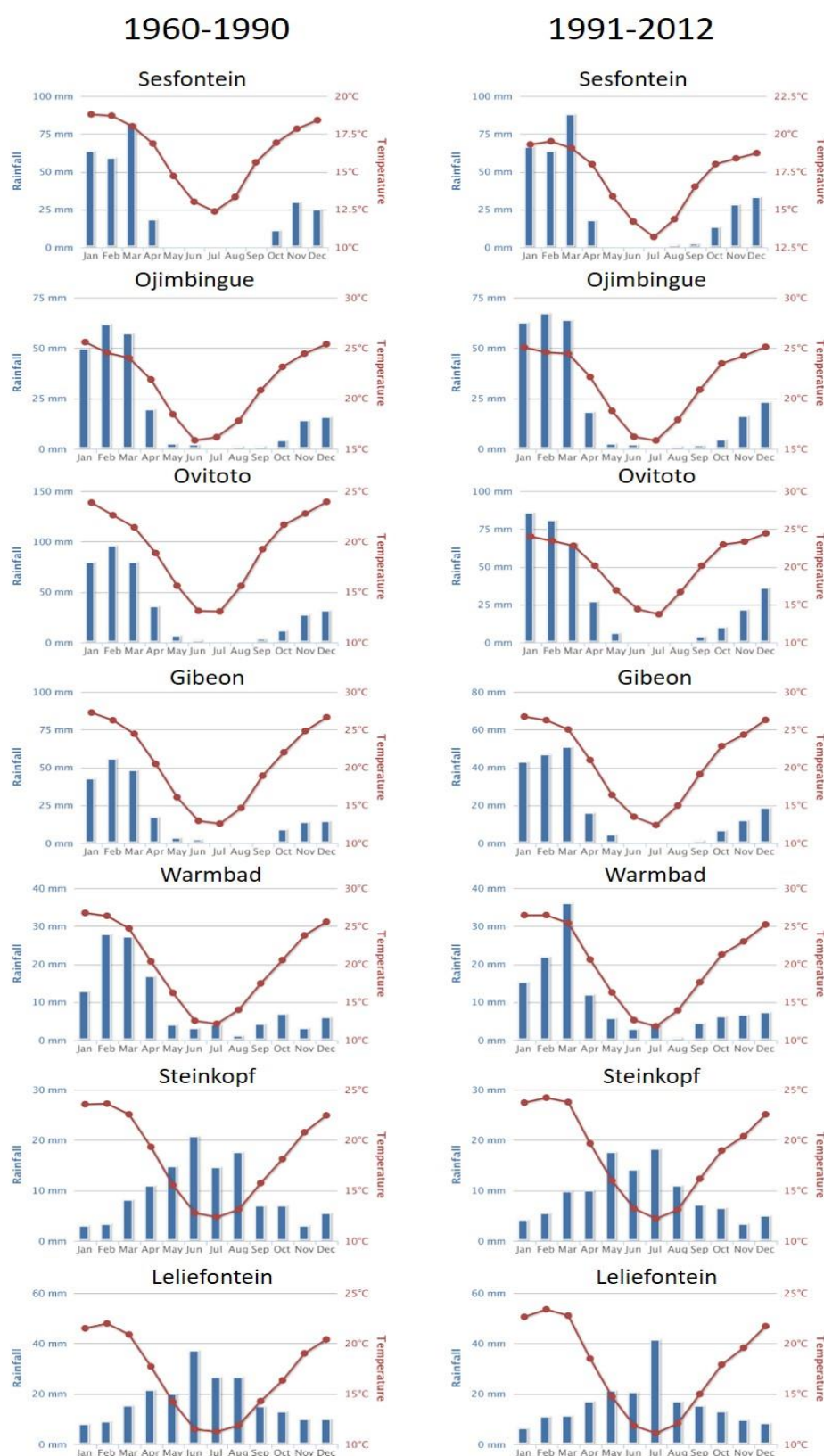


Figure 3: Rainfall and temperatures between 1960-1990 and 1990-2012 in the seven study sites (Source: CRU TS dataset 3.1).

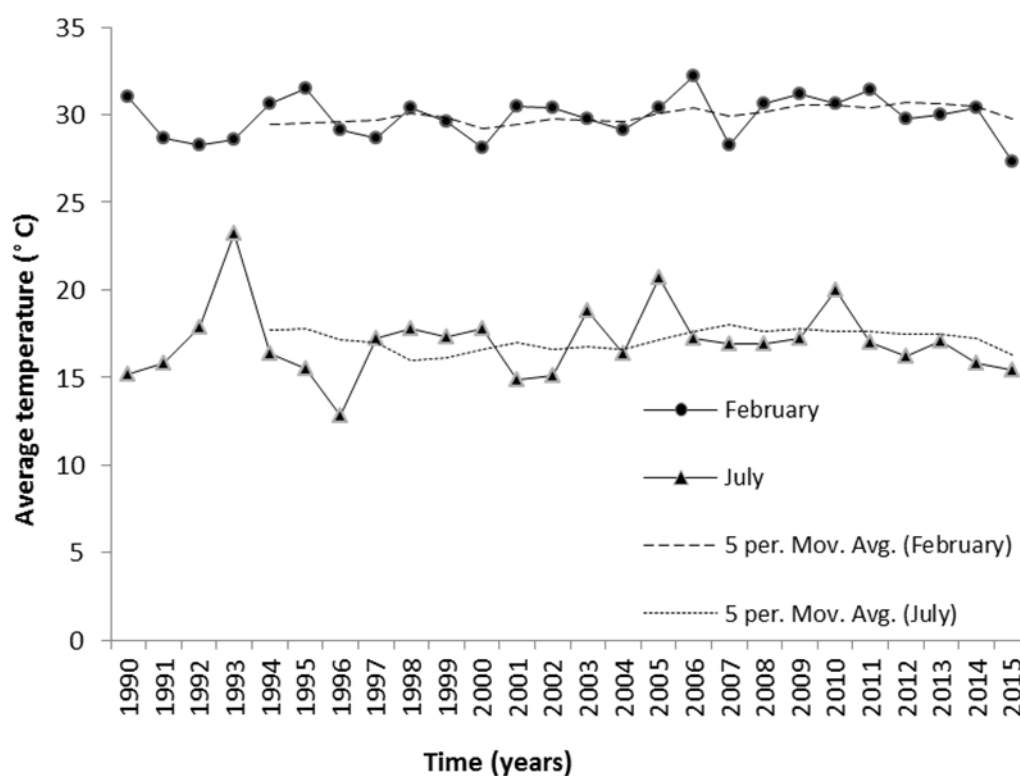


Figure 4: Mean temperatures for the hottest (Feb) and coldest (July) months in Steinkopf from 1990 to 2015 (South African Weather Service, unpublished data).

Rainfall

Pastoralists from South Africa mentioned that rainfall during the winter season has shifted and decreased. Namibian pastoralists have noted a similar trend in summer rainfall. However, rainfall data shows no clear decreasing trend and in some Namibian sites rainfall have increased over the years considering the upward trend of five years moving averages (Figure 5). However, it could be noted that there has been shifts in rainfall periods over the years in almost all of the study sites (Figure 3).

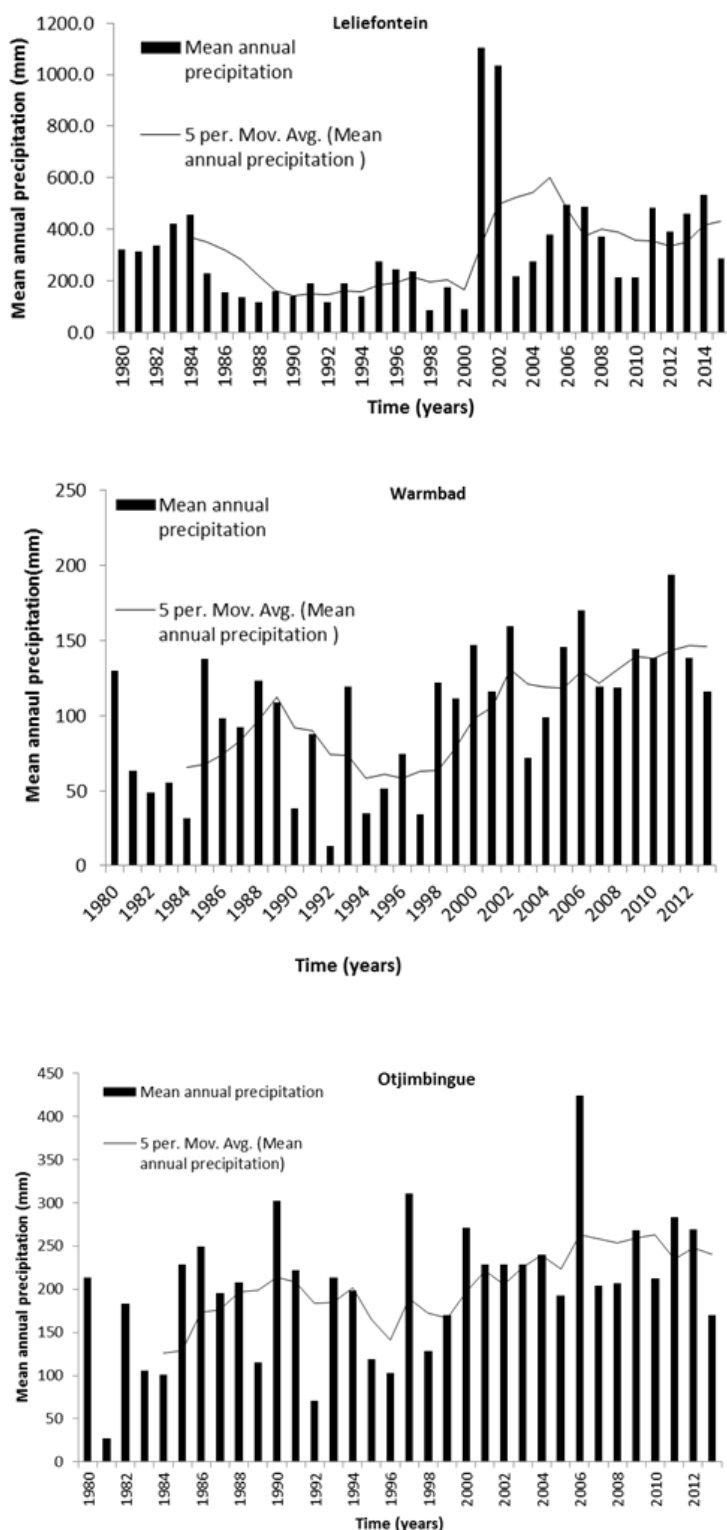


Figure 5: Mean annual precipitation in Leliefontein, Otjimbingue and Warmbad from 1980 to 2014.

Both Namibian and South African farmers further agreed that rainfall and seasonality were more predictable in their youthful years (1970s and 80s). For the current study, Leliefontein pastoralists noted that the winter onset rains used to start at the end April or beginning of May, but now tends to start in June. This was similar in Steinkopf where pastoralists indicated that the start of their onset rains were characterised by an eight-day rain period which occurred in April/May; which is now absent.

Pastoralists from Ovitoto, Otjimbingue and Sesfontein have reported a delayed onset of rainfall which could be confirmed by the rainfall data (Figure 3). These pastoralists have reported that early rains have also become very rare in Namibia as one male pastoralist from Ovitoto put it *“Getting early rains/onset rains depends on whether it is a lucky year or not”*. According to respondents, the duration for a normal rainfall season had been reduced from five months to four months in all Namibian study sites however this could not be validated by rainfall records.

Respondents from both Namibia and South Africa also indicated that over the past years (since the 1990s), rains fall for a shorter duration with higher intensity. The 2015 rainfall event might have influenced the farmer’s perceptions since the drought period was followed by a period of high rainfall.

Wind

All interviewed pastoralists from Namibia and South Africa were in agreement that August is their windiest month; however, in recent years they sometimes received stronger winds at different times of the year(s). This is confirmed by rainfall recorded from African Drought and Flood monitor database where there was a general increase in wind speeds in most study sites after 2013, when the lowest wind speeds have been recorded since 1981. Only in Ovitoto, have wind speeds increased from 2010 onwards.

In South Africa, when pastoralists were asked how the direction, speed, and season of wind have changed, their responses differed between the two study areas. More pastoralists from Leliefontein (16 out of 20) indicated that the wind has changed over the past years. Only a few farmers (11 out of 20) agreed that they have noted these changes. South African pastoralists from Leliefontein has noted changes in wind speed and frequency which has become stronger in recent years than in the past.

The majority of Namibian farmers interviewed reported changes in wind speed. Two pastoralists related that no changes in wind direction had been noted. Others have noted variations in wind direction associated with changes in speed and force. For instance, pastoralists from Sesfontein have noticed that easterly winds were stronger and associated with good rains in the past. Currently this have changed as westerly winds have become stronger and are blowing away clouds. As a result, “whirl winds” that were seen as “prayer for rain” are no longer bringing rain. In the southern Namibia, north- easterly winds were stronger and was an indicator for good rains but now the south westerly winds are more prevailing and are an indicator of poor rains. In Warmbad south-westerly winds are associated with winter rains, while the north-westerly winds are associated with summer rain. Changes that are noted is that in the past westerly winds were more prevailing but currently easterly weak winds that do not bring rain are more prevailing.

Drought

In Northern and Central Namibia, drought is defined as a result of a lack of forage for livestock to consume as a result of poor rainfall. Furthermore, Ovitoto and Sesfontein pastoralists reported that increase in people and the number of livestock is one of the causes of drought as forage per livestock unit is reduced. Another pastoralist in Ovitoto defined drought to be caused by both climate change and mining activities, which reduce forage and rangeland access due to the encroachment of other land uses. Other reasons given by Sesfontein pastoralists for drought include poor farming methods that reduce vegetation cover and veld fires, which consume valuable plant material. However, pastoralists in South Africa generally define drought as the lack of rain during the rainfall season.

Pastoralists generally remember drought periods, since drought often has severe impacts on their livestock and their livelihoods. Some older pastoralists remember drought from as far back as 1958 but mostly remember more recent droughts from 2011 onwards of which some are still experiencing its impacts. Table 2 outlines the different drought periods experienced by pastoralists in southern Africa. These drought memories could be regarded as fairly accurate as they could be linked to previous El Niño events in southern Africa.

Table 2: Drought Periods experienced in Namibia and RSA

EL NIÑO SEASON	DROUGHT PERIOD	SESFON-TEIN	OVITOTO	OTJIMBIN-GUE	GIBEON	WARMBAD	STEIN-KOPF	LELIE-FONT EIN
NO DATA	1958			X				X
NO DATA	1959			X				
NO DATA	1960			X				
NO DATA	1961			X				
NO DATA	1967/1968						X	
NO DATA	1969						X	
NO DATA	1970/1972						X	
NO DATA	1978							X
NO DATA	1980	X				X		
1982/83	1981	X	X	X		X		
1982/83	1982	X						
1982/83	1983	X						
1982/83	1984	X						
1986/87 & 1987/88	1988/1989	X		X	X			
1991/92	1991/1992			X	X	X		
1994/94	1993/1994		X	X				
1994/95	1996	X	X					
1997/97	1997/1998	X						
1997/98	1998/1999							X
2000/03	1999/2000			X				X
2000/03	2003/2004		X	X		X	X	X
2004/05	2004/2005	X						
2006/07	2006/2007	X						
2009/10	2008/2009			X				
2009/10	2011				X			
2013/14	2012/2013	X	X	X		X		
recent	2014/2015					X	X	X

Through the semi-structured interviews livestock pastoralists also explained how the current weather patterns are impacting their farming systems and subsequently their livelihoods. In 2015 South Africa and Namibia experienced a severe drought, and Namaqualand region in South Africa and southern Namibia which include Gibeon and Warmbad were affected. Droughts resulted in animal losses, where some pastoralists in Steinkopf lost above 60 and in Gibeon pastoralists lost all livestock. Pastoralists both in Namibia and South Africa reported that the shift in seasons affects the lambing season, increases lamb mortality due to forage scarcity and decrease milk production of the ewes.

Indigenous indicators for forecasting weather and local climates

Pastoralists in Namibia and South Africa have developed their indigenous knowledge through intergenerational knowledge transfer as well as many years of close relationships with the natural environment. Traditional indicators to monitor climate serve as early warning systems for future changes in climate or indications of extreme events. This study identified five major categories of indicators based on the traditional weather forecasting and climate prediction related to rainfall conditions.

Wind

In general, wind could be considered the forgotten part of climate change as most experiences and perceptions of climate change and variability is mainly linked to rainfall and temperature. However, some pastoralists identified wind (in the seasonal calendar) as one of the most dominant indicators of climate change in their rangeland.

The reason why the wind is such an important factor in southern Namibia and in South Africa is because farmers still depend on windmills and the lack of wind affects water availability for their livestock. Due to the geographical location of Sesfontein, respondents believe that winds that tend to blow from the coast (western direction), bring along dew but also blow rain clouds away. Pastoralists in South Africa believe that impacts of wind direction on rainfall can have an impact on the duration of their annual ephemeral blooms, which are important food for their livestock during the wet winter season.

Livestock behaviour

In both the Namibian and South African case studies, pastoralists associated ecstasy/joy (jumping around) among livestock as an indication that the rainfall season is approaching. It has profound meaning if the jumping takes place as the livestock return to the 'kraal', or at night. According to the interviewees, cattle and goats also tend to flap their ears as a sign that the rainfall season is forthcoming. Goats are also used in rituals to predict whether it will rain in Sesfontein in Namibia. This is usually done by looking at the veins of the animal, if it doesn't have enough water content then it is an indication of poor rainfall. One pastoralist in Steinkopf, South Africa stated that the goat ram will only impregnate ewes when he knows rains are about to fall. However, these signs of livestock behaviour do not indicate how much rain will fall and for how long.

Flora and fauna

Vegetation, birds and mammals are also observed and serve as early warning systems for local pastoralists. In South Africa, pastoralists from Leliefontein observed that when the non-succulent leguminous shrub, *Calabota sericea* (locally known as fluitjebos) starts to flower it is an indication to move to other grazing areas in the lower altitudes because the cold seasons is approaching. In Namibia, pastoralists from Sesfontein observed when pods (locally known as "Etokoti") start growing on *Colophospermum mopane* trees as a sign that the rainfall season is approaching. If it does not grow, a drought could be expected. Pastoralists from Sesfontein also observed the "Rain Bird" that make specific sounds that are associated with rain. Sightings of bats moving around a lot were also signs of the approaching rainfall season. A sight of flamingoes from the Namibian coast is also an indicator of rainfall in Sesfontein.

Astronomy

Pastoralists from Sesfontein in Namibia rely on astronomy as well to forecast rainfall. According to the indigenous knowledge passed on by their ancestors, the position and shape of the moon can tell whether it will be raining or not. When the half moon is on its back it creates a 'bowl' and thus rain can be expected. When the half moon is upside down there will be a drought. Pastoralists in South Africa did not rely on astronomical indicators for rainfall or drought.

Discussion and conclusion

Climate change mean different things to different people and activates different sets of beliefs responses as well as different degrees of urgency about the need to respond. This ultimately relates to jargon, where one thing can be called by different names by different people in different places. Pastoralists explained that changes are part of nature's cycle, spiritual beliefs of God's plan, or Mother Nature punishing humans for not taking care of it. Their spiritual beliefs are consistent with pastoralists elsewhere in southern Africa (Nyanga et al., 2011; Muller & Shackleton 2014), which emanates mainly through their closeness with nature.

Climate change is a technical concept that is not easily understood by local farmers. There are variations in definitions and understanding of climate change amongst scientists and indigenous farmers. The temporal scale that pastoralists use to refer to change is short to medium term as compared to longer term projections and climate data observations and projections that are used to identify and project change in climatic variables. Pastoralists tend to associate their perceptions and knowledge of climate change primarily on variables that are relevant for livestock survival and farming decisions. As such, rainfall and temperature linked to drought are key climatic variables that pastoralists observed to have changed over time. However, changes in wind are noted especially because pastoralists rely on this variable to forecast rainfall and to provide water from underground sources. Thus explanations of climate change from farmers are mostly detailed on how change affects them as farmers, while the western science explanation is detailed on the cause and effect of change (Peloquin & Berkes, 2009).

Farmers reporting a shift in the start and end of the rainy season was also found with Zimbabwean (Moyo, Myumi, Kunzekweguta, Mazvimavi & Craufurd, 2012) and Zambian farmers (Mulenga & Wineman, 2014), where Zambian farmers reported a later start (shift from October to November) and earlier end (shift from April to May) to the rainy season and Zimbabwean farmers reported a shift from October to end of November or early December. Results of decreases in rainfall amounts and occurrences were found in other studies conducted within African countries (Speranza, Kiteme, Ambenje, Wiesmann & Makali., 2010; Roa, Ndengwa, Kizito & Oyoo., 2011; Hartter,

Stampone, Ryan, Kirner, Chapman & Goldman, 2012; Ogellah, Vogl, Fitzinger & Hauser, 2012; Ndambiri, Ritho & Mbogoh, 2013).

Pastoralists remember extreme events or in most cases, recent events that affected their agricultural production as was evident in this study concur with other studies (Ferrier & Haque, 2003; Osbahr et al., 2011; Moyo et al., 2012). Furthermore, nomadic pastoralists in Mongolia have expressed an increase in the intensity of droughts and sandstorms as the most severe challenges escalating from climate change (Marin, 2010).

Namibian and South African farmers' perception of increases in summer temperatures were also found in studies from India (Varadan and Kumar 2014), Nigeria (Fatuase and Ajibefun, 2013), and Kenya (Ndambiri et al., 2013). The perception of Leliefontein farmers on increases in wind frequency and intensity is similar to observations by the Arctic people. The Inuit people in the Arctic have reported that winds in their area has become stronger and blows more constantly, with a change in prevailing wind direction (Nakashima, 2012).

Given these similarities with other land users around the world and observed climatic records, we can confidently say that pastoralists in Namibia and South Africa understand the changes in the climate that have occur over their lifetime. The validity of local knowledge has been shown by various others authors (Vedwan & Rhoades, 2001; Hageback et al., 2005; Cabrera, Breuer, Hildebrand, 2006; Newsham & Thomas, 2011) comparing it to scientific climate data. However, there are instances where local knowledge has not been confirmed by quantitative climate data (Rao et al., 2011). The knowledge of indicators and its use as a traditional form of early warning system for local farmers have been useful over the years. It has contributed to sound decision-making regarding rangeland and livestock management. These are similar results to Fernández-Giménez & Estaque (2012), where local communities use local warning signs to enlighten them on any change to occur in their area. Indigenous communities use local knowledge of their environment with its resources to develop indicators that enable them to read their environment and tell them if something unusual is happening (Luseno, McPeak, Barrett, Little & Gebru, 2003; Marin, 2010; Kagunyu, Wandibba & Wanjohi, 2016). These communities have been forecasting weather and indicating changes in their weather patterns (Nakashima et al., 2012). However, the reliability of these indicators has not yet been studied in detail; therefore, this study only provides an understanding of these indicators and its usefulness. In the absence of timely seasonal forecasts, these traditional indicators are useful sources of information for pastoralists.

Livestock farmers have over many years accumulated local knowledge that is important for decision-making (Berkes et al., 2003). Pastoralists in the Namaqualand and Sesfontein particularly are known to possess in-depth ecological knowledge, which has allowed them to adapt to climate and environmental change (Samuels and Allsopp, 2006). Various other studies conducted in Africa (Gbetibouo, 2009; Maddison, 2007; Moyo et al., 2012; Okonya et al., 2013; Simelton et al., 2013) indicated that adaptation strategies utilized by farmers depend on their knowledge of climate change and variability. As in other farming systems, this knowledge adds to rural development and community resilience to climate change and variability (Agrawal, 1995). In conclusion, the wealthy local knowledge of pastoralists embedded in their experience and traditions had been a useful source of information regarding drought and climate variability impacts and possible adaptation strategies to be undertaken. However, the diminishing usefulness of this traditional early warning system contributes to the vulnerability of pastoralists to climate change and variability in the drylands of Namibia and South Africa.

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LIFE HISTORY: AN ALTERNATIVE METHODOLOGY FOR VULNERABILITY RESEARCH?

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Abstract: This research investigates the nature of vulnerability, amongst female subsistence farmers in the Bamenda Highlands region of the Cameroon, to climate and environmental change. Much existing research investigating gendered vulnerability has been conducted using quantitative measurements such as vulnerability indexes. A similar method, using a household questionnaire survey, was piloted for this study with the aim of delivering vulnerability indexes. The questionnaire approach provided a snap shot of the current state of participants' vulnerability but did not give insight into the underlying causes of vulnerability that had developed over a lifetime. Instead, a life history method was considered as an alternative approach which allowed participants to give a full, personal account of their circumstances through narrating their life stories. This approach revealed that vulnerability as experienced by women in the Bamenda Highlands region of the Cameroon should be understood as a process, formed over time. It also allowed women to narrate the adaptations they had made which enhanced their resilience. The authors contend that this methodology might be a useful contribution to recent theory conceptualizing adaptation as 'pathways of response,' and might provide opportunities for more appropriate policy formulation in the context of climate change.

Introduction

Vulnerability to climate change has been assessed using various methods and frameworks aimed at establishing the differences in vulnerability between individuals, groups, nations or regions (Füssel, 2010). Vulnerability is a concept, which has been used extensively in various fields including disaster management, sociology, geography, development studies, and most recently, climate change research (Füssel, 2007; Moret 2014). The concept has varying interpretations in different contexts, which has led several scholars to suggest that it should be understood in relation to local contexts (Adger 2000; Banda & Mehlwana 2005; Moser 2011; Tschakert & Machado 2012; Nkem et al. 2013). This paper makes use of research in the Bamenda Highlands region of the Cameroon, to propose the use of a life history methodology in understanding the processes responsible for vulnerability.

Vulnerability frameworks and measurement

The working group II of the Intergovernmental Panel on Climate Change (IPCC, 2014) defined vulnerability as:

"the propensity or predisposition to be adversely affected ...[v]ulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope with and adapt to the adverse effects of climate change, including climate variability and extremes" (IPCC, 2014, 5).

Theorists of social vulnerability tend to associate social vulnerability with social inequalities embedded in gender, class, race, culture, age and power structures (Cannon, 2002; Cutter, Boruff & Shirley, 2003). Africa as a continent is particularly vulnerable to climate change (Denton 2002; Filomina 2014; Siulemba & Moodley, 2014). This is based on a number of factors such as slow economic growth, heavy reliance on rain-fed agriculture, poverty and difficulties in responding to climate fluctuations (Orindi & Eriksen 2005; Somorin 2010; Ringler et al. 2011; Rademacher-Schulz, Schraven & Mahama, 2014). Within Africa vulnerability varies among individuals, communities, societies, nations and genders (CARE, 2011).

Feminists strongly argue that vulnerability is gendered. Butler and Gambetti (2013) argue that vulnerability is worsened by unequal power relations between men and women. Structural differences exist between men and women in most societies that can exacerbate differences in vulnerability and adaptive capacity to climate change. Some examples include differential access to and control over productive resources, power relations, division of labour and poverty (Hansson 2007; BNRCC 2011).

Studies have revealed differential impacts of climate change and variability on women and men, with women often being the worst off during disasters, with respect to livelihood losses (Cannon, 2002; Baten, Khan and Titumir, 2010). Although vulnerability cannot be equated with poverty, it can be compounded by poverty, as poverty is often associated with limited resources which in turn, can limit adaptive capacity (Eriksen, Brown & Kelly, 2005; O'Brien et al., 2007; United Nations Commission on the Status of Women, 2008; Moret, 2014). In spite of women's vulnerability to the adverse effects of climate change, much research also shows how women use their knowledge and capacities to sustain their livelihoods amidst adverse effects from climate change. For instance, women in Peru

have diversified their livelihoods to non-farm activities as a coping strategy in the context of climate change (CARE, 2011).

Many studies have focused on quantifying vulnerability by generating vulnerability and adaptation indices (Downing 1990; Kelly & Adger 2000; Turner et al. 2003; Christensen et al., 2003; Pulhin et al., 2006; Cutter & Finch, 2008; Ringler et al., 2011; Below et al., 2012). An index based approach makes use of a questionnaire survey methodology or large secondary data sets to develop a quantifiable scale of vulnerability (Vincent, 2007; Baudoin, Sanchez & Fandohan, 2013). Although there are advantages to vulnerability index methods, specifically in relation to the providing useful data sets to inform policy decisions, this quantified method fails to give a full account of people's experienced vulnerability.

The quantitative approach relies on the use of socio-economic variables to analyze household but this approach has been criticized by feminist scholars for facility to reflect the complexity and richness of women's lives (Kwan, 2001). Furthermore, the selection of socio-economic variables to analyze resilience of household livelihoods often requires large data sets which are not as readily available in lower income countries (Jones & Tanner 2015). Jones and Tanner (2015) propose that people's interpretation of their own capabilities and capacities should be taken into account when measuring resilience to weather and climate extremes. Gender inequality, can be measured using both quantitative and qualitative approaches but the depth of detail, particularly around how this inequality has developed and is perpetuated over time, emerges effectively through using the life history approach (Metso & Le Feuvre, 2007; Scott, 2010; Below et al., 2012).

Life history approach

Emerging research has noted that there are shortcomings in the quantitative approach to vulnerability and proposes that people's subjective understanding of vulnerability and resilience form the focus of new research (Füssel & Klein 2006; Hunter 2009; Moosa & Tuana 2014; Jones & Tanner 2015). Proponents of this approach argue that people should be encouraged to narrate their experiences since they understand their situations better than others (Jones & Tanner, 2015). It is against this backdrop that the life history methodology has been proposed in this paper as an alternative approach to vulnerability assessment and it is hoped that it might contribute to the conceptualization of new pathways of adaptation. The life history method refers to an approach whereby individuals account for, and build theories relating to, their experiences of the social world over time (Musson, 2004).

"[The] life history method is firmly rooted in an interpretive epistemological perspective, and specifically in the symbolic interactionist paradigm which views human beings as living in a world of 'meaningful objects' – not on an environment of stimuli or self-constituted entities" (Musson 2004:34).

The method makes use of individual explanations and interpretations of an event to understand their experiences.

The life history approach was pioneered by anthropologists and it was later used by sociologists (Abu Bakar and Abdullah, 2008). Although at one point criticized as outdated, the approach underwent a resurgence in the 1990s, being used in various disciplines including criminal psychology, economics, education, geography, anthropology, linguistics, psychology and sociology (Atkinson, 1998). Abu Bakar and Abdullah (2008) argued that the life history approach is useful for understanding and explaining people's experiences through acquiring detailed information about their lives. Although the life history approach is an old research methodology it has not been utilized in climate vulnerability and adaptation study. Therefore, this research aimed to illustrate why the life history approach could be considered as an alternative approach for assessing vulnerability to climate variability and change. The paper emerges from field data collection for a broader study into women's vulnerability in the Cameroon.

Description of study area

The study was carried out in Belo and Oku Sub-Division in the Bamenda Highlands Region, in Northwest Region of Cameroon. Belo is located 28.16 km and Oku 75.7kms from Bamenda, Capital of Northwest Region of Cameroon. The Northwest Region of Cameroon lies within the Savannah Zone which is dominated by trees and bush Savannah. It is characterized by two seasons namely the wet and dry seasons. Rainfall ranges from 1700mm to 3000mm annually. The peak of rainfall in this region occurs between July and September with monthly measurements ranging from 400mm to 500mm. The rains often start after mid-March and continue until November. Temperature ranges between about 10°C and 25°- 28°C and the widest range between the 24-hour maximum and minimum occurs between November and March. Belo and Oku Sub-Division are part of Kilum-Ijim Mountain Ridge and the peak of the mountain is mount Oku. Located between latitudes 6° 07' and 6° 17' N and longitudes 10° 20' and 10° 35' E, the Kilum-Ijim Mountain ridge has an altitudinal range of 1600m – 3011m (Lambi and Neba, 2009; FAO 2010).

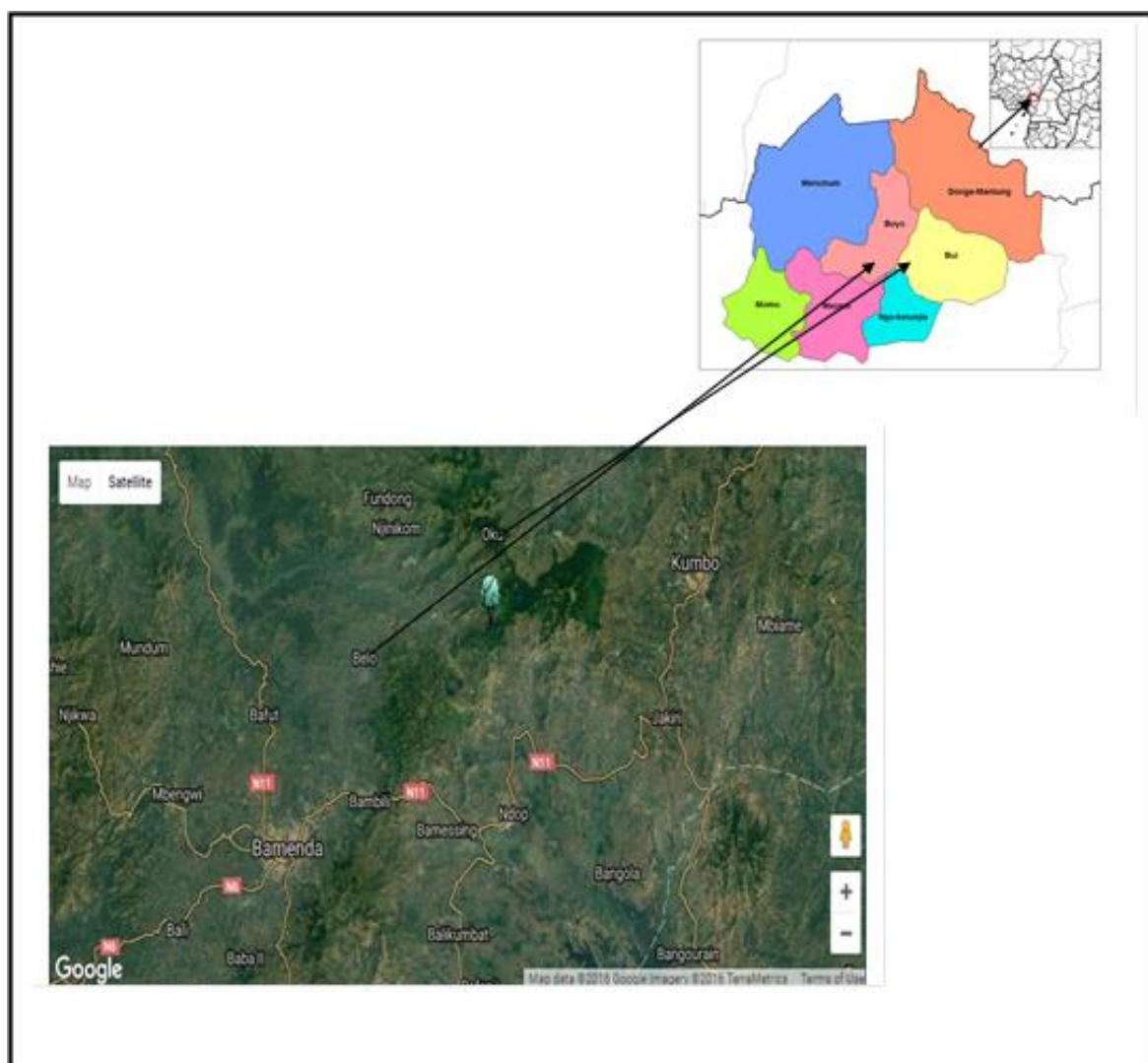


Figure 1: Map of the study area: Belo and Oku Sub-divisions of the Bamenda Highlands region of Northwest Cameroon (adapted from Rarelibra, 2006)

Sampling and data collection

The study sample included 20 female farmers selected from two neighboring communities, namely Belo and Oku in Northwest Cameroon. A snowball sampling technique was used, facilitated by grassroots contacts from Non-Governmental Organizations namely Cameroon Gender Watch (CAMGWE) and Belo Rural Development Association (BERUDA), as well as the Sub-Divisional Delegate of Agriculture for Oku and Noni. It was easier to access participants through these grassroots organizations since they have worked in the region and interacted with the farmers for many years, developing a rapport with them. The data was collected in two phases. The first phase was a reconnaissance field visit from January – February 2015 and the second phase was from November to December 2015 when the data was collected using the life history approach.

The questionnaire approach was the initial method chosen for the PhD research, which focused on measuring gendered vulnerability and adaptation. The questionnaire was designed and piloted during the preliminary fieldwork conducted in January – February 2015. The outcome of the interview brought out various aspects of vulnerability but it did not assist the researcher in understanding the deeply rooted, but not immediately visible, gender based differences in experienced vulnerability between men and women or highlight how vulnerability developed over time. Furthermore, with the questionnaire approach it was difficult to pull out gender issues which are usually silent and may not even be perceived as an issue by the participants (Below et al. 2012). The challenges experienced from using the questionnaire provoked the search for an alternative method.

Various qualitative data collection approaches were considered such as focus groups, key informant interviews and life history interview methods. All of these methods were used in a mixed method study, but for the participant data,

the main method chosen was the life histories due to the advantages discussed below. Life history interviews were conducted in participants' local language with the help of field research assistants.

Data Analysis

Once the narratives were obtained and transcribed themes relevant to interpreting them were chosen. These included issues such as access to land, inheritance practices, access to education, marriage, number of dependents, farming methods and many more. Atlas,-Ti software was utilized to support the data analysis process. The life history method allowed the narration of subjective stories, unearthed otherwise invisible gender dynamics and allowed for emotional expressions.

Results and discussion

This section represents the outcome of the analysis of women's narratives of their lives in terms of their socio-cultural and economic situations and their experiences of climate change. Also emerging is information relating to how they developed resilience to adverse conditions based on their knowledge and capabilities. The analysis was approached through a comparison between the life history and questionnaire approaches in analyzing vulnerability.

Comparing questionnaire and life history methodologies

In this section differences in information obtained through the life history and the questionnaire methodology are discussed. These differences point to the usefulness of the life history method in vulnerability research and are summarized in Table 1 below.

Table 1: Comparison of Methodologies

Variables	Life History	Questionnaire
Subjectivity	Subjective account of participants' life experiences	Quantifiable data obtained in order to produce an index based output. (Limiting depth of detail relating to subjective experience).
Detail	Gives insight into people's past and present lives and their experiences of climate change	Provides a snap shot of people's current situation
Gender Dynamics	Participants' narration and follow-up questions brought out some gender discriminatory practices which would have been missed using only a questionnaire approach	The approach limited participants' responses to predefined categories. Even the open ended questions at the end of the questionnaire did not seem to illicit more detailed responses, possibly because participants were influenced by the earlier questions.
Emotional Expressions	Allowed participants to tell their own subjective story. Provided participants an opportunity to express their past emotionally. Feelings of regret, bitterness and low self-esteem emerged, as well as motivation and excitement and stories of resilience. All of these were useful in interpreting gender dynamics.	Participants were provided with multiple choice responses and they tend to complete the exercise without actually relating to it.

Subjectivity versus objectivity: Emerging voices

The life history approach brought out the subjective narrative of experienced vulnerabilities, which exposed women to the effects of climate change. Some issues which emerged included: limited access to education, early pregnancy, forced marriage, domestic violence, lack of land ownership and poverty.

In their stories the women narrated the problems they faced in accessing education with expressions of regret, bitterness and dissatisfaction. Some accounts emerged (note that pseudonyms were used for all participants):

Emelda: I started school and attended just for five days then someone came and convinced my father that women are not supposed to go to school. Then my father made me drop out of school and told me that I will be working on the farm.

Magdalene: My uncle raised and sponsored me in school. My condition was not good; he did not take very good care of me; I had to do piece jobs to get money to buy my school needs. I struggled until I got to primary seven; at the time female children were denied the right to go to school; I was interested in furthering my education but my uncle refused. I became frustrated and did things that were not according to my plans; due to the frustration I carried my first pregnancy; my challenges affected the dream of what I wanted to become.

Miriam: My father was not interested in sending a girl child to school; his interest was to give us away in marriage;

Euphemia: The greatest challenge in my upbringing is that I loved to go to school but never had the opportunity to do so. At the time when I was growing up children could not make choices, we just waited to be sent to school, and if we were not sent we could not protest. Farming was my last resort; had it been I was educated I could have done something else and farming would be taken as a part time activity.

Florence: Only my brother went to school. In our days only stubborn children went to school. Obedient children were kept at home to protect them from beatings in school. So we stayed at home and accompanied our parents to the farm.

Isabel and Evelyn narrated how early pregnancy disrupted their educational life and led them into forced marriage. Their stories are captured in the following excerpts:

Isabel: I fell pregnant at the age of 18 in 1987; I was in primary 7. That caused me to drop out from school; two years after my delivery my father gave me out to my husband for marriage. I did not object when my husband was visiting our home to ask my hand in marriage. At first I objected, but my father insisted and I felt that if I continued to resist, and I happen to have another child in our home, I will be rejected, hence I accepted.

Evelyn: I had two children in our family compound; a boy deceived me that he will marry me but he disappointed me when he heard that I was pregnant; my mother was very happy; she prepared me to farm and feed my child; years later after having the second child I was handed over for marriage by my uncle acting in the place of my father. My uncle was willing to play the role of a father to give me away for marriage, but when it came to supporting my education he was not willing. The man who is now my husband was visiting the compound but I did not know his intentions. I thought he had a friend in our family. One day my uncle told me that I will carry my children and accompany this man to live with him and assist him, and he will in turn assist me and my children. I understood that I had been given out for marriage in my case I was happy because I had suffered too much and was still suffering with my children; so I saw it as a relief that there is someone who will be assisting me.

Cindy narrated the challenges which forced her into a marriage to a man she did not know. She saw marriage as a means of liberating herself from her suffering, but instead she suffered domestic violence. Her story was told as follows:

Cindy: He was very violent. He was violent spiritually and physically ... I took the children with me when I left my marriage and we all lived with my parents.

The women also narrated the challenges they had in accessing and controlling land. Mostly land was accessed through their husbands. As a result, when women were divorced, or widowed or unmarried they often lost control over land. As a divorcee, Cindy could not obtain land through her husband, and relied on borrowed land, which left her vulnerable to eviction:

Cindy: I faced challenges in relation to land. I am farming on borrowed land and do not know when the owner of the land may want me out of the land. I might just be surprised to vacate the land with my crops on it, and that will be a big loss for me. It also discourages me from making some huge investment on my farm for fear of losing it.

Angela, who is a widow, explained how some of her farmlands were seized by her brother in-law after the death of her husband.

Angela: I lost some of my farms when my husband passed away. My in-laws took the farms that were family land from me. My husband's half-brother took the land and sold it.

Evelyn also explained the story of how she, her mother and her sisters were sent away from her father's compound after his death, and the farmland was seized by her half-brother. Her story is captured in the following narrative:

Evelyn: my father left farms but since we were in a polygamous family, and my mother had only female children while the other wife had male children, we were deprived from inheritance. After my father passed away one of the first wife's male children sent my mother out of the family compound and confiscated her farmland given to her by her late husband. He said a woman has no use because we are like commodities for sell; he said we should go and get married that every property belongs to them.

Magdalene explained that she had access to the farmland, which her mother cultivated before her death, but she did not have control over the land since she is a woman. Her story was told as follows:

Magdalene: the parcels of land are mine to cultivate but I cannot sell them because they were given to my mother by my father. Only my brother can sell the land when he has a problem, which needs finance to solve. I cannot sell because I am a woman; even if he wants to sell the farm that I am cultivating I have nothing to say.

These women's narratives their experiences from their own personal point of view. The above extracts illustrate the depth of detail that emerges from this approach which differs from the information which would emerge from a questionnaire based methodology. Also remarkable, was the fact that although the interviews were with different women at different locations, similar stories and experiences emerged, which provided patterned insight into women's vulnerability. Although a survey could provide a quantitative representation of women's vulnerability, and if sampled correctly, allow the generalization of the results, it would have failed to give vulnerable women the direct voice that emerged using this method. In particular, narratives of power relations between fathers' and daughters; husbands and wives and men and women, which are not easily measured by the questionnaire approach.

Details of women's experiences, gender issues and emotional expressions

In addition to the advantages mentioned above, the life history approach highlighted the fact that vulnerability develops over time and is directly related to social and cultural gendered practices. These include practices related to girls' education, early arranged marriages, access to and control over land, in particular, all of which affected women's range of livelihood options. The narratives revealed how women's adaptive capacity is limited by structural inequality. However, women's vulnerability is not static, and this study indicated showed how inequality is created over lifetimes. This is very important for developing effective adaptation measures and actions that will not exacerbate inequalities and worsen vulnerability (Aguilar, 2006).

The life history approach also provided the participants the opportunity to narrate their personal successes. These women emerged not as helpless victims but as agents of change, and lessons in resilience emerged (Lorenzoni et al. 2008; Tschakert & Machado 2012). Although not the subject of this paper, the study revealed ways in which women who used their capabilities both individually and collectively, were able to change their lives and those of their children. In narrating their stories some expressed confidence, self-esteem and satisfaction about their achievements:

Magdalene: I have 8 children now and decided to go back to school (Women empowerment center); a vocational training institution for women, and I was offered a job after graduating. I was motivated by my situation; I realized that I was suffering and saw this center as a place to change my life since it empowers women. I carried my last child at the age of six months to school ... I am happy because I can express myself in public which was something I could not do before. I can apply to teach anywhere even in theory or practical. I make contribution in the running of the home, support in paying children's school fees, buy something that we lack at home without any problem. I support my husband financially; I am proud of myself for the things I am doing.

Miriam: I never gave up on education in spite of what I went through; I completed standard six and passed the teachers grade three entrance. I had the training and gained employment to teach with the mission primary school; after three months some volunteers came from community development and sensitized us about an exam into community development training. Three of us went for the exam from my place; I succeeded alone out of the three. After the training I was employed.

Miranda: I am a member of the credit union and MC2 bank, which is also a financial institution. In the credit Union I am registered as an individual, while in MC2 my group is registered and I benefit through the group's membership. MC2 provides business and education loan. The interest on the loan is very minimal. The group takes the risks on behalf of their members. I have benefited from the business loan. I took a loan last November to invest in my cassava business.

These form just a few selected examples of the voices and stories that emerged.

Conclusion and recommendations

This paper discussed the advantages that were identified in making use of the life history method as an alternative approach to climate change vulnerability assessment. This paper compared the life history and questionnaire approaches. The aim was to demonstrate how the two approaches differ in analyzing vulnerability, yet both are useful in constructing an understanding of vulnerability. The life history approach brings out how vulnerability builds overtime. It shows how access to education, early pregnancy, forced marriage, domestic violence, and lack of land ownership contributed to women's vulnerability. Although the outcome of the research cannot be generalized to the population as a whole in the same way that a more quantitative method could, it does indicate some patterns and deepens our understanding of women's vulnerability. The strength of the approach lies in its 'story telling' nature, which unearths details of gendered and emotional experience. The study identified both experiences of vulnerability and of resilience, as well as various emotional feelings, including regrets, self-esteem, dissatisfaction, confidence and satisfaction. The findings of this research therefore suggest that the life history approach should be considered as an alternative tool for vulnerability analyses.

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Environmental History and Vulnerability: Lessons from the past

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Abstract: Understanding what causes the vulnerability of a particular community to climate and environmental change can be enhanced through detailed historical research into past livelihoods. Equally, identifying livelihood strategies that enhance the resilience of a community can be understood through historical research. Applying contemporary theoretical concepts associated with vulnerability theory to historical research can provide insights which might be useful for adaptation. Concepts such as exposure, risk, adaptation, adaptive capacity and resilience are used to understand contemporary vulnerability to climate change or to predict future vulnerability. However, making use of this theory to identify how natural resource dependent rural communities adapted to and coped with, periods of climate variability in the past, might highlight different lessons relating to contemporary adaptation. As an example – the reconstruction of the livelihoods of the Namaqua Khoikhoi population during the 18th century is presented briefly. The changes in their livelihoods that enable them to cope with climatic variability are highlighted and contrasted with those that eventually led to their material decline. The research makes the case that, in the context of global environmental change, it is important to look back as well as forward to understand resilience.

Introduction

Within the contemporary context of climate change various bodies of theory have emerged to understand the potential ways in which societies are affected by climate and environmental change and ways in which they can potentially adapt to these changes (IPCC, 2014). ‘Vulnerability’ as a concept has its roots in hazard and disaster research and has now grown into an extensive body of theoretical and empirical research (Adger, 2006; Füssel & Klein, 2006; Leichenko & O’Brien, 2008; IPCC, 2014). One of the aims of vulnerability research aims to identify who will be affected worst by climate and associated environmental change. Other areas of focus include who will be worst affected by climate change; how this should be measured and what variables should be included when trying to measure vulnerability (Füssel, 2007; 2010). Linked to this, research on ‘adaptation’ and ‘adaptive capacity’ attempts to identify ways in which communities engage in strategies which enable them to change appropriately in response to environmental pressures and sustain themselves over time (Adger, 2003; Adger & Vincent, 2005; Vincent, 2007). The majority of this research is contemporary, much of it involves ways to measure vulnerability quantitatively and aims to translate this understanding into appropriate response policy.

In this paper, it is argued that detailed historical research in general and environmental history in particular, may provide researchers with a deeper understanding of the processes that create vulnerability over time. In addition, environmental history may provide insights into livelihood changes that amount to adaptation over the long term, that is, livelihood changes that allow communities to survive environmental extremes and recover more quickly after an extreme event. A case study of historical livelihood reconstruction of the Khoikhoi population of Namaqualand is presented briefly to substantiate this argument.

Vulnerability

Climate change has created a new impetus for research focusing on people’s potential for experiencing harm. The concept of vulnerability emerged from early hazard and disaster research which showed that people’s potential for experiencing harm, from a particular natural disaster, was related to their social, economic and political circumstances (Blaikie et al., 1994; Wisner et al., 2004; Janssen et al., 2006; Vogel et al., 2006). Much of this research aims to measure the potential for communities and individuals to experience harm, using approaches which include the development of vulnerability indices (Hahn et al., 2009).

Vulnerability research focusses on potential to experience harm and can be conducted at particular scales: national, provisional, regional, local, household or individual (Adger & Vincent, 2005; Vincent, 2007). Equally, it can be done on different time scales and often involves quantitative index-based, research looking at contemporary situations (Hahn et al., 2009; Füssel, 2007; 2010). Other studies are predictive, looking at future scenarios, such studies are often limited in their capacity to identify the broader, long term drivers of vulnerability.

Concepts associated with vulnerability studies include exposure, risk, adaptation, adaptive capacity and to a certain extent resilience (O’Brien et al., 2004; Janssen et al., 2006; Leichenko & O’Brien, 2008). Resilience thinking differs from vulnerability in that it originated in the natural sciences and involves systems-based research (Holling, 2001; Holling & Gunderson, 2001; Gallopín, 2006). Exposure and risk are related concepts which focus on, among other things, the degree to which a particular unit, be it a household, community, group, or nation state; is exposed to the

risks associated with climate change. Risk can change over time depending on the combination of livelihood activities. The type of exposure experienced might be directly related to climate change and natural fluctuations or it may be indirect and involve exposure to wider economic fluctuations (O'Brien & Leichenko, 2003; O'Brien et al., 2009). The extent to which a community is able to adapt successfully over time will be determined by its adaptive capacity (Engle, 2001; Brooks et al., 2005; Smit & Wandel, 2006; Goldman & Roismena, 2013). Adaptation, in this sense, is the term used to indicate that the community has been able to change to cope with fluctuations, and to maintain its livelihood and stability over time (Adger & Vincent, 2005; Nelson et al, 2007; Eriksen & Kelly, 2007).

Research into the livelihoods of natural resource dependent rural communities, which in the past would have been conducted within a rural livelihoods framework, or with a focus on poverty is now regularly conducted from the perspective of measuring vulnerability to future climate change. "Vulnerability is produced in and by society" and as a research framework, allows an understanding of the confluence of environmental stress with various forms of social and economic powerlessness (Ribot, 2014, 667).

One critique of vulnerability and adaptation research is that it tends to focus "on response rather than the causality" (Bassett & Fogelman, 2013, 47). It is often quantitative, making use of methodologies to measure vulnerability such as vulnerability indices (Hinkel, 2011). The variables to be included in these measurements are debated, as is the weighting of the variables, since they will affect the outcome of the measurement (Füssel, 2007). In contemporary cases, groups or nation states could lose out on the IPCC's adaptation funding, depending on the variables chosen and the weighting used, to measure vulnerability (Vincent & Cull, 2014).

Ribot (2014) critiques contemporary vulnerability research which aims to identify "who is vulnerable rather than why, indicators rather than explanation, fixes rather than causes – as if cause were not part of redressing vulnerability and its production" (Ribot, 2014, 669). In fact, with the focus on the potential for future harm associated with climate change, vulnerability studies are often predictive in nature. As such, much contemporary vulnerability research has missed the opportunity to learn from historical lessons of adaptation. With calls for more robust engagement of the humanities in climate change research and for multi-disciplinary approaches to researching contemporary environmental problems, deep historical enquiry into past human-environment relationships becomes important (Hulme, 2009; 2011; Brown et al., 2010; Lawrence, 2010).

Vulnerability frameworks are useful theoretical conceptualizations designed to assist in identifying the root causes of vulnerability. Examples of these frameworks include the pressure and release framework (Wisner et al., 2004); the adaptability/resilience framework (Fraser, 2007) and the double exposure framework (Leichenko & O'Brien, 2008). Each of these frameworks is applicable to particular local contexts over different time frames. The pressure and release framework examines the social, economic, political and environmental drivers of vulnerability, showing how these differ for specific groups in a society. This framework, allows for the identification of the 'root causes' of vulnerability, that result in particular groups being negatively affected when a hazard or disaster occurs (Wisner et al., 2004). For the most part, applications of this framework have not extended as far back in time as the research done for this paper. Fraser's adaptability/resilience framework made use of historical case studies to examine historical vulnerability (Fraser, 2007). An attempt was made to apply this to the Namaqua case, but it was not found to correspond to the circumstances of this study. On the other hand, the double exposure framework, which was designed for the contemporary situation, examining the confluence of multiple stressors of environmental change and globalization did seem to apply in this case due to its emphasis on exposure (this is the subject of a different paper: Kelso and Vogel, 2015).

Eriksen et al. (2011) argue that it is important for adaptation to be sustainable proposing three principles of sustainable adaptation that are relevant to this research. Firstly, they argue that effective, sustainable adaptation should recognize the particular local context in which it takes place, secondly that it should integrate local knowledge in adaptation practice, and lastly that feedbacks between local and global processes should be considered (Eriksen et al., 2011). Given these criteria, historical vulnerability research is particularly well placed to assist in identifying sustainable adaptation, because it covers a long time frame. In addition, it allows for the identification of causes of vulnerability and of adaptations that were effective over a long time period.

Recent research in vulnerability theory suggests that we recognised that adaptation is a process that should be viewed and understood over time, tracing so-called 'pathways of adaptation' (Wise et al., 2014). This can be aided by historical research into past society-nature relationships and adaptation to climate variability.

Environmental history and societal adaptation

Historical research differs from contemporary vulnerability research due to its longitudinal perspective that allows for the identification of adaptation that was successful or unsuccessful in the past (Brown et al., 2008). ‘Tipping points’ which have caused the decline of societies can be more effectively identified through historical research (Butzer, 2012, 109). In addition, in revealing how humans have interacted differently with nature in the past there is the possibility of revealing lessons that relate to transformative adaptation (O’Brien, 2010; 2012). Historical research has the advantage of shedding light on the processes that create vulnerability rather than simply measuring existing vulnerability (Endfield, 2007; Ribot, 2014).

Several studies have investigated historical vulnerability. These include research undertaken in southern Africa, (Hannaford et al., 2014), India (Adamson, 2014), colonial Mexico (Endfield & Fernández Tejedo, 2006; Endfield, 2007) as well as Mozambique (Ekblom, 2012). These have focussed on the social or environmental factors that have caused the decline of these societies. This suggests that historical research is important for understanding adaptation in contemporary contexts.

Historical method

The main difference between historical vulnerability research and contemporary vulnerability research is the methods used for the investigation. The methods used for historical research include conventional historical methods such as historical documentary research, historical policy research as well as historical environmental research. This research can focus on past livelihoods, past human-environment relationships and particular environmental factors such as plants, soil, livestock management strategies. Historical adaptation to climatic extremes and indigenous knowledge systems are also important areas for research.

More of this kind of research has been done in the international arena than in the South African context (Brádzil et al., 2005; Harrison, et al., 2013; Todd et al. 2013). In the African context the fact that most of the records have been written by the colonial population is problematic. Thus, in order to interpret the livelihoods of the local population, all available documentary and other sources of information should be consulted and interpreted. Combining historical documentary research with archaeological research; interpretation of remaining art and artefacts and linguistic and ethnographic research could potentially provide much deeper insights and more nuanced information.

In the case study referred to in this paper the livelihoods of the Namaqua Khoikhoi were researched with the aim of examining the way in which their livelihoods have changed over time. The period examined spanned the earliest available written records, from the mid-1600s until the early 1900s, with the main focus being on the 1800s (van der Stel, 1979). The intention was to account for the decline that occurred in their material circumstances and to identify the role of climatic extremes in accounting for this decline. The way in which the Namaqua Khoikhoi adapted to climatic fluctuations such as drought periods in the past were also identified (Kelso & Vogel, 2015).

Background

Namaqualand is a semi-arid region prone to extended periods of low rainfall (Cousins et al., 2007; Hoffman et al., 2007). Recently, it has been shown that minimum and maximum temperatures have been increasing over the last century (Davis et al., 2016). As part of the broader study for this research a proxy precipitation data set was constructed for the 19th century, with particular interest in identifying the extended drought periods (Kelso and Vogel, 2007; Neukom et al., 2013). This did not show a notable difference in the frequency or intensity of drought and dry periods between the 19th century and the 20th centuries. In the absence of measured meteorological data drought intensity can only be interpreted on a very broad scale.

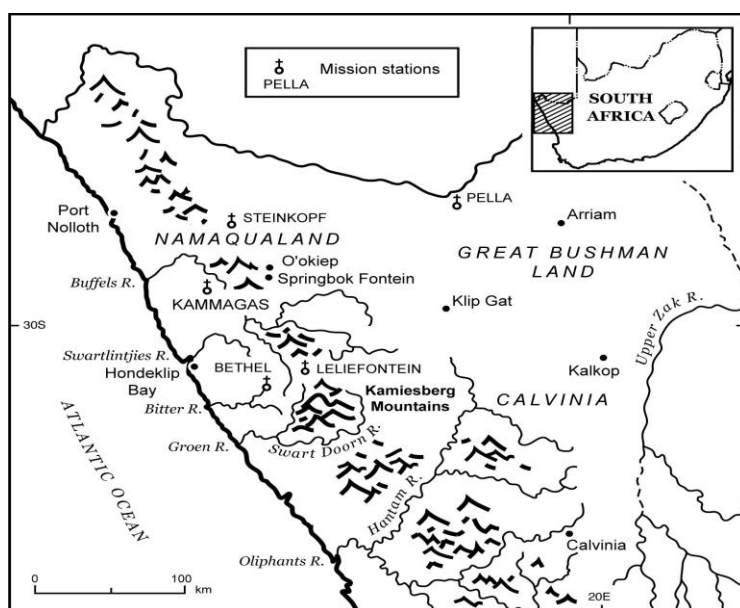


Figure 1: Map of the Namaqualand Region

Historical livelihood research

The primary research for this study involved a detailed review of all historical documentary records, as well as secondary archaeological studies for the region, from the earliest available records until around 1928 (Webley, 1992; 2007). The aim was to reconstruct the climate of the area as well as the livelihoods of the Namaqua Khoikhoi population. The focus was on Namaqualand generally and on the Kamiesberg mountain region and the Leliefontein mission settlement in particular. The aim of the research was to reconstruct the livelihoods of the local population and to see how they had coped with drought and climatic variability in the beginning of the 19th century. What became obvious was that they were able to cope better with droughts in the beginning of the 19th century and to recover quicker after drought periods than they were in the second half of the century. A full examination of the livelihood change has been published in a previous paper, and is only summarized here to serve as an example of how a detailed historical study can yield a different understanding of sustainable adaptive practices (Kelso & Vogel, 2015).

The findings of the historical livelihood study are summarized in table 1 below. In summary, the research identified how livelihood diversity which involved exposure to the wider economy seemed to be responsible for an increase in the exposure, risk and vulnerability of the population. Involvement in mining and transport riding for mines exposed the Namaqua Khoikhoi population to economic factors external to their environment and through that, to greater fluctuation and eventual decline of their material circumstances (Shaw, 1970; Smalberger, 1975). While they were able to cope with fluctuations in their natural environment, they were not able to do so with fluctuations in the broader economy.

Table 1: Summary of livelihood bundles of Namaqua Khoikhoi

Livelihoods 1800-1850	Livelihoods 1850-1900
Widespread transhumance during droughts	Limited transhumance due to land encroachment
Consolidated control over land	Encroachment on neighbouring land
Predominantly large stock	Predominantly small stock
	Spread of lung sickness
Seasonal agriculture	Seasonal agriculture
	Introduction of wage labour on copper mines and farms
	Later collapse of copper price and mine closures
	Introduction of transport riding
LIMITED LIVELIHOOD DIVERSITY	INCREASED LIVELIHOOD DIVERSITY
EXPOSURE: ENVIRONMENTAL FLUCTUATION	EXPOSURE: ENVIRONMENTAL AND ECONOMIC FLUCTUATIONS

The findings of the research contrast with contemporary arguments that suggest that livelihood diversity is an effective adaptation strategy, in the context of climate and environmental change.

This historical research showed that, in the historical context, livelihood diversity – where this increased exposure, in particular economic exposure – actually reduced the ability of the community to cope with climate extremes. This paper is not intending to make the argument that contemporary communities should revert to limited livelihood activities, consisting exclusively of livestock herding, with widespread transhumance ranges. It is recognized that the contemporary context differs vastly from that of the 18th century. However, these historical findings can be relevant when looking at the rangeland size necessary to sustain livestock in the Namaqualand area, or when entering debates over whether rangelands should be communally managed or divided into private small-holder plots (Liebert & Rohde, 2007; Richardson, Hahn & Hoffman, 2007). This knowledge is useful in the context of land reallocation and re-distribution.



Figure 2: Namaqua Khoikhoi people photographed outside 'matjieshuis' (C.T., AG 14369)

This historical inquiry allowed for the differentiation of adaptation from coping strategies which did not enhance the resilience of the population over time (Eriksen et al., 2005; 2011). Adaptation in this case refers to a change made by a community or group that makes them less vulnerable to climate change or variability. Not all changes made by communities during times of stress are classified as adaptations, only those that make community livelihoods more sustainable over the long term are classified as adaptations (Eriksen et al., 2011).

In this case, widespread transhumance was identified as an effective livelihood strategy in times of drought and climate stress. This then, was a sustainable adaptation over the long term as it allowed faster recovery from droughts and climate extremes. The use of contemporary theoretical frameworks associated with vulnerability and resilience research therefore assisted in identifying the ability of a human-environment 'system' to sustain itself over time and in identifying how this changed over time.

Other historical methods worth considering

In light of this research, other historical methodologies are being explored for their potential in identifying subjective experienced vulnerability and resilience. Initiatives are exploring the use of life histories to examine vulnerability to climate change in the Bamenda Highlands region of the Cameroon (Azong and Kelso, 2016). This research aims to identify the intersectionality between environmental stress and gendered experience. Research into past livelihoods as narrated by the oldest members of the community in Tsekong Village in the Eastern Cape is also being conducted. These are ongoing projects which are not published as yet but so far they are yielding different results to the index-based vulnerability research and to the historical research used for this study. Broader research,

which encompasses different disciplines such as anthropology, sociology, linguistics and archaeology might yield different insights as to how communities have coped with extremes in the past (Brown et al., 2010; Hulme, 2011).

Lessons from the past

This case study illustrates how historical research can provide insights that challenge contemporary narratives of adaptation. In the Namaqua case specifically it emerged that livelihood diversity did not increase resilience and was not an effective adaptation. Instead, widespread transhumance and adaptations that worked within the limitations of the natural resource base, were effective over the long term. Recovery was quickest in the first half of the 19th century when exposure remained within the natural environment and had not expanded to include the broader international economy. This research supports recent calls that vulnerability research should explore the causes of vulnerability be they social, economic, political or environmental (Ribot, 2014; Eriksen et al., 2011). Historical research has a role to play in examining the formation of vulnerability and potential 'pathways of adaptation' (Wise et al., 2014). Finally, contemporary vulnerability theory can provide analytical frameworks to assist in interpreting the past. There are limitations to the degree to which these lessons can be applied to a contemporary context and no attempt is made to suggest a return to pre-mercantile economies, but this example highlights how increased exposure increases risk.

Conclusions

This paper illustrates the value of historical research in vulnerability studies, specifically in determining lessons relating to effective adaptation to climate extremes. As the case study indicates, the success of specific adaptive practices was only identified because the study spanned such a long time frame. This research indicated that widespread transhumance over large rangelands was successful in enabling the Namaqua Khoikhoi population to cope with droughts. This differs from contemporary studies that suggest that livelihood diversification is a positive adaptation strategy. While the usefulness of this is limited in a much-altered contemporary context, aspects of this finding can be of interest for land ownership, land redistribution and stocking density debates. This case study provides evidence that detailed historical research may provide valuable lessons for adaptation.

Studies examining past human-nature relationships through a broader set of methodologies such as archival research, art history research, archaeological research, linguistic research and ethnographic research all have potential for providing insight into alternative, more sustainable human-nature relationships. Historical research has huge potential in assessing integrated human-environment systems and there is scope for applying resilience theory to the past in order to identify characteristics of resilient systems. Finally, detailed, local-level environmental histories assist in understanding the complexity of the past, the drivers of vulnerability as processes and pathways, and may provide lessons which help in re-imagining the future.

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C.T: Cape Town National Archives, Roeland Str. Cape Town. Photograph collection: AG14369 Namaqua pictured outside Matjieshuis with goats. No date.

ENVIRONMENTAL PROCESSES, CONDITIONS AND GEOGRAPHICAL TECHNOLOGIES

DETECTING AND MAPPING SMALL SUBSISTENCE FARMS ON FLOODPLAIN WETLANDS USING WORLDVIEW-2: COMPARISON OF SUPPORT VECTOR MACHINE AND MAXIMUM LIKELIHOOD CLASSIFIER ALGORITHMS

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Abstract: Wetlands contribute in diverse ways to the livelihoods of many people yet human encroachment and intensified agricultural activities have threatened the existence and the functions of wetland ecosystems. In particular, in this study area, subsistence and commercial agriculture in the form of banana and sugarcane are a threat to the wetland as both types of farming are dependent on good water supply. Despite the assumed contribution of subsistence agriculture to wetland loss and degradation, few studies have quantitatively assessed the extent of impacts of agriculture on wetlands. Understanding the nature and extent of impacts of agricultural activities on wetland environments is therefore an important initial step towards ensuring sustainable subsistence farming that aims to maximise farming activities as well as promote the productivity of wetlands. The need for an effective monitoring system for wetland conservation and management is required. However, detecting and mapping these small subsistence farms in wetland areas is difficult due to poor accessibility and is also costly and time consuming using traditional field surveys. Remote sensing can be a powerful tool to monitor wetland changes, degradation as well as wetland losses. This main objective was to evaluate the performance of support vector machine (SVM) and maximum likelihood classifier (MLC) in detecting small subsistence farming operations in floodplain wetlands of the lower Mfolozi catchment in KwaZulu, Natal, South Africa using high spatial resolution Worldview-2 (WV-2). The results from this study show that the small subsistence farms in wetlands can be accurately mapped using WorldView-2, maximum likelihood classifier (MLC) and support vector machine classifier (SVM) with an overall accuracies of 73% and 70%, respectively. These results provide a robust and accurate spatial framework to assist wetland managers in focussing their existing monitoring and control efforts to specific areas that are highly susceptible to the agricultural impacts.

Introduction

Wetlands contribute in diverse ways to the livelihoods of many people (Verma and Negandhi, 2011). Wetland ecosystems provide flood attenuation, maintenance of dry season flow, pollution control and detoxification, climate regulation, freshwater for drinking and domestic supply, agriculture, fiber and fuel, medicinal purposes and biodiversity support (Mailvaganami, 1994; Sahagian and Melack, 1996; Seyam *et al.*, 2001; McCartney and van Koppen, 2004; Emerton, 2005; Junk *et al.*, 2006). Wetlands can provide the retention, recovery and removal of excess nutrients and waste treatment (Finlayson *et al.*, 2005). Wetlands act as sinks for greenhouse gases such as carbon dioxide which influence local and regional weather patterns (Finlayson and D'Cruz, 2005).

Despite the above important ecosystem services, wetlands are threatened (Adam *et al.*, 2010; Ramsar, 2010; Thorburn *et al.*, 2011; Turyahabwe *et al.*, 2013). Most of the wetland ecosystems have been lost through anthropogenic activities such as water abstraction, agricultural practices and pollution (Frenken, 2005). Dams and water abstraction can reduce the amount of water available to support wetlands and river systems, which alter water flowing downstream (Davies and Day, 1998). Farming practices, which use a lot of water for irrigation purposes can cause changes in the catchment soil and vegetation conditions leading to disturbances of how precipitation is routed to wetland catchments. The latter leads to major disturbances of the wetland water budget or cycle (Voldseth *et al.*, 2007). Discharge of waste and irrigation return flows from agriculture cause pollution to wetlands through eutrophication (Katukiza *et al.*, 2014; Nyenje *et al.*, 2014). South Africa is a water-scarce country receiving an average of less than 500 mm of rainfall per year (Breen and Begg, 1989; WWF, 2004) and almost all of its accessible freshwater has already been allocated for use, of which agriculture, industry and mining are the largest users (DWA, 2010). Approximately 85% of the coastal wetland area in KwaZulu-Natal has been transformed into sugarcane fields leaving a few scattered patches of wetlands (Begg, 1986).

The need for an effective monitoring system, which can enhance wetland conservation and management is required for South Africa. It is difficult to monitor wetland environments on a regional scale because of high costs of surveys, is time consuming and limited accessibility to wetlands (Ozesmi and Bauer, 2002; Adam *et al.*, 2010). It is important to make inventories of both historical and current changes of wetlands in terms of the extent to which agricultural activities pose threats to the sustainability and integrity of wetlands (Scott, Gauthier and Mudie, 2014). Remote sensing and GIS can be powerful and effective techniques to monitor changes and degradation in wetland environments, which can lead to losses in wetlands (Munyati 2000, Ozesmi and Bauer 2002). Contribution of small subsistence farms to wetland degradation can be overlooked due to the lack of detailed inventories at a scale that is appropriate for their assessments. Therefore, this study aims at evaluating the performance of support vector

machine (SVM) and maximum likelihood classifier (MLC) in detecting and mapping small subsistence farming operations in floodplain wetlands of the lower Mfolozi catchment in KwaZulu, Natal, South Africa using high spatial resolution Worldview-2 (WV-2).

Materials and methods

Study area

The Mfolozi floodplain (Figure 1) is an extensive floodplain wetland system, which is approximately 19 000 hectares in extent (Ellery, *et al.*, 2009). The upper two-thirds of the floodplain have been transformed to cultivate sugarcane and to a lesser degree *Eucalyptus* plantations. The remainder falls within the Isimangaliso Wetland Park but has nevertheless been extensively cultivated by small-scale subsistence farmers (Grenfell, *et al.*, 2009). According to Grenfell, *et al.* (2009), historically, the floodplain was a mosaic of permanent and seasonal herbaceous wetland, with *Cyperus papyrus* and *Phragmites australis* as the dominant plant species. Where vegetation has not been cleared, *Ficus trichopoda* trees occur on the banks of abandoned and active channel courses. The Mfolozi River flows eastward along the northern part of the floodplain. A second river, the Msunduze River, drains a localized catchment, and flows along the southern margin before turning northward at the Maphelane dune cordon, and joining the Mfolozi River near its mouth. The region experiences a subtropical climate, with large seasonal variations in precipitation. Thus, despite subtropical temperatures, inundation of the floodplain is seasonal. Rainfall in the region of the coastal Mfolozi floodplain averages 1090 mm/a, declining to 645 mm/a toward the upper catchment boundary. Potential evapotranspiration on the floodplain is 1805 mm/a (Schulze, 1997).

Image acquisition and pre-processing

A cloud-free WV-2 image captured on 11 June 2015 was used in this study. WV-2, launched October 2009, is the first high-resolution 8-band multispectral commercial satellite. Operating at an altitude of 770 km, WorldView-2 provides 46 cm panchromatic resolution and 1.85 m multispectral resolution. WorldView-2 has an average revisit time of 1.1 days (www.satimagingcorp.com/satellite-sensors/worldview-2/). The sensor has eight bands, coastal band (400-450 nm), blue (450-510), green (510-580), yellow (585-625 nm), red (630-690), red edge band (705-745nm), near infrared 1 (770-895) and near infrared 2 (860-1040nm).

Worldview 2 imagery was obtained from Digital Globe in a Tagged Image File Format (TIFF) files with D-WGS-1984 projections, which made it possible to export them to ENVI 5.3 and GIS processing software. Images were already orthorectified by the provider. The imagery was atmospherically corrected using Flaash Standard Model on ENVI 5.3 software. Images were re-projected to UTM Zone 36S using projections and transformation toolset on ENVI 5.3.

Reference data collection

A true colour composite (bands 5, 3 and 2) was created for better identification of land cover classes; grassland, built-up areas, degraded grassland, coastal sand, indigenous forest, plantation forest, mature sugarcane, young sugarcane, subsistence farms, waterbody, wetland and bare-land & harvested sugarcane. Training classes (Table 1) were created for each land cover class based on field survey information. Signatures describing statistical characteristics of each land cover class were extracted using the Area of Interest (AOI) tool in ENVI 5.3. The reference data were collected using simple random sampling based on their represented land cover classes within the study area. The reference data were then divided randomly into training and validation data sets (Table 1).

Image classification

The Support Vector Machine (SVM) and Maximum Likelihood Classifier (MLC) supervised classification techniques were used to classify land cover classes. In the following subsections, a brief explanation of the two classification algorithms is provided.

Support vector machine

The Support Vector Machine is a machine learning supervised classifier trained to find an optimal classification hyperplane through minimizing the upper bound of the classification error (Cortes and Vapnik, 1995). Vapnik (1995) further explained that the hyperplane with SVM leaves the maximum margin between the two classes, where the margin is defined as the sum of the distances of the hyperplane from the closest point of the two classes. If the two classes are non-separable the SVM looks for the hyperplane that maximizes the margin while at the same time minimizes a quantity proportional to the number of misclassification errors.

Maximum likelihood classifier

The Maximum Likelihood Classifier is the classification technique that assigns pixels in the image to the class that has the maximum likelihood of belonging to (Lillesand *et al.*, 2000; Ndzeidze, 2004). It has a sound theory and preferred algorithm especially in land cover and land use monitoring approaches (Palaniswami *et al.*, 2006 and Lillesand and Kiefer, 2004). It is available in many commercial image processing software, and is therefore the mostly used technique (Palaniswami *et al.*, 2006; Lillesand and Kiefer, 2004; Gao, 2008; Otukey and Blaschke, 2010).

Accuracy assessment

Accuracy assessment determines the quality of the classification derived from remotely sensed data (Congalton and Green, 1999). Accuracy assessment was conducted for the classified image using confusion matrix module on ENVI. A confusion matrix was subsequently constructed to compute the overall accuracy, user's and producer's accuracies, and kappa statistic (Congalton and Green, 2008). An error of commission represents pixels that belong to another class but labelled as belonging to the class, whilst error of omission represents pixels that were assigned to the incorrect class. The Kappa coefficient is an overall index which combines both errors of commission and omission. It demonstrates a measure of reliability of the classification. According to Landis and Koch (1977), Kappa ranges between 0 and 1. The Kappa can be broken into six groupings for interpretation. Table 2 presents KIA statistic and strength of agreement (Viera and Garrett, 2005).

Results: Performance of SVM and MLC

Twelve land cover classes including subsistence farms were obtained from the use of SVM and MLC (Figure 2 and 3). Generally, as seen in the overall accuracy results, MLC had higher overall accuracy than SVM, however, SVM performed better than MLC with higher user's and producer's accuracies for small subsistence farms. These results are in agreement with Szuster *et al.*, 2011 and Yu *et al.*, 2012. Szuster *et al.*, 2011 examined and compared the performance of the SVM and MLC classification techniques in the tropical coastal zone and has been concluded that SVM is a better classifier. Yu *et al.*, 2012 also applied SVM and MLC in lithological classification using Aster imagery, results also showed that SVM gives higher accuracy in comparison to MLC.

Accuracy assessment was performed for both SVM and MLC classifiers to evaluate the prediction performance of the trained models using the independent test data set. Tables 2 and 3 show detailed confusion matrices of classification accuracies for SVM and MLC, respectively. The MLC classifier had a higher accuracy than the SVM classifier. The overall accuracy for MLC was 73 %, with a kappa value of 0.69. In both classifiers, waterbody, coastal sand, indigenous forest and bare-land & harvested sugarcane achieved high user's and producer's accuracies. MLC generated lower user's and producer's accuracies for grassland, degraded grassland, young sugarcane, wetlands, subsistence farms and built-up areas. Using MLC there was a class confusion between pixels for subsistence farms and wetlands because of the open canopy of subsistence farms. Young sugarcane was also confused with grassland. On the other hand, based on SVM there was a confusion between young sugarcane, grassland and wetland, mature sugarcane and young sugarcane generating lower user's and producer's accuracies. SVM generated better user's and producer's accuracies on subsistence farms than the MLC classifier.

Discussion

Detailed land cover mapping is an important research topic in land change science and landscape planning nowadays. Anthropogenic activities are constantly changing land cover patterns and influencing biophysical processes (Li *et al.*, 2014). To estimate agricultural extents, detailed and accurate Land-Use and Land-Cover (LULC) maps generated from high-resolution images are desired in the decision-making process to manage sustainable land resources. According to Foody 2002; Lu and Weng, 2007 cost and availability of remotely sensed data with appropriate spatial, spectral, and radiometric resolutions continue to be an impediment to wide application in LULC mapping. Against this background this study sought to determine the performance of the multispectral-sensor (Worldview-2) in mapping and detecting small subsistence on floodplain wetlands.

Classification results in this study demonstrated that Worldview-2 imagery using SVM and MLC classification techniques are valuable in mapping and detecting the human activities such as agricultural practices in the wetlands. Using SVM and MLC, high classification accuracies were achieved (Tables 2 and 3). SVM and MLC successfully classified twelve LULC classes and their results were compared. MLC achieved higher classification overall accuracy than MLC by 3% (Tables 2 and 3), nonetheless SVM performed better in classifying subsistence farms which was the main aim of the current study. The spatial and spectral characteristics of the WorldView-2 data set allowed us to separate areas covered by sugarcane into three LULC classes: mature, young, and harvested. We also successfully separated areas covered by grass into degraded grassland and grassland. In South Africa, attempts to separate these cover types using traditional multispectral data (SPOT and Landsat) have to date been unsuccessful (Fairbanks *et al.*, 2000; Islam *et al.*, 2008; Otukey and Blaschke, 2010; Cho *et al.*, 2012). Diverse studies that have used VW-2 for predicting and mapping forest structural parameters, urban land cover mapping and discriminating

commercial forest species have concluded that VW-2 data have considerably improved the classification and prediction accuracies compared to conventional sensors (Ozdemir and Karnieli, 2011; Zhou *et al.*, 2012; Peerbhay *et al.*, 2014).

Both SVM and MLC were unable to fully deal with the high spectral variation inherent in some LULC types such as mature sugarcane, grassland and wetland, and hence classification error on the LULC maps (Figures 2 and 3) which is consistent with Adam *et al.*, 2014. According to Lu and Weng, 2007; Duro *et al.*, 2012, the issue of high spectral variation inherent in some LULC types is a common problem when classifying heterogeneous landscapes using high spatial resolution based on per-pixel classification techniques.

The overall accuracies obtained in this study provides reliable information that can be used to assist wetland managers in focusing their existing monitoring and control efforts to specific areas that are susceptible to agricultural impacts. Therefore, this knowledge is critical in the management of our endangered and threatened wetland ecosystems in South Africa. Notwithstanding, the interpretation of these results can only be regarded as preliminary, since further research is needed in using Worldview-2 in the study area. Given the overall accuracies achieved for broad LULC classes, further research is required to develop a technique to classify land cover types. Random Forests (RF) can be used which are known to be more accurate on forests and globally on croplands (Pelletier *et al.*, 2016). The use of object-based classification would have improved the results than pixel-based classification. Pixel based classification only uses the spectral information in the image while object based classification uses spectral, spatial, contextual, and textual information (Flanders *et al.*, 2004; Leukert, 2004). In object-based classification, the image is segmented into objects that form the classification units, which improves classification accuracy (Manakos *et al.*, 2000; Niemeyer and Canty, 2003).

Conclusion

The present study has provided an insight in evaluating multispectral sensor, Worldview-2 with classification techniques SVM and MLC to demarcate land cover types in a heterogeneous coastal landscape. When comparing the two classifiers, results demonstrated the similarity of the overall performance of SVM and MLC with a slight higher percentage accuracy by SVM in classifying subsistence farms. Misclassifications or confusions of LULC types can be attributed to high spectral variation inherent. Subsequently, the use of alternative approaches such as random forests and object based image algorithm should be further explored.

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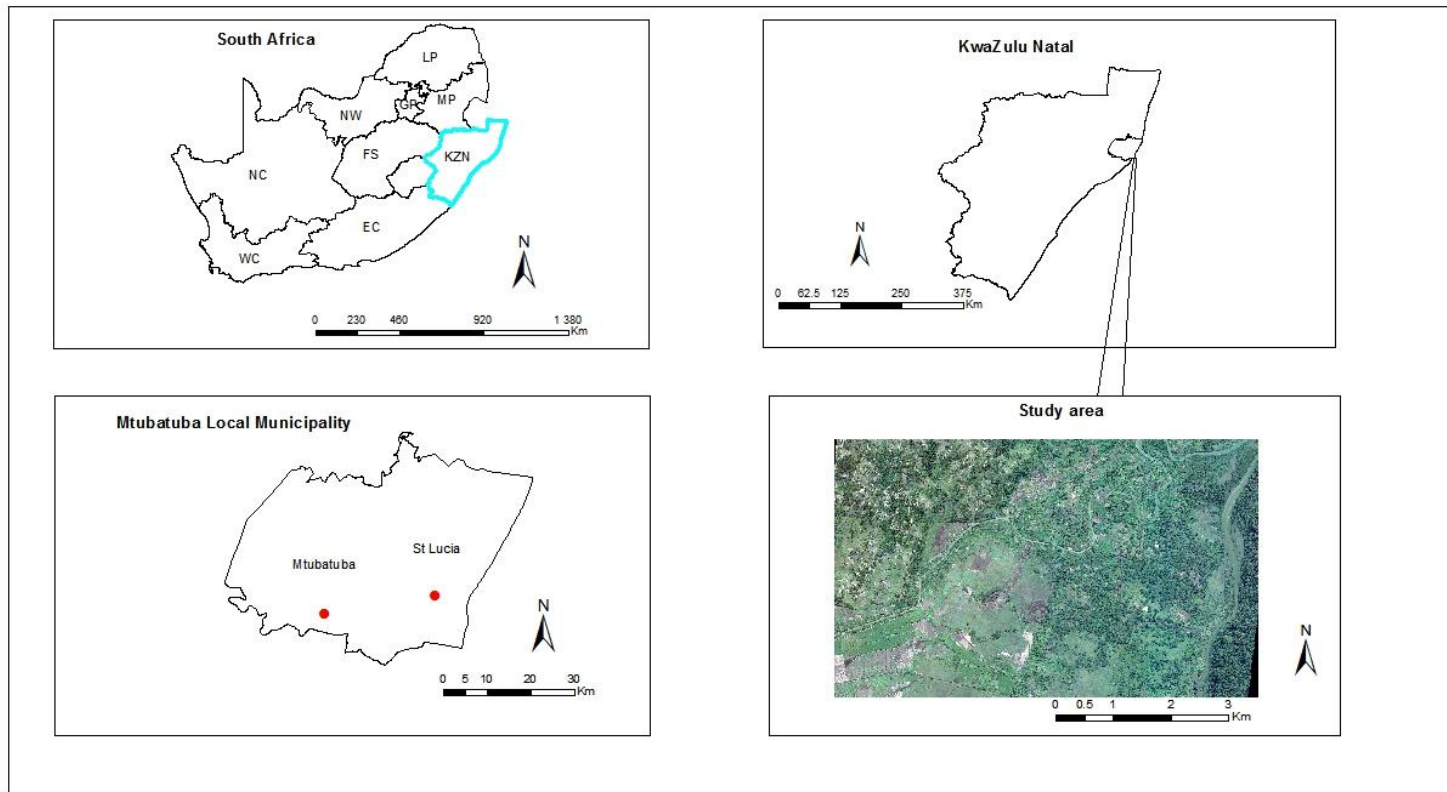


Figure 1: The location of the study area Mfolozi wetland floodplain in KwaZulu Natal, South Africa.

Table 1: Training and validation data sets for the land cover classes

Land cover class	Code	Training data set	Validation data set	Total
Grassland	G	8628	3080	11708
Built-up areas	BUA	2441	1797	4238
Degraded grassland	DG	6033	3817	9850
Coastal sand	CS	5317	4872	10189
Indigenous forest	IF	7993	5530	13523
Plantation forest	PF	2620	2046	4666
Young sugarcane	YS	4364	3987	8351
Mature sugarcane	MS	2462	1831	4293
Subsistence farm	SF	7887	3677	11564
Waterbody	WB	3744	3739	7483
Wetland	WL	18111	7188	25299
Bareland & harvested sugarcane	BHS	10966	10707	21673

Table 2: KIA statistic and strength of agreement (Presented after Viera and Garrett, 2005).

KIA	Strength of Agreement
< 0.00	Poor
0.21 – 0.20	Slight
0.21 – 0.40	Fair
0.41 – 0.60	Moderate
0.61 – 0.80	Substantial
0.81 – 1.00	Almost perfect - Perfect

Table 3: Confusion matrix and associated Maximum Likelihood classifier (MLC) accuracies based on independence test data set. The accuracies include: Overall accuracy (OA %), kappa statistic, user's accuracy (UA %), and producer's accuracy (PA %).

Class	G	BUA	DG	CS	IF	PF	MS	YS	SF	WB	WL	BHS	Row Total	UA
G	2258	12	2522	1	106	4	56	493	347	0	3270	0	9069	25
BUA	6	1080	1	23	2	0	0	10	156	0	8	11	1297	83
DG	2403	89	4073	1	113	70	81	180	383	0	1008	2	8403	48
CS	0	149	0	6439	0	0	0	6	16	12	5	7	6634	97
IF	203	142	286	60	19647	1299	1471	5	391	0	282	196	23982	83
PF	3	36	11	0	313	1696	69	0	11	0	132	0	2271	75
MS	0	7	8	2	698	88	7909	1	344	0	0	0	9057	87
YS	657	205	255	56	57	0	0	2620	608	0	360	6	4824	54
SF	326	151	830	23	771	43	341	99	3297	0	1062	627	7570	44
WB	0	3	0	388	0	0	0	0	5	8595	0	0	8991	96
WL	1016	123	768	105	503	2	7	788	453	0	6275	398	10438	60
BHS	0	1194	0	242	2	0	0	16	128	0	821	13748	16151	85
Column Total	6872	3191	8754	7340	22212	3202	9934	4218	6139	8607	13223	14995	108687	
PA	33	34	47	88	88	53	80	62	54	100	47	92		
OA	73													
Kappa	0.69													

Table 4: Confusion matrix and associated Maximum likelihood classifier (SVM) accuracies based on independence test data set. The accuracies include: Overall accuracy (OA %), kappa statistic, user's accuracy (UA %), and producer's accuracy (PA %).

Class	G	BUA	DG	CS	IF	PF	MS	YS	SF	WB	WL	BHS	Row Total	UA
G	3180	25	832	15	111	25	34	70	159	0	2573	4	7028	45
BUA	13	1897	2	66	6	25	34	70	159	0	72	92	2436	78
DG	320	13	3917	4	89	19	52	97	101	0	1706	14	6332	62
CS	4	38	1	4992	0	0	0	6	23	2	33	41	5140	97
IF	8	87	88	9	5630	357	107	0	1047	0	177	15	7525	75
PF	3	26	105	0	712	2146	111	0	276	0	79	4	3462	62
MS	4	0	27	1	139	68	215	3287	0	356	68	0	4165	50
YS	76	30	166	7	32	0	2	1931	139	0	1041	17	3441	56
SF	71	133	145	81	538	38	62	27	3777	0	582	25	5479	69
WB	0	1	0	345	47	186	0	0	0	3839	0	0	4418	87
WL	238	72	345	47	186	3	9	121	411	0	7288	47	8767	83
BHS	150	0	119	5	36	150	10	0	2	168	1482	11707	13829	85
Column Total	4067	2322	5747	5572	7526	3017	636	5609	6094	4365	15101	11966	72022	
PA	78	82	68	90	75	71	34	34	62	88	48	98		
OA	70													
Kappa	0.66													

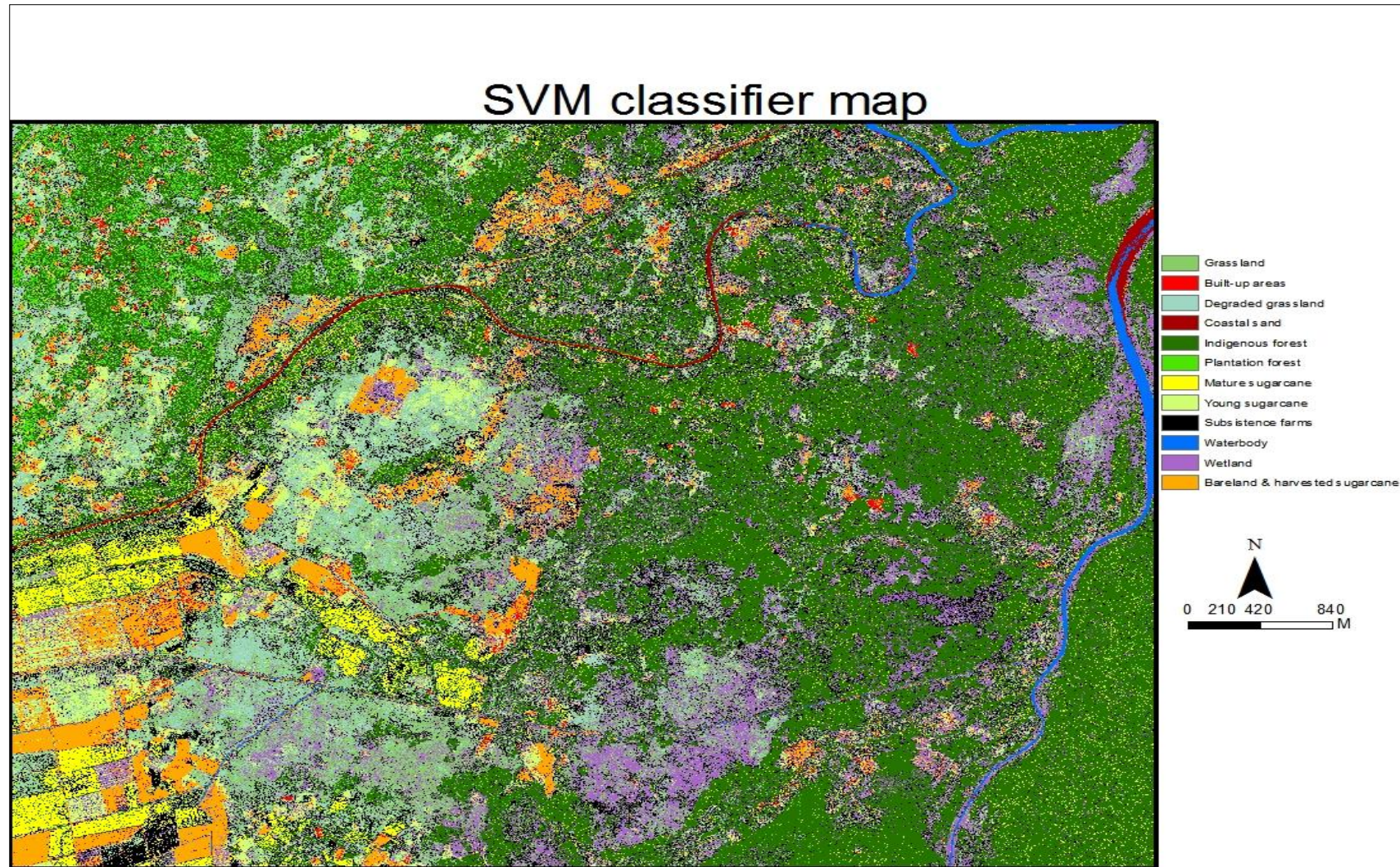


Figure 2: Land use/ land cover classification based on support vector machine classifier

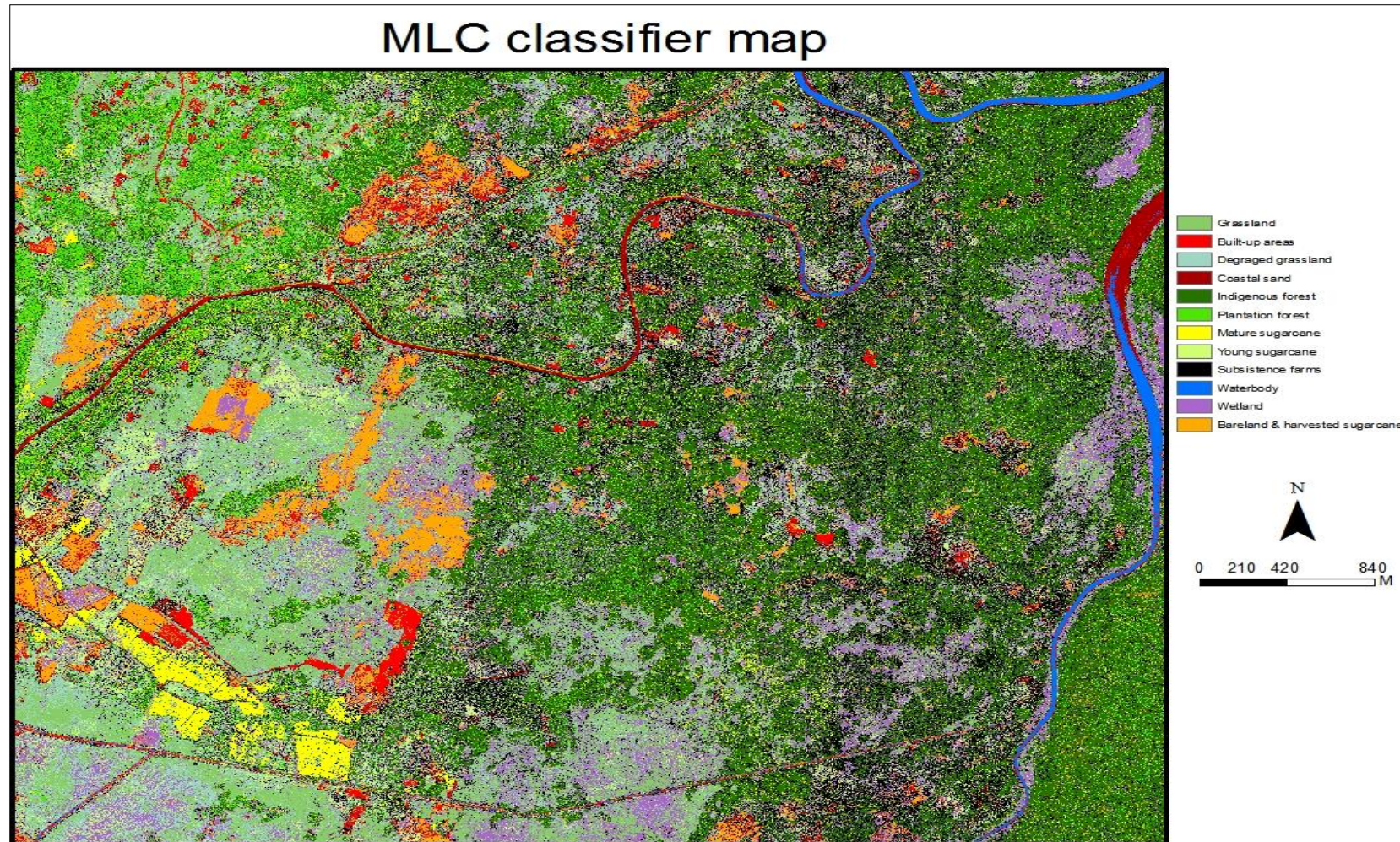


Figure 3: Land use/ land cover classification based on maximum likelihood classifier

LAND COVER CHANGE INDUCED BY MILITARY ACTION: A CASE STUDY OF TWO SOUTH AFRICAN MILITARY TRAINING AREAS

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Abstract: Military activities may cause significant land cover changes. The more frequent and aggressive the military exercises, the more severe the impact on land cover. Remote sensing techniques have been used to study land cover change in the Grahamstown Military Training Area (GMTA) and the South African Army Combat Training Centre (SAACTC). High resolution satellite imagery for 2001 and 2013 and for 1991 and 2014 were analysed for the GMTA and SAACTC, respectively. An unsupervised classification method was adopted to classify and define the land cover types in the satellite images. This study shows that the impact of military activities on vegetation in both light and heavy military training areas is relatively similar. However, the magnitude of change varies from one case to another. At the GMTA, the results show that woodland increased by approximately 2.07%, while grassland and bareland decreased by 1.47% and 0.61%, respectively, between 2001 and 2013. The results for the SAACTC revealed that grassland surfaces increased by more than 9.45%, whereas the woodland and bareland surfaces decreased by magnitudes of 9.33% and 0.11%, respectively, between 1991 and 2014. The increase in grassland surface and decrease in woodland cover are attributed to both physical disturbances and fires that usually ignite during training exercises. Nevertheless, the suspension of some training areas from military exercises at the SAACTC accounts for the decrease in bareland surface over the period of 23 years.

Introduction

Remote Sensing has proved to be an efficient tool to study and monitor land cover change overtime (Goodchild, 1994; Al-Tamimi & Al-Bakri, 2005). Various factors induce changes in land cover, namely, urbanisation, agricultural expansion, land pollution and deforestation. Natural factors such as changes in rainfall patterns and pest infestation may have a similar impact. Military training exercises during peacetime can also have a considerable negative impact on land cover changes within military controlled land areas. Military training exercises assume various forms and each training exercise has its own influence on the land cover in the area being used.

Military training exercises include infantry training involving small-arms firing, combat vehicle operations, mortar and artillery firing, as well as airstrikes (Whitcotton, David, Darmody, & Price, 2000; Johnson, Wang, Howard, & Anderson, 2011). Quist, Fay, Guy, and Knapp (2003) argue that military land use involves movement of large and wheeled vehicles which have impacts ranging from minor to severe soil compaction and surface alteration. These activities cause both acute and chronic disturbances in ecosystems (Linkov, Grebenkov, & Baitchorov, 2001). Further, armoured vehicles destroy land cover and alter ecological habitats (Linkov *et al.*, 2001; Harmse, 2003; Warren, Holbrook, Dale, Whelan, Elyn, Grimm, & Jentsch, 2007; Wang & Wu, 2013). Whitcotton *et al.* (2000) argue that even foot traffic in military training areas can induce significant disturbances on land cover in particular. Moreover, military exercises can also lead to complete loss of land cover, especially where training activities are aggressive and frequent. Nonetheless, it is not an entire training area that suffers the same level of disturbance. Quist *et al.* (2003) and Tikhomirov (2006) argue that the disturbance of the physical environment is not only confined in places over which tracked and wheeled military vehicles drive, but high levels of surface disturbances are also found at target points. Obviously, low-lying segments of the training area are constantly impacted because it is where most of the training activities are carried out. Therefore, military training areas always show heterogeneous landscapes (Warren *et al.*, 2007). Some portions of training areas remain undisturbed, thus, harbour disturbance-averse species; while other parts, where disturbance is frequent, tend to favour disturbance-dependent species (Warren *et al.*, 2007). Military foot traffic has a significant adverse impact on the soil by increasing its bulk density, thereby decreasing rain-water infiltration which, in turn, increases soil erosion (Whitcotton *et al.*, 2000; Quist *et al.*, 2003). Johnson *et al.* (2011) argue that military activities unavoidably cause the degradation of natural resources and land conditions. An increase in soil erosion in conjunction with the destruction of habitats and fragmentation of the landscape in military controlled areas are evidence of the destructive nature of military activities (Johnson *et al.*, 2011).

The current study attempts to investigate the effect of military training on land cover change (change in surface vegetation cover) and establish whether the extent of land cover change varies between heavy military training (aggressive military exercises) and light military training (infantry military exercises).

Research location

The two military training areas of the South African National Defence Force (SANDF) under study are the Grahamstown Military Training Area (GMTA) and the South African Army Combat Training Centre (SAACTC). They have been classified for light and heavy military use, respectively. While light military use denotes a military training area dominated by infantry training exercises with limited mechanised training activities, heavy military use designates the firing of powerful military weaponry and infantry training. The GMTA used by the 6 South African Infantry Battalion (6SAI Bn) is located in the Eastern Cape Province. This is the airmobile battalion of the South African Army. The GMTA is approximately 5 970ha in size (Mckenzie, 1998); this equals 0.005% of South Africa's landmass. Grahamstown lies at the intersection of four different climatic zones [Makana Integrated Development Plan (IDP), 2014]. Accordingly, rainfall is received throughout the year with a mean annual precipitation of approximately 680mm (IDP, 2014). Contrary, Haigh, Fox, Davies-Coleman, Hughes, Atkinson and McCann (2008) argue that the average rainfall for Grahamstown ranges between a 250 and 500mm spread throughout the year. This area has a Mediterranean climate, thus, it receives most of its rainfall during the winter months of the year (SAexplorer, 2014). The lowest average rainfall is received in June (33mm) and the highest average rainfall is recorded in March and October (75mm) of each year. The Grahamstown's climate is semi-arid and has a bimodal rainfall pattern (Haigh *et al.*, 2008). Temperatures range from 5.4°C between June to August and 27°C in January and February, while the hottest and wettest months in Grahamstown are from December to March. The maximum monthly average temperature varies between 20°C and 27°C, save for July. The Grahamstown area is also known as the Albany region, which comprises two forms of succulent plants: xeric succulent thicket and mesic succulent thicket. The Albany Thicket consists of the Great Fish thicket, Great Fish Noorsveld, Kowie thicket and the Eastern Cape Thornveld (Mmoto, 2009). Consequently, the GMTA is characterised by thick Thickets which are found throughout the training area (Brandt, Korobin, Loffer, Tao, Schnetter, Hinder, Castelberry, & Thomas, 2011).

The SAACTC, where the 46 South African Brigade is stationed is located in the Northern Cape Province and is approximately 156 5000ha in size and is divided into ten training ranges (Range A to Range J). Its landmass is equivalent to almost 0.13% of South Africa's total landmass. This military land is also used by the South African Air Force (SAAF) for almost all military purposes such as the firing of high-explosive weapons, anti-tank and armour weapons, anti-aircraft weapons, fire and manoeuvring military training, small-calibre weapons, target hitting and demolition work (DoD, 2005).

The greater proportion of the Northern Cape Province falls within the 0.05 – 0.2 aridity class [Northern Cape State of the Environmental Report (NC/SoER), 2004]. Aridity classes are defined by calculating the ratio of the mean annual precipitation to the potential evapotranspiration (NC/SoER, 2004). According to Van den Berg (2010), it is only the eastern part of the Northern Province - from Kuruman southwards to Hanover - that can be described as semi-arid. This is where the SAACTC is situated. Thus, the SAACTC is located within the rainfall region of the province, where the average annual rainfall is above 230mm. The temperatures in this province are extreme; hence winter is very cold while summer tends to be extremely hot (SAinfo, 2012). The coldest months are June and July. During these months, the minimum temperatures are usually below 5°C with maximum temperatures below 20°C. Maximum temperatures of up to 43°C are normally recorded during the summer months which are November to February (Siyanda District Municipality IDP, 2012/2013).

The SAACTC military training area is situated within the savannah, Kalahari Plains and Mountain Thorn Bushveld Biome (Van den Berg, 2010). It is characterised by succulent vegetation and other plant species common in semi-arid and arid regions. The most common vegetation in the military training area includes the Camel thorn tree (*Acacia erioloba*), the shepherd's tree (*Boscia albitrunca*) and the grey camel thorn tree (*Acacia haematoxylon*) (van Rensburg, 2009). The *Acacia erioloba*, *Boscia albitrunca* and the *Acacia haematoxylon* are endangered plant species found in the training area (van Rensburg, 2009).

Research technique

This study assesses land cover change at GMTA and SAACTC, respectively, using Remote Sensing (RS). Al-Tamimi and Al-Bakri (2005) state that Geographic Information Systems (GIS) and RS can be effectively used to map land use and land cover change. They further indicate that these techniques are relatively cheaper and results are obtained much quicker than the traditional approach of extensive field verification of the interpretation of aerial photographs (Dewan & Yamaguchi, 2009). Busch (2002) states that land managers are always seeking faster and less expensive data collection techniques. Land cover change in recent times is more widespread and happens much faster than before (Green, Kempka, & Lackey, 1994). Accordingly, monitoring of land cover and land use change have become a key component in strategies for managing natural resources (Kiran, 2013). Therefore, a reliable, easily accessible, relatively cheaper and easier to process landcover data is required for careful inventory and monitoring of changes (Mas, 1999; Mutanga, Dube & Ahmed, 2016). However, quick results in some instances may compromise specificity in terms of the severity of degradation, as well as identification of drivers. This affects both classification methods (supervised or unsupervised). For example, the grassland cover class is always known to incorporate gardens and crop/farmlands. In addition, rock outcrops also form a single land cover

class together with bareland surfaces because the two cannot be distinguishable in the image. Nevertheless, satellite images (explained below) of the two military training areas, for two different dates per study site, were acquired and analysed.

Techniques for extracting land cover from pre-processed images are grouped into two types, namely, supervised and unsupervised classification (Lillesand & Keifer, 1994). Supervised classification was not chosen for this study because it requires extensive field survey before classifying the image (i.e. determining land cover classes), and assigning numerical descriptors of various land cover types present in the area of interest (Lillesand & Keifer, 1994; Babamaaji & Lee, 2014; Deka, Dutta & Rabha, 2015). This research adopts the unsupervised classification method to classify and define features on the satellite images (discussed below) (Zhang, Lu, Yang, & Sun, 2011; El Gunaid & ElHag, 2013). Congedo and Munafò (2013) refer to this as the semi-automatic classification method. It classifies elements of the remote sensing imagery according to their spectral signatures (Congedo & Munafò, 2013). However, poor image quality can lead to inaccurate classification of land cover surfaces (Boswell, 2015). Thus, high resolution images are required for this method of classification, and are useful for assessing land cover and land cover change (Congedo & Munafò, 2013). Therefore, unsupervised classification (explained below) was appropriate for this study due to the researcher's inability to conduct ground verification. An extensive field verification of land cover classes is difficult in a military training area due to the existence of unexploded ordnance.

Landsat 5 Thematic Mapper (Landsat 5 TM) of 1991 and Landsat 7 Enhanced Thematic Mapper Plus (Landsat 7 ETM+) of 2001 at a resolution of 30 m, and Landsat 8 Operational Land Imager (Landsat 8 OLI, the Panchromatic Band) of 2013 and 2014 at 15m spatial resolution were used for land cover classification. All these images were downloaded from the United States Geological Survey (USGS) online portal (<http://earthexplorer.usgs.gov/>). The orbital path and row of the imagery for the study area are identified as 170 and 083, respectively. A false colour combination (i.e., infrared, red and green) and natural colour combination (red, green and blue) were used as reference in the interpretation process of Landsat imagery. This is a standard remote sensing method used in interpretation of land cover classes in the current study. Adopting Rawat and Kumar's (2015) approach, sub-images of the satellite images were generated to extract the study area from all the images by creating a geo-referenced boundary. Unsupervised classification and ISODATA (Iterative Self Organizing Data Analysis Technique) were used to classify the multispectral images of 2014 into a specific set of land cover themes (Lillesand & Keifer, 1994). Unsupervised classification approach allows one to set a fairly large number of classes that can subsequently be reduced to fewer classes depending on the variability present in the area. The approach also allows spectral clusters to be identified with a high degree of objectivity (Lillesand, Kiefer, & Chipman, 2008). In addition, the method does not require in-depth, prior knowledge about the land cover types present in the area of interest. Thus, unsupervised classification is data-driven rather than knowledge based (Ahmad & Quegan, 2013).

The land cover types used by Thompson (1996) which were incorporated in the study included shrubland (low density of woody vegetation); forest plantations (systematically planted and man managed tree resources); thicket (woody self-supporting plants growing naturally); scrub forest (intermediate vegetation between forest and thicket); bushland (similar to thicket, but characterised by open canopy cover). Unimproved grassland (indigenous grass growing naturally); improved grassland (planted grassland either indigenous or exotic species - man managed). Bare rock/soil (natural areas of exposed soil with little vegetation); degraded soil (permanent or seasonal man-altered areas of low vegetation cover). Built-up land (including settlement areas and man-made structures) was not classified as bareland class for the current study since built-up areas are not found in the military training areas used. The bareland cover included paths, vehicle tracks and any surface devoid of vegetation cover. Orthorectified high spatial resolution aerial photographs acquired for the years 2001 and 1991 (for GMTA), 2013 and 2014 (for SAACTC) (as shown in Figures 1 & 3) were used in the study as reference data. These were the only available images for the study area and were obtained from the National Geo-Spatial Information, Department of Rural Development and Land Reform (DRDLR). The aerial photographs acquired were for September 1991, October 2001, January 2013 and December 2014. These aerial photographs were acquired in red, green and blue electromagnetic radiations. The spatial resolution of the aerial photographs was 0.5m while the spatial coverage was approximately 5km in the east-west and 6km in the north-south direction. These characteristics were deemed accurate for this study. The selection of these images was determined by image quality. It should be noted that a rainy season poses a challenge to remote sensing application since clouds interfere with the transmission of electromagnetic radiation between the sun and the earth as well as between the earth and the sensor (Xie, Sha and Yu, 2008). As a result, different dates can be used to study land cover change of a given area. The same problem has been encountered in the current study. Thus, the selection of the different dates was dictated by availability of good quality images. In addition, it was important to use images that showed the level of land cover immediately after the major training exercises of the SANDF. These periods are the winter and the summer seasons. As explained in the research location section, the major training period at the SAACTC starts in late winter and continues into the end of the spring season.

The land cover types identified in the current study were approximated according to Thompson's (1996) standardised land cover types for interpretation purposes. The standard classification system was modified by merging structurally similar land cover types in order to suit the land cover types of the study area. Consequently, the land cover types were categorised as woodland, grassland and bareland (see Table 1 for characteristics of each class). It should be noted that, in this study, the grassland class does not incorporate other green surfaces such as agricultural fields and gardens (improved grassland) as is commonly incorporated (Diallo & Bao, 2010), but unimproved grassland covered surfaces. Similarly, the bareland surface does not include build-up areas.

Results

The results obtained from the analysis of the satellite images are presented in Figures 1-5. The maps of the two study areas are presented on different scales because the SAACT training area is much larger (1 565km²) than the GMTA (59.70km²). Figure 1 describes land cover types for each of the periods during which the GMTA was studied, while Figure 2 shows the magnitudes of land cover change at the GMTA over the same period. Further, Figure 3 illustrates the spatial distribution patterns of the land cover types at the SAACTC in 1991 and 2014, whereas Figure 4 displays the magnitude of land cover change at the SAACTC over the period of observation. In addition, the magnitudes of land cover change are presented in Figures 2 and 4, while the aerial extent of change in each land cover class per study area are presented in Table 2. Clearly, the woodland cover at GMTA has increased by 2.07% over the 12-year period (Figure 2). This is equivalent to 1.97km² spatial coverage (Table 2). During the same period, the grassland cover decreased by 1.47%, which is equal to 1.47 km² in spatial extent. Meanwhile, the bareland cover also decreased by approximately 0.61% translating into 2.15 km² in almost 12 years. This indicates that some of the grassland and bareland surfaces noted in the 2001 image were colonised by shrubs and herbaceous vegetation during the period of observation, thus the decrease in these land cover classes. As Hinchman, McMullen, Carter and Svernghaus (1990) argue that the rate of recovery of any surface from disturbance depends on a number of factors such as moisture content, soil fertility and soil layer. The recovery, unless otherwise assisted through seeding, is a normal ecological process associated with succession which occurs once the existing vegetation has been severely disturbed by any force (Hinchman *et al.*, 1990).

Land cover change at the SAACTC is different from what has been noted at the GMTA. Figure 3 shows the spatial distribution patterns of the land cover classes at the SAACTC for the period under observation. In the 2014 image, the distribution patterns of the woodland and bareland surfaces appear to have shrunk by magnitudes of 9.33% (equivalent to 1 058 km²) and 0.11% (approximately 2 963 km²) during the period of observation (Figure 4). Grassland surfaces appeared to have increased by more than 9% (about 1 613 km²) between 1991 and 2014.

In both study areas, as it appears in Figure 5 in conjunction with Figures 1 and 3, it is very clear that significant disturbances are mainly confined in the low-lying sections of the training areas. Armoured vehicles and human traffic are constant and frequent here.

Table 1: Land cover classes defined for the study area

Land cover class	Class definition
Woodland	• Dense continuous vegetation • Thicket (including prickly pear) • Bushland, Scrub, Shrubland
Grassland	• Unimproved grassland
Bareland	• Degraded land • Bare rock/ soil

Table 2: Spatial variation in land cover types in the study areas

Land cover classes	Land cover change (%) per class during the period of observation		Total change (%)	Area size (Km ²)
	2001	2013		
Woodland	35.21	37.28	2.07	1.97
Grassland	26.37	24.9	-1.47	1.47
Bareland	38.42	37.81	-0.61	2.15
	1991	2014		
Woodland	54.43	45.10	-9.33	1057.87
Grassland	35.70	45.15	9.45	1612.78
Bareland	9.86	9.75	-0.11	2962.81

Discussion

The physical disturbances of the ground surface in a military training area cannot be avoided (Marlaer & Moore, 2011). Triender and Cole (n.d.) argue that adverse impacts are generally unavoidable as some result from accidents while others arise from ignorance. Generally, military training activities cause a variety of impacts on the physical environment and, by their nature, have considerable effects on the environment (ESWG, 2006). In recent times, therefore, military practitioners constantly face challenges in properly integrating environmental concerns regarding military planning and execution to avert irreparable damage to the environment. Meanwhile, improperly and poorly planned training exercises may cause severe environmental damage to the training area, thereby causing significant ecological damage (Komar, Bozek, Dvorak, & Novotna, 2009). This aspect of military activities constitutes an aggression on the part of most military training activities, which results in land cover change (van Donk, Huang, Skidmore, Anderson, Gebhart, Prehoda, & Kellogg, 2003), as observed in Figures 1 and 3. The destruction and alteration of ecological habitats are glaringly obvious in Figures 1 and 3. Some of the substantial damage to land cover (such as loss and destruction of vegetation) and soil in military land areas is severe where armoured vehicles make sharp turns and where off-road military vehicles travel during training exercises (Haugen, Ayers, & Anderson, 2003). In addition, military activities often result in the direct removal of vegetation through various activities (Silveira, Comerford, Reddy, Prenger, & DeBusk, 2010), such as the setting up of base camps and digging up of trenches. This could explain the existence of bareland surface though it has decreased over the observed period resulting in a 1.47% decrease in grassland cover at the GMTA (Figure 2). Undoubtedly, the adverse effects of armoured vehicles and human traffic manifest itself in the spatial distribution pattern of land cover in the two military training areas. The decrease in grassland land cover observed at the GMTA (see Figures 1 & 2) can be ascribed to human traffic, military vehicles and other associated activities. Rawat and Kumar (2015) argue that change in land cover does not necessarily indicate land degradation. It may indicate that the land cover has been altered, thus the spatial distribution pattern of land cover may become different to what it was before. This can be linked to the intensity of land use or the aggressive nature of the activities carried out, such as movement of armoured vehicles, firing of mortars and other artilleries as these military activities are aggressive. The increase in woodland at GMTA (Figure 1) can, to a certain extent, be linked to the spatial distribution of the *Opuntia Indica* species within the training area. The GMTA is heavily infested with the *Opuntia Indica* invasive species; its spatial distribution is linked to numerous vectors including birds, baboons and monkeys found in this military training area. This invasive species is popularly known as prickly pear or *itolofiya* (in IsiXhosa) (Beinart & Wotshela, 2011). It has degraded many ecosystems across the South Africa (van Wilgen, Reyers, Le Maitre, Richardson, & Schonegevel, 2007).

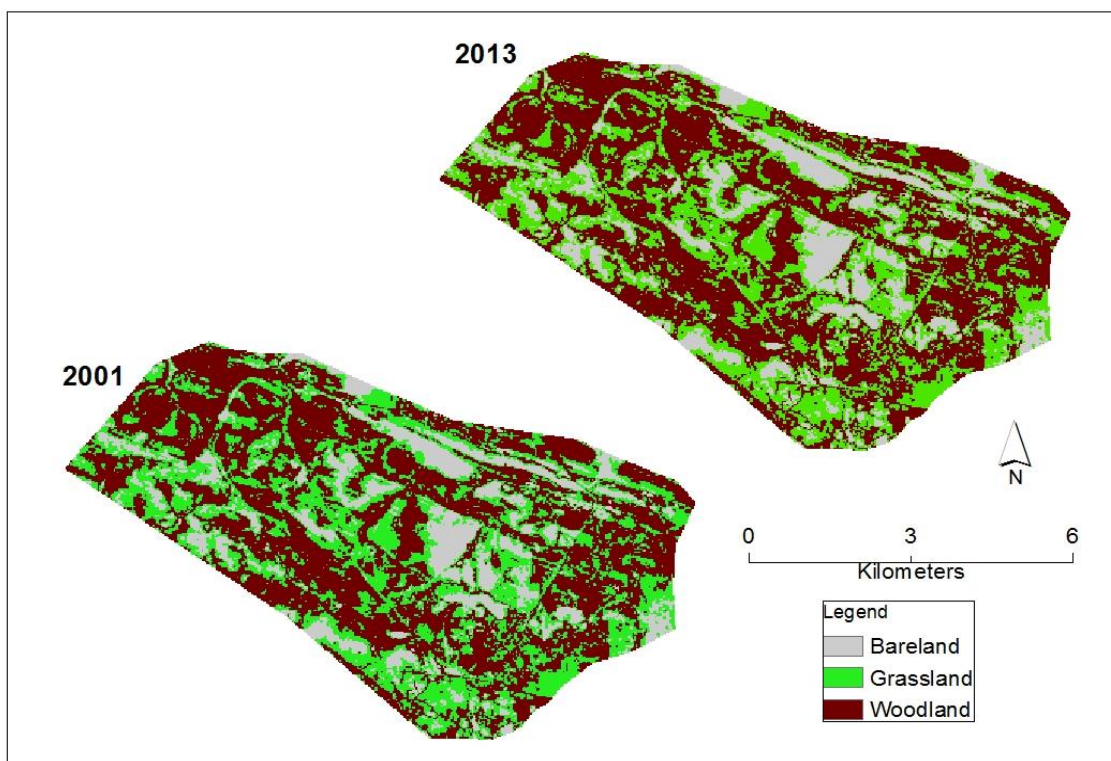


Figure 1: Spatial distribution of land cover types at GMTA

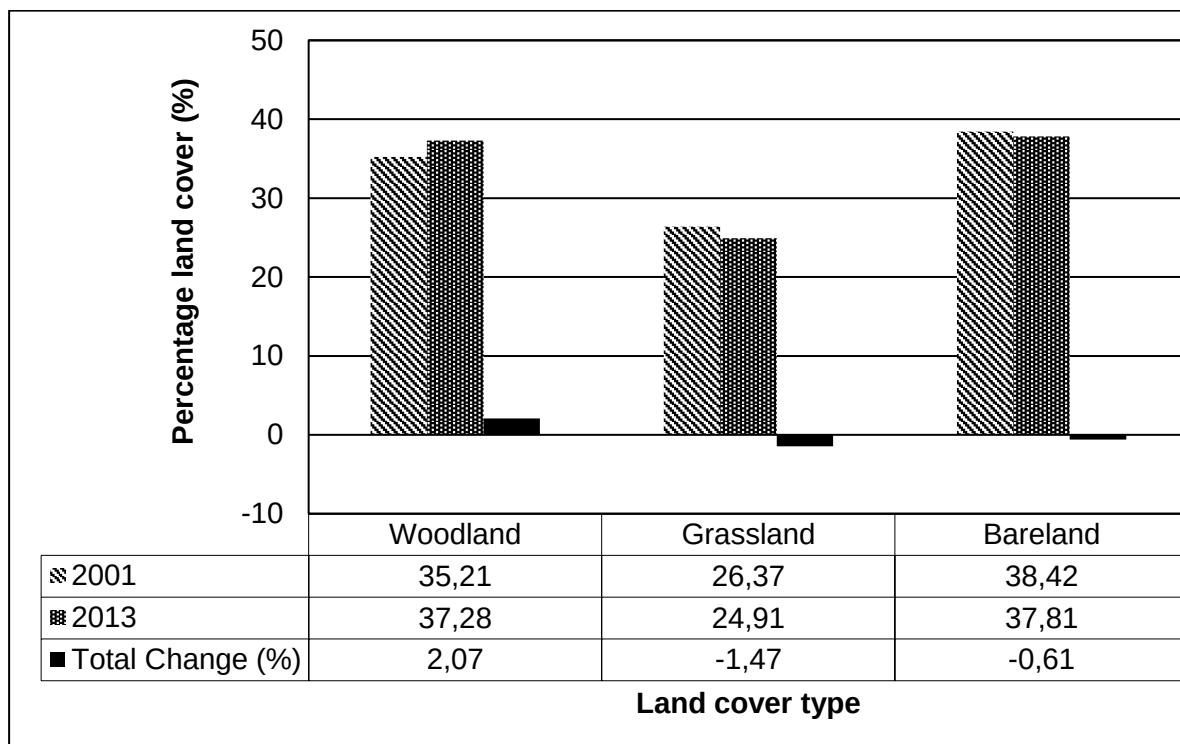


Figure 2: Magnitudes of land cover change at GMTA

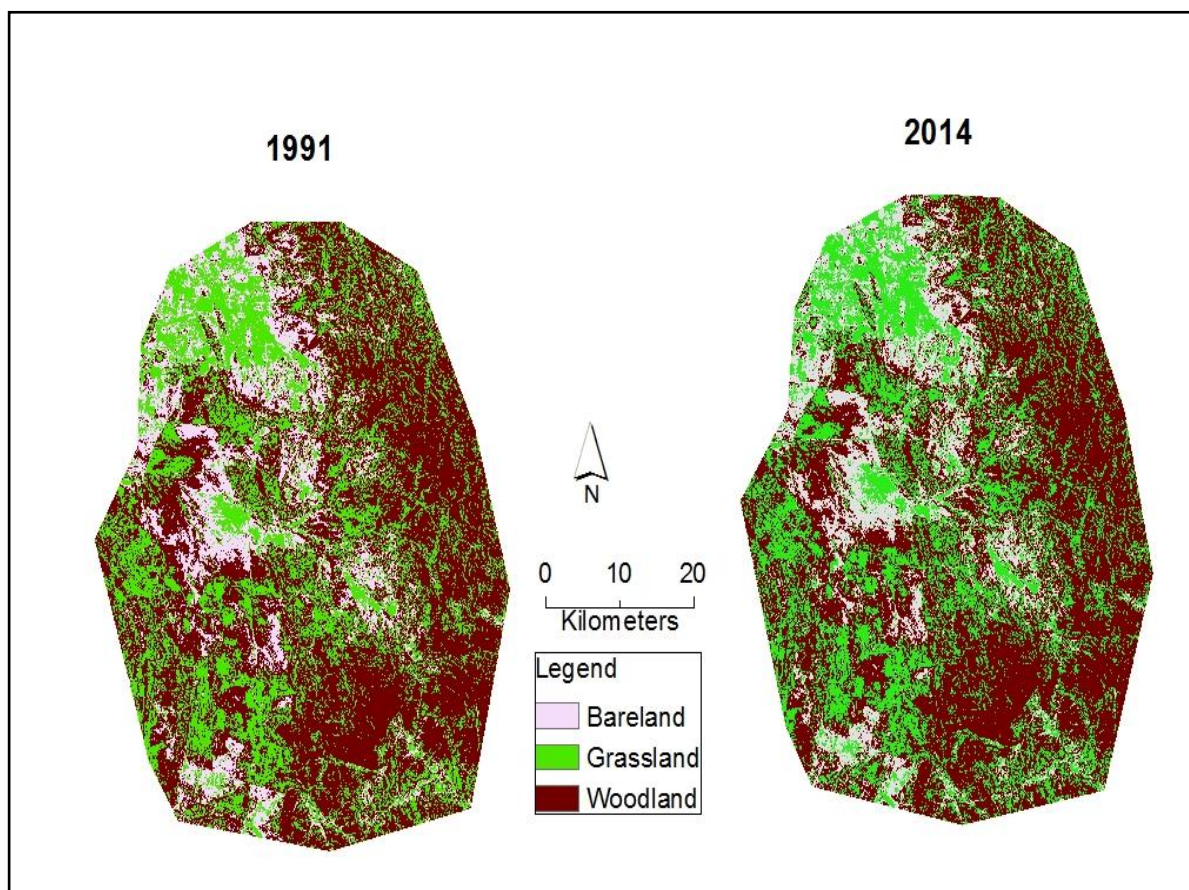


Figure 3: Spatial distribution of land cover type at SAACTC

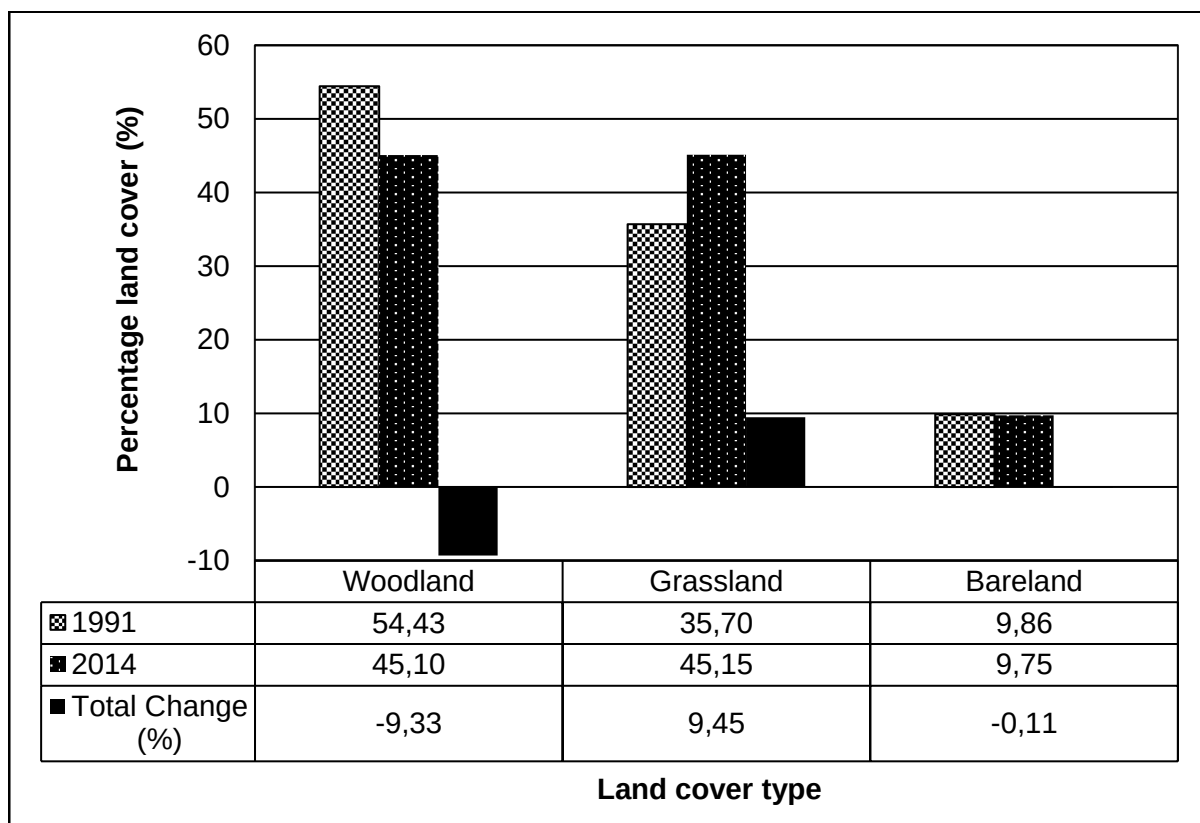
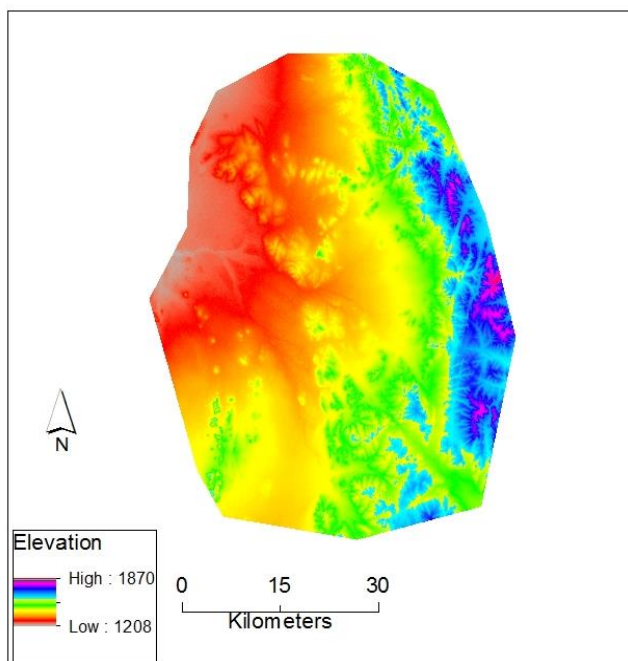
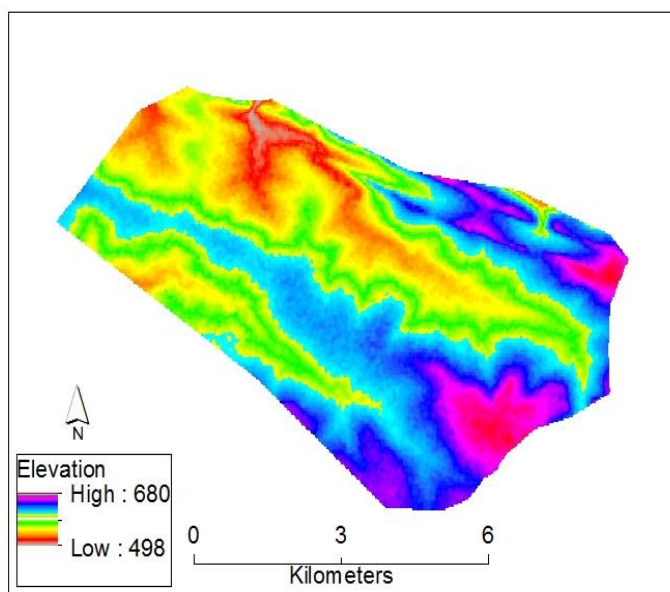


Figure 4: Magnitudes of land cover change at SAACTC



Elevation of SAACTC



Elevation of GMTA

Figure 5: Elevations of the study areas (GMTA & SAACTC)

Every year, major training exercises with varying intensity are carried out at the GMTA and SAACTC. Therefore, the constant disturbance of the ground surface in military training areas leads to considerable land cover destruction (i.e., vegetation cover tends to be very scarce) (Sample, Steichen, & Kelley, 1998; Greičiūtė, Juozulynas, Šurkienė, & Valeikienė, 2007). This supports the results of the current study which indicate that land cover in military training areas does change over time, especially where aggressive training exercises are frequently carried out. There are various periods of annual major training exercises carried out by the SANDF at both training areas (DoD, 2012). For instance, in July 2011 the GMTA hosted Exercise Shared Accord (Wilson, 2011). This is a bi-national training exercise during which the SANDF and the US Marine Corps carry out military training exercises together.

The 2011 bi-national military training exercise was a three-week long intense military training of the two armed forces. Its disastrous effects on the physical conditions of the training area at the end of the training exercise were obvious. There are numerous major annual training exercises carried out at SAACTC; the main exercise is called Exercise Seboka. This exercise is a month-long conventional military brigade training exercise (Helfrich, 2012). According to Helfrich (2012), the brigade of Seboka in 2012 was constituted by seven units ranging from infantry battalion to the SAAF. Consequently, the execution of this training exercise involved more than 3000 soldiers. The artilleries used include standard infantry rifles (the R5), mortars, machine guns, cannons of various caliber mounted on various military vehicles such as the Rooikat or Ratel armoured vehicles and the Olifant are used for firing rockets. In addition, the Rooivalk combat helicopter is extensively used during Exercise Seboka (Helfrich, 2012). After such an intensive training exercise, the disturbance on the ground surface is clearly visible. These surfaces will take time to fully recover from such intensity of aggression on the military training range/s used for this exercise.

Consequently, the target points (i.e. impact areas) are also characterized by bareland surfaces. In both study areas, some of the bareland surfaces are branded by high levels of mechanical disturbances caused by explosions, thus creating conditions conducive to soil erosion (Haugen *et al.*, 2003; Johnson *et al.*, 2011; Nyakatawa, Mays, Britton, Pacumbaba, Haward, & Svendsen, 2011). Similarly disturbed surfaces were noted at GMTA and SAACTC. Yet, the target sites are rotated as per the combat tactic(s) taught or perfected. This is important especially at SAACTC where airstrikes and other heavy artilleries (as indicated above) are fired. The firing of live ammunition through bushes also causes significant damage to the trees in the line of fire. Such impact was noted at the GMTA after Exercise Shared Accord in 2011. This can have a significant influence on the status of land cover derived from remotely sensed data. In the army, bushes are very important depending on the military tactic being taught. The firing of missiles and other high calibre weaponry employed during training, blasts the ground surface, uproots vegetation and disturbs the soil structure. This may decrease grassland and woodland at GMTA and SAACTC respectively. Thus, the decrease in woodland cover at the SAACTC is attributable to the firing of missiles and other high calibre weapons.

In both study areas, the woodland cover is found in high-lying grounds of the training area and/or sections of the training area that are seldom used (Figure 5). Certain sections of the high-lying areas of the military training area are often used as target points (i.e. where targets are placed). Therefore, they are impacted upon by high calibre weaponry; as a result, these areas may also show the existence of bareland surfaces (Figures 1 & 3). As the results show (Figure 5 in conjunction with Figures 1 & 3), bareland surfaces are dominant in low-lying areas because the greater military activities that take place during training exercises are always carried out here.

In some instances, fire (during training exercises) destroys thousands of hectares of vegetation within the training area and, sometimes, even beyond. The destruction of vegetation through veld fires can also degrade military training range conditions. Veld fires are inherent in military training exercises since many of the munitions used are ignition sources (CEMML, n.d.). For instance, veld fires usual ignites during military training exercises at the SAACTC (van Rensburg, 2010). These fires have severe ecological effects, including their effect on the spatial distribution of land cover in the SAACTC training area. Thus, the land cover change observed in the SAACTC, as shown in Figures 3 and 4, is to a certain extent associated with such veld fires. In addition, the effect of the 1991/1992 drought may not be overlooked. This drought episode had a significant contribution to the land cover change between 1991 and 2014. The 1991/1992 drought undoubtedly was one of the worst droughts in South Africa in more than four decades (Vogel, Laing, & Monnik, 2000; Water Research Commission [WRC], 2015; South African Weather Services, 25 November 2016).

Masih, Maskey, Mussá and Trambauer (2014) argue that the 1991/1992 drought affected the whole continent of Africa. Thus, its adverse impact on the land cover change in both the military training areas can never be overlooked. Records also show that there were other droughts between 1991 and 2014, which include the 1995/1996 and 2003/2004 (Masih *et al.*, 2014). Therefore, the decrease in woodland cover and increase in grassland cover could be related to military associated veld fires (Figures 3 & 4). In this regard, van Rensburg (2010) estimated that about 90 000ha (equivalent to 57.51%) of the training area had been destroyed by veld fires during training exercises. On the other hand, it could also be argued that the drought cycles that South Africa often experiences in almost every four years (WRC, 2015) have also contributed to the decrease in the land cover of the SAACTC training area. Nevertheless, the veld fires related to military training activities have proven to be one of the major challenges that threaten the ecological integrity of the entire SAACTC training area. It has also been acknowledged in the Environmental Closure Report (ECR) of Exercise Seboka 2009 that veld fires have led to serious ecological damage, which could take up to a maximum of 200 years to restore (van Rensburg, 2010). The ECR for the year 2009 further indicates that veld fires have destroyed vegetation in numerous training ranges to date (van Rensburg, 2010). Therefore, military land managers, range operators and environmental officers of the SANDF are challenged to implement all the necessary and existing plans to effectively deal with this problem at the SAACTC. It is unfortunate that the implementation of the environmental management system (EMS) in the SANDF collapsed or was withdrawn in 2007 due to lack of progress (Smit, 2011; Magagula, 2014).

The existence of the EMS would have effectively operationalized the military integrated environmental management (MIEM) programme of the SANDF leading to the arrest of the veld fire problems associated with military training exercises. Understandably, van Rensburg (2010) argues that this problem has been exacerbated by the scheduling of major training exercises in the late winter and early spring periods during which the grass is dry causing high wildfire risk. Training ranges that are void of vegetation may not be suitable for certain military training exercises. In this regard, Rawat and Kumar (2015) argue that land use affects land cover and change in land cover affects land use; this also applies to the armed forces. Each military training exercise is carried out to teach and even perfect certain combat tactics. Therefore, they ought to be carried out under specific environmental and weather conditions. Vegetation in a military training range also provides camouflage, which a desert-like environment cannot provide. However, the use of vegetation as camouflage during training exercises is prohibited. This prohibition is meant to maintain the ecological integrity and sustainability of the training areas.

Further, the decrease in bareland surfaces between 1991 and 2014 at the SAACTC (Figure 4) can be attributed to the suspension of some training ranges, especially those that show high levels of degradation. This is one approach adopted by the SANDF to allow degrading training ranges to recuperate. However, Fehmi, Farmer and Zimmerman (2001) argue that the need for trained troops determines the frequency and intensity of training exercises at military areas, rather than the capacity of the land to sustain the training. This becomes a persistent challenge in reconciling military activities with environmental protection and sustainability.

Conclusion

The study has shown that military exercises and activities are significant drivers of land cover change. The more frequent and aggressive the training exercises, the more severe the impact will be on land cover. It is presumed that the major cause of land cover change at the GMTA is driven by the direct adverse physical impacts of military exercises. These include physical disturbances of the ground surface (where the target points/areas are, and where wheeled vehicles make sharp turns) as well as the running over and trampling of vegetation by the troops during military training activities. As regards the SAACTC, it can be concluded that both direct and indirect military activities cause the changes observed in land cover. Indirect impact, in this instance, refers to the veld fires during some of the training exercises, which destroy vast hectares of land. Yet, the SANDF has procedures and plans to deal with veld fires (wildfires) as elaborated in the guidebook on environmental considerations during military operations (ESWG, 2006) and environmental management implementation plan (EIP) for defence (DoD, 2008). This situation signals SANDF's major challenge in effectively implementing the veld fire risk management plan to reduce or even curb incidences of veld fires. The direct impacts are apparently difficult to completely eradicate given the nature of military training activities. However, these impacts can be minimised by rotating training exercises in different training ranges. Mutanga *et al.* (2016) argue that assessment of biomass to quantify fuel load in rangelands is imperative towards reducing incidents of veld fires. There also has to be early warning systems to manage veld fires. This approach can also be adopted in quantifying fuel load in military training areas especially at the SAACTC where veld fires have proven to be a major problem.

Nevertheless, the frequency of military training is determined by the need to keep the army ready for combat as anything else becomes secondary to this. Consequently, there is always a conflict between protecting the environment and having combat-ready armed forces. Understandably, the security of the state becomes the first priority over and above environmental protection. In addition, unsustainable utilisation of these national assets may lead to the availability of unrealistic military training areas. Therefore, military range managers are constantly confronted with this conundrum of caring for the environment while allowing military training to be carried out. Equally important, environmental protection will ensure that these land areas provide genuine training conditions in the future.

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SWAT AND OBIA BASED SEDIMENT YIELD ANALYSIS IN THE TSITSA CATCHMENT OF THE EASTERN CAPE PROVINCE, SOUTH AFRICA

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Abstract: Soil erosion is one of the largest environmental problems facing Sub-Saharan Africa. It causes a loss of arable land, decrease in water quality and negatively affects water storage facilities. It is therefore important to map and monitor soil erosion in order to mitigate the negative effects. This study aimed to determine the combined sediment yield from sheet, rill and gully erosion in the Tsitsa Catchment, South Africa. Two separate methods were employed to estimate soil erosion from (1) sheet and rill erosion and (2) gullies. First, the SWAT model was applied to determine the sediment yield from sheet and rill erosion over a 6-year period from 2007-2012. Second, object based image analysis for change detection on two SPOT 5 images was applied in order to determine the rate of gully growth between 2007 and 2012, followed by estimating sediment yield from gully erosion based on a constant sediment delivery rate. The results of the two methods were then combined in order to calculate the overall sediment yield in the catchment. It was found that gully erosion generates 55 times more sediment than sheet and rill erosion. The average amount of sediment generated from gullies was estimated to be 10.5 t/ha/yr while sheet and rill erosion produces 0.18 t/ha/yr. Using a hydrological model alone would have severely underestimated sediment yield rates, but by combining the two methods the study was able to produce a more accurate estimation of sediment yield in the catchment.

Introduction

Soil erosion is one of the largest environmental problems facing Sub-Saharan Africa. It causes a loss of arable land, decrease in water quality and negatively affects water storage facilities (Sidorchuk, Marker, Moretti, & Rodolfi, 2003; Symeonakis & Drake, 2010). Soil erosion is defined as the detachment and movement of soil particles through physical processes such as rain, flowing water, wind, ice, temperature change, gravity or other natural or anthropogenic agents (Jones & Thompson, 2007). There are three main forms of soil erosion: sheet, rill and gully erosion. Sheet and rill erosion are usually shallow forms of erosion (< 30 cm) which can be removed through conventional tillage. Gully erosion is deeper (> 30 cm) and cannot be removed through tillage operations (Poesen, Nachtergaele, Verstraeten, & Valentin, 2003).

It is imperative to devise a means through which soil erosion and the associated problems can be mitigated. Prevention and remediation measures rely largely on the understanding of factors controlling the sediment dynamics in a catchment, including sediment generation, transport and deposition (le Roux, Sumner, Lorentz, & Germishuyse, 2013). It is important to model sediment yield in a catchment in order to effectively manage or develop agricultural or water resources. Numerous hydrological models have been developed to calculate soil erosion rates from sheet and rill erosion. However, currently there is no validated, reliable hydrological model able to model gully erosion (Sidorchuk *et al.*, 2003). In catchments where gully erosion is prominent, studies based solely on hydrological modelling may severely underestimate the soil erosion and sediment yield. The absence of gully erosion in models is due to two main reasons. First, the development of erosion models has focused on areas of intense agriculture, which are common in developed countries. These areas are better managed and have less or no gully erosion compared to free grazing areas of rural catchments found in less developed countries. The second reason is due to the spatial and temporal heterogeneity of gully erosion processes, which make the modelling of gully erosion difficult (Sidorchuk *et al.*, 2003).

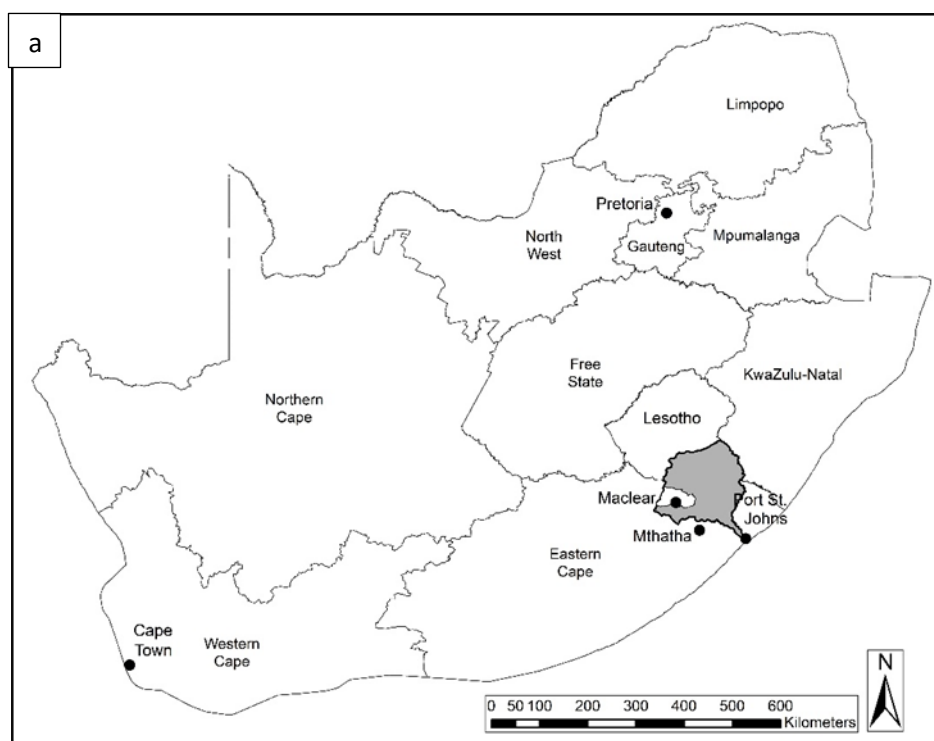
This study aimed to combine two widely used methods in order to determine the sediment yield from sheet and rill erosion as well as from gully erosion in a rural catchment in the Eastern Cape Province, South Africa over a 6-year monitoring period. Very few studies have attempted to model both sheet and rill and gully erosion (de Vente *et al.*, 2013). First, a hydrological model, the Soil and Water Assessment Tool (SWAT), was used to determine the sediment yield from sheet and rill erosion. Second, remote sensing and object based image analysis (OBIA) was used to map gullies and determine the amount of sediment yield derived therefrom.

Hydrological modelling is based on a pre-defined, pre-programmed model where the user can alter the inputs in order to obtain results for their specific study area. In contrast, when using OBIA software, the user has to create a methodology to allow for the identification of soil erosion in the images. Although the two techniques are very different, in this study the applications of both these approaches are identical: which is to estimate soil erosion and the resultant sediment yield. Combining these two techniques allows for a more complete analysis of soil erosion in a catchment.

Study site

The study was conducted in the upper Tsitsa Catchment from the Ntabelenga village in the Eastern Cape Province, South Africa (Figure 1). The Tsitsa River is a main tributary to the Mzimvubu River which is on record the largest river in South Africa without a dam. The Department of Water and Sanitation has thus identified the Tsitsa Catchment as a potential site for a water resource development (le Roux, Barker, Weepener, Van den Berg, & Pretorius, 2015). Studies on the catchment have highlighted extensive soil erosion, in particular gully erosion (Laker, 2004; van Huyssteen, Hensley, le Roux, Zere, & Du Preez, 2005; van Tol, Akpan, Kanuka, Ngesi, & Lange, 2014; le Roux *et al.*, 2015). The upper Tsitsa Catchment runs from its source in the Drakensberg, approximately 3000 m above sea level (ASL), to the outlet at the Ntabelenga village at approximately 900 m ASL. Rainfall is concentrated in the summer months (November-March), with January receiving the most rainfall, mostly in the form of thunderstorms. Average annual rainfall varies from 1400 mm in the upper reaches to 850 mm at the valley bottom (Agrometeorology Staff, 1984-2008).

The geology is varied with basalts of the Drakensberg formation found in the upper reaches of the catchment while the lower valleys are underlain by sedimentary sandstones and mudstones of the Clarens, Molteno and Elliot formations (Botha & Singh, 2012). Soils derived from the sedimentary geology are typically dispersive and erosive (Laker, 2004; van Huyssteen *et al.*, 2005). Duplex soils, which are prone to tunnelling, are also common in the catchment (van Tol *et al.*, 2014; le Roux *et al.*, 2015). Land use in the catchment is prominently agricultural, with only small towns and villages, the largest of which is Maclear.



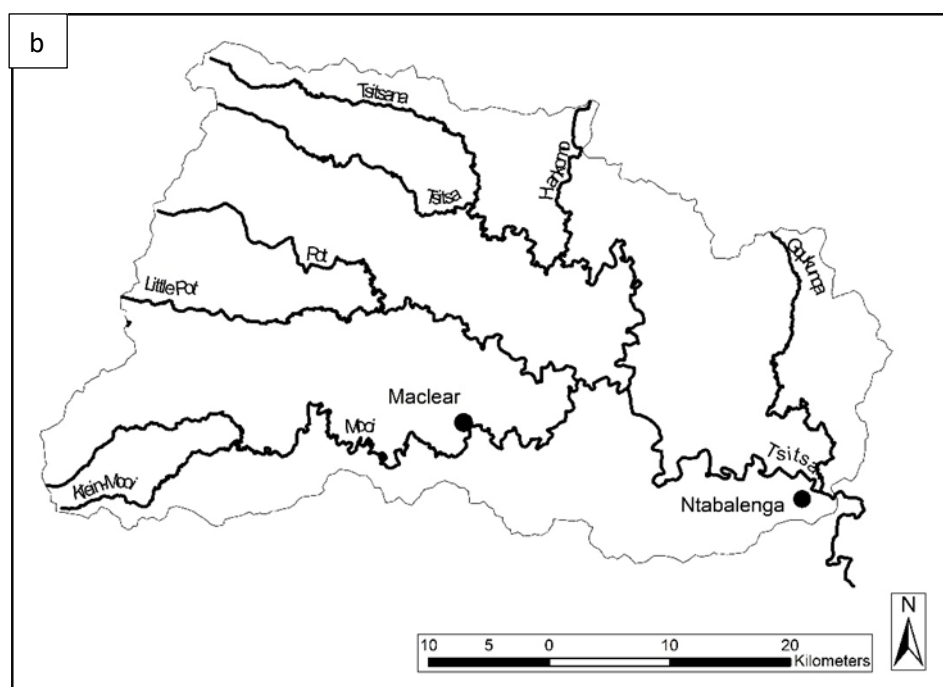


Figure 1: (a) A map of South Africa indicating the Mzimvubu Catchment in grey and the upper Tsitsa Catchment inside the Mzimvubu in white. (b) An enlarged map of the upper Tsitsa Catchment with the main rivers and towns.

Methods

The study aimed to use two established methods to determine the amount of sediment yield generated in the upper Tsitsa Catchment, South Africa over a 6-year monitoring period. The period 2007-2012 was chosen as there was sufficient data available to run both techniques. The methods section is divided into two themes, SWAT and OBIA. Each method will be described in detail in the respective succeeding subsections.

The SWAT model is a physically based, basin-scale, continuous-time model that functions on a daily time step and aims to predict the impact of management on water, sediment and agricultural chemical yields in ungauged watersheds (Gassman, Reyes, Green, & Arnold, 2007).

OBIA is a form of image analysis and takes into account auxiliary information, such as geometric properties and the spatial relationships with surrounding features, this allows for an approach similar to the cognitive approach of the human operator. Through OBIA, it is possible to analyse erosion features as spatial objects so they can be categorised based on their geometric properties as well as their spatial relationship with neighbouring features (Shruthi, Kerle, Jetten, Abdellah, & Machmach, 2015).

SWAT methodology

The SWAT model was chosen as it is a spatially semi-distributed model, which has gained international acceptance and has been applied to many large catchments across the world with minimal calibration needed. SWAT is downloaded free of charge and has an ArcMap extension, ArcSWAT, which allows it to be run in the ArcMap interface. This gives the user flexibility in the representation and organisation of spatial data. SWAT also considers many aspects of connectivity such as upland sediment generation, channel transport and sink deposition (le Roux *et al.*, 2013).

The model was set up and run in ArcMap. For the model setup, the hydrologically improved STRM Digital Elevation Model (DEM) created by Weepener, van den Berg, Metz, & Hamandawana (2012) was used as the elevation input. In the second phase of the model setup, SWAT requires land use and soil data to determine the area and the hydrologic parameters of each land-soil category simulated within each sub-watershed. The land cover input used for this study was an updated national land cover map produced by the Agricultural Research Council (ARC). A national Land Type map was used as the soil input (Land Type Survey Staff, 1972 – 2006). Weather data acquired from the ARC-Institute for Soil, Climate and Water's automatic weather station for the period was used as the climate inputs (Agrometeorology Staff, 1984-2008). The model was run with a 5-year warm up period and the results were obtained for the period 2007-2012.

Due to the absence of data on sediment loads, model calibration concentrated on the hydrological part of the model. This was done by adjusting sensitive model parameters similar to other studies by Tibebe & Bewket (2011). The

hydrological component was calibrated by modifying the curve number and base-flow coefficients, whereas the erosion component was calibrated by adjusting the USLE soil erodibility and support management factors, similar to le Roux *et al.* (2015).

OBIA methodology

The software package, eCognition, was used to conduct OBIA on two adjacent SPOT 5 images from 2007 (16 February) and 2012 (2 & 20 April). eCognition has been widely used in earth sciences to develop rulesets for the automatic analysis and classification of remote sensing data. eCognition Developer can be used for feature extraction, change detection and object recognition (Trimble Navigation Limited, <http://www.ecognition.com/>). SPOT 5 images were used due to their generally good spatial resolution (5 m) as well as the ability to sense wavelengths in a range of bands which allowed for the use of the normalised difference vegetation index (NDVI) and the modified normalised difference water index (MNDWI). The ruleset was developed using SPOT 5 images as the only input data. It was hoped that by using only the images as the input data the ruleset would not be location or time dependent, allowing it to be transferred to other SPOT 5 images of the catchment with minimal adjustments (d'Oleire-Oltmanns, Marzolf, Tiede, & Blaschke, 2014).

After the segmentation, NDVI and MNDWI were used to remove vegetation and water which helped to streamline the rest of the process. A series of rules based on brightness, size and neighbouring objects were written to identify gullied areas. The rules also classified roads as gullies and this was removed using the road line map of South Africa supplied by the National Geospatial Information. For the 2007 image the brightness values of the ruleset needed to be adjusted slightly.

The results of the ruleset were then exported and the accuracy was tested using a random point sampling method (Mararakanye & Nethengwe, 2012). A gully location map for the 2007 imagery produced by le Roux & Sumner (2012) is also available and was used as the reference data for 2007. A similar reference dataset for 2012 was manually digitised in 2014 from 2012 imagery. A sample of 144 random points, generated through ArcMap's random point generator function, were placed in the exported OBIA gully map and the accuracy was calculated by determining whether the points which fell inside the gullies were also represented by gullies in the reference dataset. Thus, this method only tested the OBIA identified gullies and if OBIA missed gullies it would not show up in the accuracy assessment. Thus, a further 144 random points across the entire catchment, not specific to gullies, were then assessed in the same manner.

Once the accuracy had been calculated the two datasets were overlaid and the difference in area was calculated in order to determine how much the gullies had expanded laterally over the 6-year monitoring period. It was assumed that gullies incise to the bedrock below before expanding laterally, thus all gullies which have expanded laterally would have already reached the bedrock below and would have no further increase in depth (le Roux *et al.*, 2015). Any gully was considered active if it had increased in surface area between 2007 and 2012.

Results

SWAT results

The sediment yield from sheet and rill erosion in the upper Tsitsa Catchment for the 2007-2012 study period is shown in Table 1 and Figure 2a. The average sediment yield for each year of the study period was approximately 0.91 t/ha. The average annual sediment yield is thus 0.18 t/ha/yr. The sediment yield in the catchment increased dramatically by over five times after 2008 with two noticeable spikes in 2009 and 2011. The average annual rainfall for the study area collected in the catchment over the 6-year period is shown in Table 2. Figure 2b was derived from the rainfall data and shows that the rainfall was lowest in 2007, gradually increasing up to 2011.

Table 1: The average sediment yield from sheet and rill erosion in the upper Tsitsa Catchment, Eastern Cape, South Africa per year over the 6-year monitoring period.

Year	2007	2008	2009	2010	2011	2012
Sediment Yield (t/ha/yr)	0,03	0,04	0,24	0,11	0,3	0,19

Table 2: The annual rainfall in the upper Tsitsa Catchment, Eastern Cape, South Africa for each year during the 6-year monitoring period.

Year	2007	2008	2009	2010	2011	2012
Rainfall (mm)	656,72	696,87	747,92	806,69	964,64	881,78

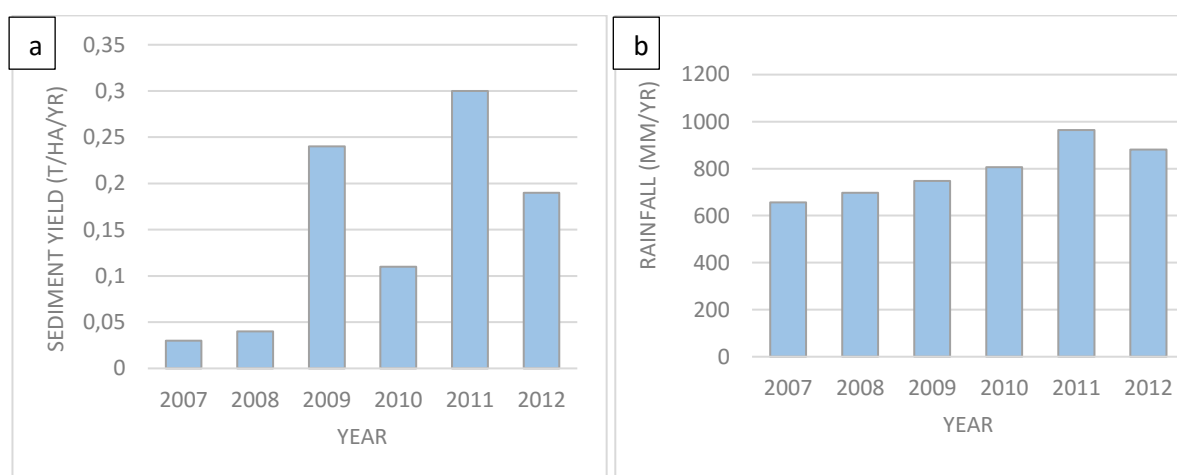


Figure 2: (a) The average sediment yield from sheet and rill erosion in the upper Tsitsa Catchment, Eastern Cape, South Africa, for each year for the period 2007-2012 modelled in SWAT. (b) The average annual measured rainfall for each year during the period 2007-2012 in the upper Tsitsa Catchment, Eastern Cape, South Africa.

OBIA results

The results of the random point sampling accuracy assessment gave an overall accuracy of 59.7%. This method also allowed for the types of errors to be categorised. It was found that of the classification errors made through OBIA, 79.3% were caused by falsely classifying rock outcrops, 10.3% by falsely classifying sheet erosion and the rest were made up of errors in footpaths and sediment in the rivers. When the 144 random points were extended to the entire catchment it gave an overall accuracy of 97.2%. Mis-represented gullies made up 2.1% and gullies which were not represented accounted for 0.6% of the error. The kappa value for each dataset was calculated and found to be 0.37 for the 2012 dataset and 0.82 for the 2007 dataset.

Figures 3 and 4 show the extent of gully erosion over the catchment for the years 2007 and 2012 respectively. The 2012 algorithm mis-classified a large portion of rock outcrops, particularly in the northern part of the catchment. On both images, the majority of the gullies appear in the lower areas of the catchment with only one or two gullies identified in the higher reaches of the Drakensberg.

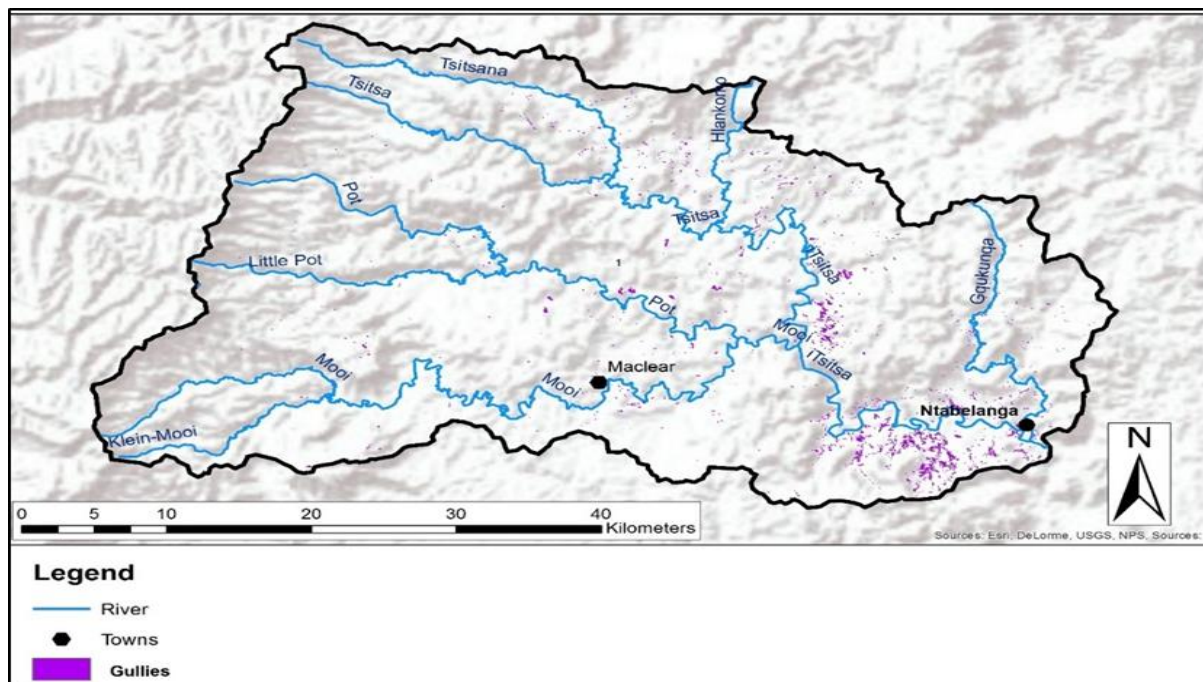


Figure 3: The extent of gully erosion in 2007 from the OBIA classification in the upper Tsitsa Catchment, Eastern Cape, South Africa.

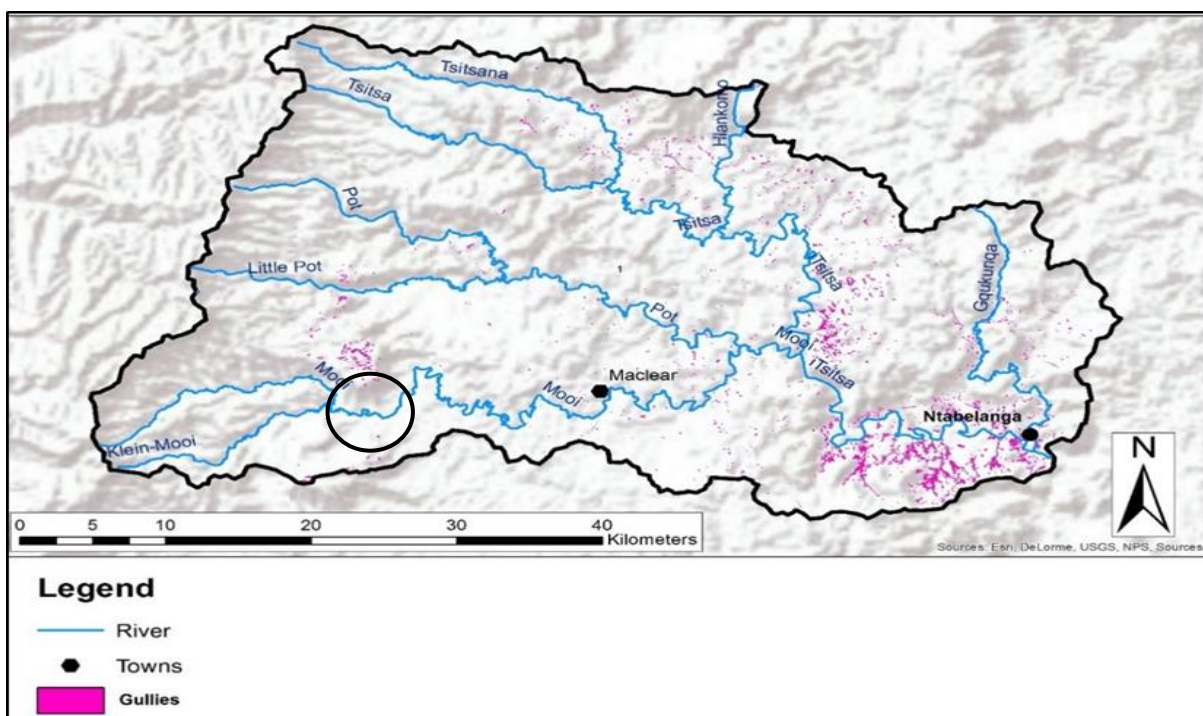


Figure 4: The extent of gully erosion in 2012 from the OBIA classification in the upper Tsitsa Catchment, Eastern Cape, South Africa, with the mis-classified rock outcrops circled in black.

Results showed that the gullies expanded in both area and length. The statistics for each were calculated in ArcMap. The area affected by gully erosion increased by 4 km² over the 6-year monitoring period. The maximum increase in area of a single gully per unit length was estimated to be 1.73 km²/km while the minimum increase in area of a single gully unit was estimated to be 0.32 km²/km and the median gully expansion was 0.7 km²/km.

Gullies can either be classified as V or U shaped depending on the type of erosion (Das & Saikia, 2013). Assuming all gullies in the catchment had the V shape would produce the minimum sediment contribution scenario, whereas assuming they all had the U shape would produce the maximum sediment contribution scenario. Bulk density was assumed to be 1.6 over the catchment and it was also assumed that gullies erode down to bedrock before expanding

laterally (le Roux *et al.*, 2015). The land type data with soil depth for the catchment were used to calculate the size of each gully in the catchment under the V and U scenarios. It is important to note that not all sediment produced from gullies ends up at the catchment outlet as some of the sediment will be deposited in sinks (Ndomba, Mtalo, & Killington, 2009; le Roux *et al.*, 2015). Furthermore, not all gullies have equal potential to deliver sediment. Factors such as vegetation cover, connectivity and continuity all determine the amount of sediment a gully will produce and channel through the catchment (le Roux *et al.*, 2015). Thus, a delivery ratio of 50% was applied to the sediment yield generated from gully erosion following the study conducted by Ndomba *et al.* (2009). It was found that gully erosion produced between 70 000-140 000 t/yr or 7-14 t/ha/yr of sediment.

Discussion

The results of the SWAT modelling showed an average annual sediment yield of 0.18 t/ha/yr, which equates to 3600 t/yr generated from sheet and rill erosion in the Tsitsa Catchment. These results correspond to that of le Roux *et al.* (2015) who found an average of 0.1-0.18 t/ha/yr for the Tsitsa Catchment when modelling it as part of the larger Mzimvubu Catchment. Yesuf, Assen, Alamirew, & Melesse (2015) found sediment yield rates to be between 0.2-3.5 t/ha/yr in their study in north-east Ethiopia. The study is similar as both catchments had a variety of land use mixed between agriculture and rangeland with rangeland being the dominant land use. Both catchments also had a mix of slope terrains.

It is noticeable that 2007 and 2008 had low sediment runoff while 2009 and 2011 had a very high sediment runoff. The average annual rainfall for 2007 and 2008 was low when compared to the other years in the study. The cause of the low rainfall in 2007 is due to the El Nino event which occurred between 2006-2007 (Hoell, Funk, Magadzire, Zinke, & Husak, 2015). 2011 had a higher than average rainfall over the study period, which is reflected in the sediment yield from sheet and rill erosion. A strong La Nina event occurred in 2011 causing the higher than average rainfall during that year (Bastos, Running, Gouveia, & Trigo, 2013).

From the gully location maps of 2007 and 2012 derived through OBIA, it is observed that most of the gullies are concentrated in the lower regions of the catchment with fewer gullies occurring on higher and steeper slopes and none on the steep slopes of the Drakensberg basalt. These results reflect those found by le Roux & Sumner (2012) who also conducted a study on gullies in the larger T35 catchment, which the upper Tsitsa Catchment forms part of. Kakembo, Xanga, & Rowntree (2009) also observed that gullies in the Eastern Cape Province occur predominantly on more gentle slopes. They concluded that the critical drainage area on more gentle slopes is higher, thus leading to gully initiation. Poesen *et al.* (2003) hypothesised that fewer gullies occur on steeper slopes because the critical drainage area needed for gully initiation decreases as the slope steepens. Tamene, Park, Dikau, & Vlek (2006) in a study conducted in Ethiopia also found that gully erosion is less prevalent on steeper slopes. They hypothesised that the reason for the observation was due to steep areas being less accessible and thus less exposed to human and livestock influences. Both hypotheses are plausible in the upper Tsitsa Catchment.

Results showed sediment yield rates of sheet and rill erosion to be 0.18 t/ha/yr and gully erosion to be 7-14 t/ha/yr. This shows that gully erosion is responsible for approximately 55 times more sediment than sheet and rill erosion. It is clear that in the upper Tsitsa Catchment gully erosion is the dominant process and results in considerable sediment yield. Using only a hydrological model for the Tsitsa Catchment would have resulted in a 93% underestimation of sediment yield rates.

The results of the study can be improved by using a finer resolution DEM. Finer scale soil and land use data will also result in more accurate results in SWAT. Finally, the use of measured flow data or sediment loadings for model calibration may have improved the results. In order to improve the OBIA methodology, finer resolution satellite imagery such as QuickBird, which has a panchromatic resolution of 61 cm and a multispectral resolution of 2.4 m for the blue, green, red, NIR and SWIR bands, is needed (Satellite Imaging Corporation, <http://www.satimagingcorp.com/satellite-sensors/quickbird/>). Using Light Detection and Ranging (LiDAR), which can measure depth as supplementary data, may also improve gully mapping as gullies are 3D phenomena defined by their depth (Chen, Su, Li, & Sun, 2009; Eustace, Pringle, & Witte, 2009; Johansen, Arroyo, Armston, Phinn, & Witte, 2010; Höfle, Griesbaum, & Forbriger, 2013).

Conclusion and recommendations

This study aimed to combine two widely used methods in order to determine the sediment yield from sheet and rill erosion as well as from gully erosion in a rural catchment in the Eastern Cape Province, South Africa over a 6-year monitoring period. SWAT was used to determine the sediment yield from sheet and rill erosion while OBIA was used to map the gullies. Currently, there is no reliable, validated hydrological model able to model gully erosion. For developed nations with intense, well managed agriculture, gully erosion is not common and thus there is no need to develop models which incorporate gullies. However, in rural catchments with free grazing, gully erosion can be severe and contribute large amounts of sediment to the catchment budget. Thus it is imperative to design studies which model not only sheet and rill erosion but also gully erosion.

Results showed that sheet and rill erosion produced 0.18 t/ha/yr of sediment while gullies resulted in 7-14 t/ha/yr. Gullies produced 55 times more sediment than sheet and rill erosion. Thus, using only a hydrological model for the Tsitsa Catchment would have resulted in a 93% underestimation of sediment yield rates. It is imperative that gully erosion is considered when modelling catchments as gullies produce a considerable amount of sediment yield. Failing to consider gullies in catchment studies will result gross underestimations of sediment yield rates which may affect management or planning strategies in the catchment.

The Tsitsa Catchment is prone to extreme soil erosion and in particular gully erosion. Any water resource development will need to consider the implications of high erosion rates and mitigate for them. Rehabilitation and better land management are imperative for any development in the upper Tsitsa Catchment.

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A MINERALOGICAL STUDY OF SOUTH AFRICAN LUNETTE DUNES SEDIMENTS USING XRF: A CASE STUDY OF THE WESTERN FREE STATE PANFIELD

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Abstract: The western Free State Panfield has the highest concentration of pans in South Africa, with densities of up to 16 ha/km². Like pans elsewhere, pans in this area have fringing lunette dunes. Lunette dunes are located on the southern and south-eastern pan margins, and this is in agreement with paleoatmospheric wind circulation in this region. Previous studies in this area include in situ sedimentological analysis of lunettes sediments and a detailed optically stimulated luminescence (OSL) dating sequence of exposed faces of lunette dunes. However, one question which remains unanswered is, what dated dune records actually mean in terms of environmental and climatic changes. This study aims to use geochemical analysis of paleoaeolian record to answer this question. The study contributes to better understanding of the chronological record for the study region and comparison of the different lunettes in the study area in terms of age, development and origin of sediments. Sediments were collected from exposed faces of lunettes from four sites (pans). Standard 5g pellets were prepared from homogenised sample for total elements oxide composition by X-ray fluorescence spectrometry (XRF) and chemical index of alteration (CIA) values were calculated using this equation; $Al_2O_3 / (Al_2O_3 + CaO + Na_2O + K_2O) \times 100$. Geochemical differences between sediments indicate differences in chemical weathering intensities, which is indicative of past climate condition. A higher CIA value occurs when most of the alkali and alkaline earth elements have been removed and therefore suggests strong chemical weathering. Higher intensity of chemical weathering in some sediments indicates availability of moisture which can be associated with warmer humid phases. Lunettes that are presently closer to ephemeral drainage lines have highest CIA value.

Introduction

“The essential reason for recognizing the Quaternary is climatic. The record of its history is stratigraphic.”
Russell, 1964.

Geomorphology, by definition, is that branch of the earth sciences that focuses on the history of landscapes and landforms and the development thereof. Quaternary geomorphology explores the adjustment of many landforms and landscapes that have existed during the last 2.6 million years, as the results of the climatic swings from glacial to interglacial conditions. The youngest part of earth's history (i.e. the Quaternary period) is of particular interest to quaternary scientists, not only because it is characterised by large changes in the temperature of both the ocean and atmosphere but also because of the biological evolution, specifically the appearance of the modern day hominid (Dehnert and Schluchter, 2008; Huguet, 2011).

The reconstruction of Quaternary geomorphic environments is frequently based on the assumption that changes in climatic variables, such as wind, temperature and precipitation have implications for the development of landscapes. Therefore an understanding of the influence that today's climate variables may have on landscapes and landforms can facilitate the use of such landscapes and landforms to deduce the environmental (climatic) conditions that prevailed in the past.

Aeolian deposits occur globally. There are various types of aeolian deposits. This study specifically looks at lunette dunes. “A lunette dune is a bow-shaped form composed of sand, silt and clay that occur on downwind margins of ephemeral lakes.” (Laity, 2008: 212). From here on ephemeral lake(s) will be referred to as pan(s). The following terms; lunette dune(s), lunette(s) and dune(s) are used interchangeably. In certain areas, lengthy aeolian sedimentary sequences provide a basis for Quaternary correlation between aeolian deposits and global record of climatic changes, some of the best published examples include the loess deposits around Prague, Brno and Nitra in the Czech Republic and Slovakia, and near Krems in Austria (Lowe and Walker, 1984); the late Holocene aeolian deposits in the Brandon Sand Hills, Manitoba, Canada (Wolfe *et al.*, 2000); aeolian deposits in central southern Africa (Thomas and Shaw, 2002); the loess deposits in lower Changjiang Valley, China (Yang *et al.*, 2004) and late Pleistocene aeolian record from lunette dunes of the western Free State Panfield (Holmes *et al.*, 2008).

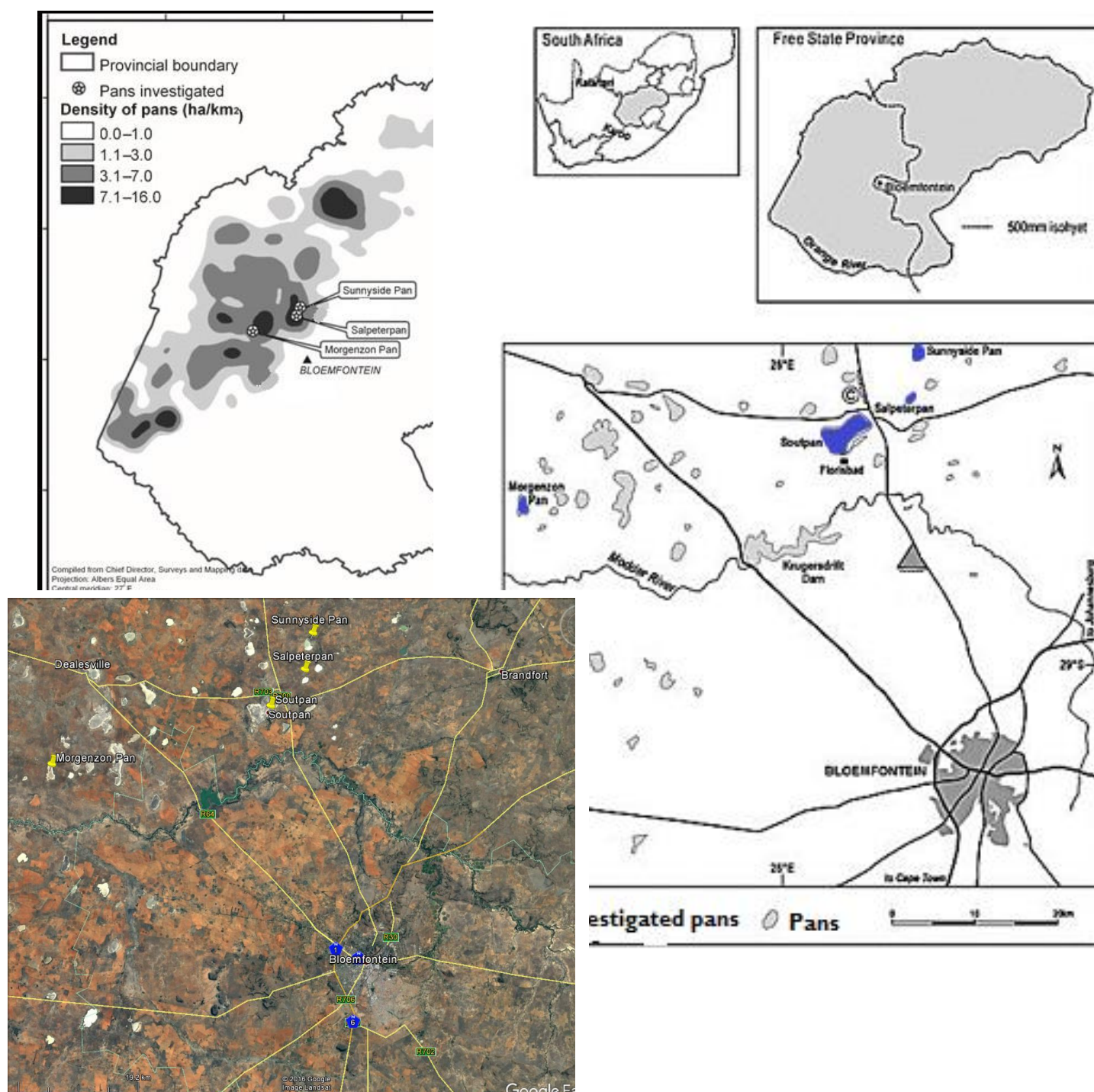
Detailed stratigraphic and geochronologic studies over the past decade have demonstrated that the extensive dune fields in arid and semi-arid environment in southern Africa, Australia, China and the Great Plains of North America are highly sensitive to climate change and record both major droughts and humid phases of the late Pleistocene and Holocene (Stokes *et al.*, 1997; Wolfe *et al.*, 2000; Yang *et al.*, 2004; Forman *et al.*, 2009 and Tooth, 2012). Within aeolian deposits, there are often sequences of soil horizons that contain records of paleoclimatic conditions going back into the Quaternary period. Additional paleoenvironmental information can also be obtained from the rich faunal and floral remains found in the deposited material, and dating of deposits is possible through the use of dating methods such as luminescence and radiocarbon dating in more recent sediments and magnetostatigraphy

and cosmogenic nuclides dating of older deposits (Meadows, 2001; Hugget, 2011). Like other sedimentary archives, lunette dunes provide information regarding the climatic and environmental history of a given area. This paper shows the usefulness of mineralogical characteristics of paleoaeolian records when reconstructing past environmental and climatic conditions in arid and semi-arid environments. Despite the sensitivity to environmental change most arid climates are not conducive to the preservation of organic material (Chase, 2009), and therefore the use of geochemical analysis helps in creating multi proxy records in these regions. This study contributes to better understanding of the chronological record for the study region and comparison of the different lunettes in the study area in terms of age, development and origin of sediments. Sediments were collected from exposed faces of seven lunettes from four sites (pans).

Study area

The western Free State Panfield, in South Africa is considered as an ideal site for geomorphological research, especially in the context of Quaternary geomorphological studies because of two reasons, the concentration of pans and number of studies that have been done in the area. The number of studies is important because it allows for comparison of dated dune records with other proxy records from the same area. The western Free State Panfield has the highest concentration of pans in southern Africa, with densities of up to 16 ha/km². The origin, development and spatial distribution of pans in this area are well documented (Le Roux, 1978; Van Zinderen Bakker, 1989; Marshall and Harmse, 1992; Grobler *et al.*, 1998; Holmes and Barker, 2006). Le Roux (1978), is the first researcher to record the pan's spatial distribution and lunettes dunes have being previously described by Lawson (1998). Holmes *et al.* (2008) provided good temporal resolution for selected western Free State lunette dunes, through a detailed OSL dating sequence of lunette dunes in the area.

As with pans elsewhere in southern Africa, pans in this area frequently display fringing lunette dunes. Lunette dunes are located on the southern and the south-eastern pan margins, and this is in agreement with paleowind directions in this region (Holmes *et al.*, 2008). The study area is in central South Africa (Figure 1), falls within the summer rainfall region. In terms of climate, precipitation fluctuates from ~500mm in the east to ~250mm in the west. Most of the pans occur on the arid side, to the west of the 500mm isohyet.



Study sites

Figure 1. **Left top:** Western Free State Panfield, showing location of pans investigated and pan densities (After Holmes, et al., 2008). **Right:** Study area showing the location of pans including a site that was revisited, Soutpan (Enlarged from the figure on the left). **Left bottom:** Areal image of the figure on the right.

Four pan lunette sites were selected for this study, the geochemistry of three of the four sites has never been investigated. The geochemical characteristics of sediments from the fourth site, Soutpan (28°45' 59" S 26°04'08"E), has been described by Rabumbulu and Holmes (2012). This study revisits the site and uses existing geochemical data to establish the intensity of chemical alteration on sediments from three dunes. The selection of the study sites was based on: 1. the presence of prominent lunette dunes, 2. the location of pans with respect to

drainage lines and 3. the existence of published OSL chronologies of the dunes. The new sites that are investigated on this paper are Morgezon Pan (28°49'36"S; 25°42'34"E), Sunnyside Pan (28°39'15"S; 26°08'53"E) and Salpeterpan (28°42'16"S; 26°08'07"E). These three sites were described and dated (using OSL from exposed faces of lunette) by Holmes *et al.* (2008). Characteristics all study sites are listed in Table 1 below. The description of these sites is based on Holmes *et al.* (2008) and Rabumbulu and Holmes (2012).

Table 1: Description of the study sites

Site	Soil sediments descriptor	Number of dunes	Oldest OSL age (ka)	Youngest OSL age	Size of the pan	Topography
Morgezon Pan	Sandy	2 confirmed 1 possible outer lunette	±18011	±80	~2.05 km ²	Undulating
Sunnyside Pan	Sandy	1	±13790	±140	~1.5 km ²	Undulation
Salpeterpan	Sandy	2 confirmed 1 possible dune	±1070	±70	~1 km ²	Undulating
Florisbad	Sandy	3 confirmed 1 possible outer lunette	±570	±280	~6.7 km ²	Undulating

The lunette dunes in this area are up to 5m in height from the pan floor and most of them have been dissected by gully erosion. Although presently the lunettes appear to be in a phase of degradation, Holmes *et al.* (2008)'s exploration revealed phases of lunette building at 12-10 ka, 5.5- 3 ka, 2-1 ka and 0.3-0.7 ka. In the south western Kalahari three major phases of dune development have been identified at 60-40 ka, 35-20 ka and 17-4 ka. Because it is quite difficult to associate these phases with specific climatic conditions, a detailed mineralogical study can shed some light into climatic conditions which are necessary for lunettes building. The oldest OSL dated sediments from the western Free State Panfield are from a lunette flanking Morgezon Pan. Holmes *et al.* (2008) recorded an age of 18.11 ± 1.07 ka, which is in good accordance with OSL ages from lunette dune sediments in the western Kalahari (Lawson and Thomas, 2002).

In South Africa bedrock type is not a clear indicator of pan distribution because 23% of pans occur on Paleogene and Neogene quaternary deposits, 21% on Dwyka shale, 12% on Dwyka series, 14% on Eccca shale, 10% on dolerite and the remaining 20% on different rocks (Hugo, 1974). However Holmes and Barker (2006) used GIS, to superimpose pan distribution in the western Free State on lithology and the results indicated that shales of the Eccca Group (Karoo Supergroup) are conducive to pan formation in this area, with approximately 10 253 of the 16 803 pans occurring on these rocks.

Derangements of drainage pattern, wind erosion and removal of dissolved salts by animal have been suggested by Wellington (1945) and Geyser (1947) as a possible cause of pan formation in this area. However Le Roux (1978) disagreed with this hypothesis, stating that the only factors that can account for the wide distribution of pans is climatic derangement in the form of wind. Although a range of geomorphological processes may be responsible for the developments of these features, Holmes *et al.* (2008) noted that in some southern African regions, pan depressions have developed along presently disturbed paleodrainage lines.

Material and methods

Lunette dunes can be easily identified on aerial photos because of their relatively bright reflectivity, defined shapes in plan view, and proximity to the downwind borders of pans. As a result of their low relief, they can be difficult to distinguish on the ground. Topographic maps of the region (covering the west-central Free State Province), orthophoto maps, vertical and aerial photographs were used to plot the location and distribution of pans and lunette dunes, as well as to demarcate study sites. Global Positioning System (GPS) was used to map boundaries.

All the samples from the three new study sites were taken from exposed phases of lunette dunes. At Morgenzon Pan two dune profiles were sampled (Figure 2). The two profiles are Profile A and Profile B, towards the northern and southern margins (respectively) of the undisturbed lunette dunes. Although there is no clear stratigraphic units, color differences are obvious. Two additional samples were taken from a younger (capping) dune.

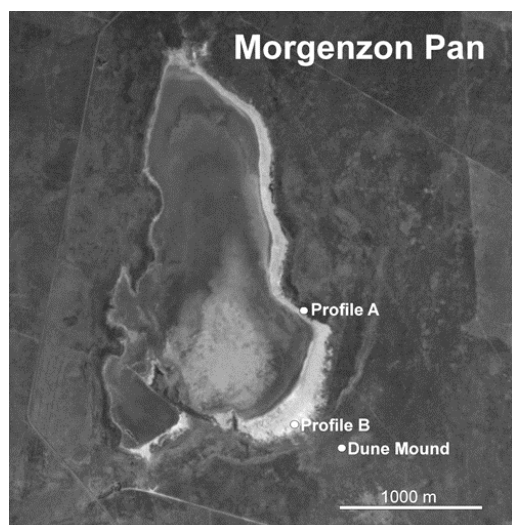


Figure 2. Morgenzon Pan showing lunette dunes and the two profiles (After Holmes *et al.*, 2008)

At Sunnyside Pan a very heavily eroded lunette was sampled, extracting structureless sand from the lunette and one additional sample was taken from exposed sides of gullies (Badland topography) on the lunette. Just like Sunnyside Pan Salpeterpan is structureless but with a weakly developed paleosol in the middle. Four samples were taken above and four below the paleosol. One additional sample was taken from a capping dune.

At Soutpan two outer lunettes were sampled. The first lunette located on the eastern margin of the pan exhibits color changes that are similar to the dune mound next to the spring found in this sites. The second lunette on the south-western margin appear to be highly eroded with no obvious color changes observed. Three grab samples were taken along what is believed (still need to be confirmed) to be a possible third outer lunette.

The exposed phases of lunettes dunes were cleaned by crapping away the surface of organic debris to a depth of about 2cm, using a builder's trowel. Soutpan is the only site that was sampled by drilling into the dune (Florisbad). The fourth dune at Soutpan was drilled until bedrock was reached at 14m below the surface.

In the lab the samples were gently grinded using mortar and pestle to break up clods. The samples were then sieved through a 2mm sieve to separate gravel and organic matter (roots). Then XRF (borate fusions) were prepared from samples that were dried at 105 degrees Celsius overnight. A standard 5g pellets were prepared from homogenised sample for total elements oxide composition by X-ray fluorescence spectrometry at Spectra analytical facility at the University of Johannesburg. The "fd1" XRF application was calibrated to allow analysis of sample with an unknown Loss of Ignition (LOI). For this analysis there was no need to measure the loss on ignition (LOI), because the LOI had already been determined as part of the sedimentological analysis. For detailed explanation of the sedimentological analysis of sediments from this study area, refer to Holmes *et al.* (2008) and Rabumbulu and Holmes (2012).

Few samples with low total sum from the first major element analysis, were then scanned (using borate fusion discs) for all possible elements. CIA values were calculated using this equation; $\text{Al}_2\text{O}_3 / (\text{Al}_2\text{O}_3 + \text{CaO} + \text{Na}_2\text{O} + \text{K}_2\text{O}) \times 100$ (Nesbitt and Young, 1982; Yang *et al.*, 2008). A higher chemical index of alteration (CIA) occur when most of the alkali and alkaline earth elements has been removed and therefore suggests strong chemical weathering.

Table 2.1: Results of new XRF analysis showing mineralogical composition and ratio between resistant and mobile compound

		Resistant compounds						Mobile and soluble compounds								
Site	Field code	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MnO	TiO ₂	Total*	BaO	CaO	K ₂ O	MgO	Na ₂ O	P ₂ O ₅	SO ₃	Total	Ratio
mass		%	%	%	%	%		%	%	%	%	%	%	%		
Morgezon Pan																
Capping dune	MZ05/1/11	86.87	2.77	1.94	<u>0.00</u>	0.74	5.44	<u>0.00</u>	2.89	0.58	1.33	0.35	<u>0.00</u>	<u>0.00</u>	5.14	1.06
	MZ05/1/12	86.79	2.78	2.16	<u>0.00</u>	0.95	5.89	<u>0.00</u>	2.38	0.60	1.30	0.40	<u>0.00</u>	<u>0.00</u>	4.68	1.26
Profile A	MZ05/1/1	86.88	3.44	2.10	<u>0.00</u>	0.86	6.40	<u>0.00</u>	2.00	0.77	1.38	0.46	<u>0.00</u>	<u>0.00</u>	4.60	1.39
	MZ05/1/2	85.05	4.10	2.11	<u>0.00</u>	0.68	6.89	<u>0.00</u>	2.23	0.91	1.46	0.51	0.05	<u>0.00</u>	5.17	1.33
	MZ05/1/3	87.14	3.74	2.00	<u>0.00</u>	0.73	6.47	<u>0.00</u>	1.81	0.83	1.38	0.49	<u>0.00</u>	<u>0.00</u>	4.50	1.44
	MZ05/1/4	82.14	4.94	2.45	0.05	0.70	8.14	<u>0.00</u>	2.34	1.06	1.80	0.55	0.06	<u>0.00</u>	5.82	1.40
	MZ05/1/5	81.84	4.98	2.50	0.05	0.68	8.21	<u>0.00</u>	2.87	1.07	1.65	0.71	0.06	<u>0.00</u>	6.36	1.29
	MZ05/1/6	81.04	5.10	2.49	<u>0.00</u>	0.63	8.22	<u>0.00</u>	3.13	1.08	1.77	0.75	0.06	<u>0.00</u>	6.79	1.21
	MZ05/1/7	77.44	5.54	2.62	0.06	0.64	8.85	<u>0.00</u>	4.47	1.20	2.02	1.18	0.05	<u>0.00</u>	8.92	0.99
	MZ05/1/8	76.63	5.40	2.91	0.05	0.63	8.99	<u>0.00</u>	4.56	1.16	1.93	1.06	<u>0.00</u>	<u>0.00</u>	8.71	1.03
	MZ05/1/9	80.20	4.79	2.35	<u>0.00</u>	0.57	7.72	<u>0.00</u>	3.48	0.99	2.01	0.76	<u>0.00</u>	<u>0.00</u>	7.23	1.07
	MZ05/1/10	82.28	4.80	2.31	<u>0.00</u>	0.56	7.66	<u>0.00</u>	2.64	1.00	1.78	0.70	<u>0.00</u>	<u>0.00</u>	6.12	1.25
Capping dune	MZ05/2/8	88.50	2.41	2.02	<u>0.00</u>	0.88	5.32	<u>0.00</u>	2.15	0.51	1.28	0.29	<u>0.00</u>	<u>0.00</u>	4.23	1.26
	MZ05/2/9	88.77	2.53	1.86	<u>0.00</u>	0.71	5.09	<u>0.00</u>	2.14	0.51	1.28	0.42	<u>0.00</u>	<u>0.00</u>	4.34	1.17
Profile B	MZ05/2/1	86.99	3.13	2.06	<u>0.00</u>	0.76	5.94	<u>0.00</u>	2.60	0.65	1.44	0.42	<u>0.00</u>	<u>0.00</u>	5.11	1.16
	MZ05/2/2	83.37	3.85	2.14	<u>0.00</u>	0.69	6.68	<u>0.00</u>	2.89	0.82	1.64	0.80	0.06	<u>0.00</u>	6.20	1.08
	MZ05/2/3A	84.57	3.80	2.05	<u>0.00</u>	0.63	6.48	<u>0.00</u>	2.80	0.80	1.58	0.61	0.06	<u>0.00</u>	5.83	1.11
	MZ05/2/3B	61.82	8.05	3.57	0.08	0.53	12.22	<u>0.00</u>	7.98	1.64	4.34	1.58	0.13	<u>0.00</u>	15.67	0.78
	MZ05/2/4	89.86	3.46	2.11	<u>0.00</u>	0.72	6.29	<u>0.00</u>	2.64	0.73	1.48	0.66	<u>0.00</u>	<u>0.00</u>	5.51	1.14
	MZ05/2/5	81.88	4.24	2.43	<u>0.00</u>	0.84	7.52	<u>0.00</u>	3.23	0.92	1.69	0.89	<u>0.00</u>	<u>0.00</u>	6.72	1.12
	MZ05/2/6	81.43	4.44	2.44	<u>0.00</u>	0.81	7.69	<u>0.00</u>	3.37	0.92	1.90	0.79	<u>0.00</u>	<u>0.00</u>	6.97	1.10
	MZ05/2/7	82.05	3.94	2.83	<u>0.00</u>	1.31	8.07	<u>0.00</u>	3.09	0.81	1.80	0.57	<u>0.00</u>	<u>0.00</u>	6.27	1.29
Dune mound	MZ05/3/1	90.73	2.26	1.65	<u>0.00</u>	0.68	4.59	<u>0.00</u>	1.77	0.49	0.97	0.25	<u>0.00</u>	<u>0.00</u>	3.48	1.32
	MZ05/3/2	88.37	2.89	1.76	<u>0.00</u>	0.63	5.28	<u>0.00</u>	2.28	0.63	1.43	0.30	<u>0.00</u>	<u>0.00</u>	4.64	1.14

Sunnyside Pan																
	SS06/1/1	74.02	7.62	1.53	<u>0.00</u>	0.56	9.72	0.08	5.04	1.80	1.51	2.22	0.08	<u>0.00</u>	10.72	0.91
	SS06/1/2	76.66	7.59	1.13	<u>0.00</u>	0.46	9.19	0.08	3.56	1.80	1.11	2.21	0.06	<u>0.00</u>	8.82	1.04
	SS06/1/3	76.06	7.64	1.77	<u>0.00</u>	0.58	9.99	0.08	4.79	1.80	1.42	2.26	0.07	<u>0.00</u>	10.43	0.96
	SS06/1/4	56.32	7.59	2.58	<u>0.00</u>	0.43	10.59	0.07	11.72	1.70	3.10	2.42	0.09	0.11	19.22	0.55
	SS06/1/5	36.91	5.34	1.91	0.05	0.30	7.60	<u>0.00</u>	15.77	1.24	11.06	1.86	0.07	0.07	30.07	0.25
Badland topography	SS06/1/6	51.33	8.08	2.44	0.06	0.38	10.96	0.07	14.27	1.87	3.79	1.78	0.08	0.07	21.93	0.50
0.00																
Dune mound	SS06/2/1	81.85	1.92	1.39	<u>0.00</u>	0.84	4.15	<u>0.00</u>	2.74	0.52	1.24	0.19	<u>0.00</u>	<u>0.00</u>	4.69	0.88
	SS06/2/2	83.83	1.95	1.13	<u>0.00</u>	0.58	3.66	<u>0.00</u>	2.68	0.55	1.20	0.21	<u>0.00</u>	<u>0.00</u>	4.64	0.79
Salpeterpan																
Capping dune mound	SP06/2/1	78.17	4.49	2.21	<u>0.00</u>	0.54	7.24	<u>0.00</u>	4.08	0.95	2.30	0.81	<u>0.00</u>	<u>0.00</u>	8.14	0.89
	SP06/2/2	90.35	3.75	1.75	<u>0.00</u>	0.64	6.13	<u>0.00</u>	0.38	0.84	0.24	0.25	<u>0.00</u>	<u>0.00</u>	1.72	3.57
Profile	SP06/1/1	86.32	2.03	1.45	<u>0.00</u>	0.61	4.09	<u>0.00</u>	2.41	0.62	0.88	0.16	<u>0.00</u>	<u>0.00</u>	4.07	1.00
	SP06/1/2	89.00	1.88	1.19	<u>0.00</u>	0.77	3.83	<u>0.00</u>	2.24	0.57	0.77	0.13	<u>0.00</u>	<u>0.00</u>	3.71	1.03
	SP06/1/3	87.93	2.06	1.16	<u>0.00</u>	0.68	3.89	<u>0.00</u>	2.37	0.63	0.81	0.24	<u>0.00</u>	<u>0.00</u>	4.05	0.96
	SP06/1/4	90.16	1.89	1.43	<u>0.00</u>	0.59	3.91	<u>0.00</u>	1.98	0.60	0.69	0.20	<u>0.00</u>	<u>0.00</u>	3.46	1.13
	SP06/1/5	85.24	3.54	1.68	<u>0.00</u>	0.63	5.85	<u>0.00</u>	2.27	1.00	1.29	0.47	0.05	<u>0.00</u>	5.08	1.15
	SP06/1/6	88.78	2.03	1.22	<u>0.00</u>	0.67	3.92	<u>0.00</u>	2.29	0.61	0.75	0.28	<u>0.00</u>	<u>0.00</u>	3.93	1.00
	SP06/1/7	81.61	3.70	1.65	<u>0.00</u>	0.57	5.91	<u>0.00</u>	3.24	1.07	1.64	0.94	<u>0.00</u>	0.10	6.99	0.85
	SP06/1/8	82.13	3.90	1.76	<u>0.00</u>	0.67	6.33	<u>0.00</u>	3.31	1.10	1.47	0.64	<u>0.00</u>	<u>0.00</u>	6.53	0.97
Paleopan floor	SP06/1/9	23.46	2.53	1.08	<u>0.00</u>	0.15	3.75	0.06	26.95	0.60	8.31	3.61	<u>0.00</u>	0.28	39.81	0.09
Concentrations have been rounded to a maximum of 4 significant figures or 3 decimals.																
LLDs are about 0.05 mass %. Measurements below 0.05 mass % have been replaced with " <u>0.00</u> ".																
Sulfur, often, is partly volatile during loss of ignition (LOI) measurement and borate fusion. Further, its LLD may be higher than 0.05 mass % SO ₃ .																
Total* excludes the mass of SiO ₂																

Table 2.2: Results of XRF analysis showing mineralogical composition and ratio between resistant and mobile compound at Soutpan (After Rabumbulu and Holmes, 2012)

		Resistant compounds						Mobile and soluble compounds								Total	Ratio
		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MnO	TiO ₂	Total	BaO	CaO	K ₂ O	MgO	Na ₂ O	P ₂ O ₅	SO ₃	Total		
Site	Field code	%	%	%	%	%		%	%	%	%	%	%	%			
Soutpan																	
South western lunette	SP1	82.61	5.80	3.28	0.05	0.71	9.84	0.00	4.07	1.11	1.66	0.63	0.71	0.00	8.18	1.20	
	SP2	81.84	5.61	3.24	0.06	0.69	9.60	0.00	4.10	1.08	1.93	0.34	0.06	0.00	7.51	1.28	
	SP3	76.96	8.04	4.33	0.07	0.63	13.07	0.00	4.71	1.57	2.34	1.25	0.11	0.00	9.97	1.31	
	SP4	81.15	6.61	3.49	0.05	0.71	10.86	0.00	4.26	1.34	1.80	0.52	0.07	0.00	7.98	1.36	
	SP5	78.40	6.94	4.00	0.06	0.56	11.56	0.00	5.52	1.34	1.23	1.28	0.08	0.00	9.46	1.22	
	SP6	78.72	8.01	3.80	0.07	0.56	12.44	0.00	4.41	1.63	2.09	0.65	0.09	0.00	8.87	1.40	
0.00																	
Grab samples	SPA	75.88	10.42	5.22	0.78	0.84	17.26	0.00	3.19	1.22	1.94	0.56	0.04	0.00	6.95	2.48	
	SPB	85.93	4.85	3.96	0.05	0.86	9.72	0.00	1.88	0.79	1.24	0.40	0.04	0.00	4.35	2.24	
	SPC	90.84	3.61	2.40	0.03	0.65	6.69	0.00	0.41	0.76	1.28	0.01	0.02	0.00	2.48	2.69	
Florisbad	FB1	87.74	5.28	3.30	0.47	0.70	9.75	0.00	0.87	0.99	0.91	0.13	0.32	0.00	3.22	3.03	
	FB2	88.20	5.20	3.35	0.06	0.66	9.27	0.00	0.89	1.00	0.97	0.37	0.03	0.00	3.26	2.85	
	FB3	88.48	5.22	2.98	0.04	0.70	8.95	0.00	0.84	1.00	0.75	0.06	0.03	0.00	2.68	3.34	
	FB4	88.39	4.61	2.89	0.36	0.62	8.47	0.00	1.57	0.95	0.86	0.04	0.03	0.00	3.44	2.46	
	FB5	88.41	4.64	2.91	0.04	0.65	8.24	0.00	1.51	0.95	0.80	0.03	0.04	0.00	3.32	2.48	
	BBBVC	84.71	10.35	3.53	0.05	0.67	14.60	0.00	1.20	1.39	1.08	0.64	0.06	0.00	4.37	3.34	
	FB10	79.31	9.76	5.11	0.29	0.66	15.82	0.00	1.18	2.32	1.23	0.36	0.03	0.00	5.13	3.09	
Eastern lunette	EL1	88.89	4.00	2.25	0.04	0.91	7.19	0.00	1.43	0.89	0.78	0.16	0.04	0.00	3.31	2.18	
	EL2	88.22	4.63	2.42	0.05	0.77	7.86	0.00	0.94	1.02	0.48	0.15	0.03	0.00	2.62	3.00	
	EL3	77.49	9.97	5.25	0.05	0.64	15.92	0.00	1.42	1.97	1.59	1.34	0.04	0.00	6.37	2.50	
	EL4	67.42	8.79	4.45	0.05	0.59	13.89	0.00	13.50	1.58	2.43	0.87	0.04	0.00	18.42	0.75	
	EL5	79.62	7.55	4.29	0.05	0.81	12.70	0.00	3.50	1.58	1.23	0.84	0.04	0.00	7.18	1.77	

Table 3: XRF, approximations. Composition of selected samples (with low total sum in Table 2) based on a qualitative scan (elements (F-) Na-U).

Site	Field code	Al ₂ O ₃	Ba	CaO	Cl	Cr	Fe ₂ O ₃	K ₂ O	MgO	Mn	Na ₂ O	Ni	P ₂ O ₅	SO ₃	SiO ₂	SrO	TiO ₂	V	Zn	ZrO ₂	Sum
	mass	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Morgazen pan	MZ05/2/3B	8.59		8.48	<<		3.70	1.64	4.64	<<	1.63		0.11	<<	65.21	0.05	0.58		<<	0.03	94.68
Sunnyside pan	SS06/1/1	8.18	<<	4.63			1.56	1.89	1.45	<<	2.28		0.05	<<	75.74	0.09	0.41			0.04	96.32
	SS06/1/3	8.06	<<	5.16	0.16		1.61	1.86	1.54	<<	2.37	<<	0.09	0.07	75.02	0.08	0.65			0.07	96.73
	SS06/1/4	8.23		12.68	0.53		2.83	1.83	3.31	<<	2.61		0.09	0.16	60.40	0.12	0.46			0.04	93.28
	SS06/1/5	6.40		18.49	1.22		2.23	1.41	13.02	<<	2.21		0.08	0.14	42.51	0.45	0.33			0.09	88.57
	SS06/1/6	9.05		15.72	0.63		2.66	2.00	4.18	<<	1.97		0.09	0.14	55.64	0.15	0.46			0.04	92.72
	SS06/2/1	2.33		2.76	<<		1.46	0.49	1.27		0.22		<<	<<	85.87	0.04	0.92			0.04	95.39
	SS06/2/2	2.39		2.67	<<	<<	1.22	0.66	1.18		0.27		<<	<<	86.36	0.03	0.69			0.03	95.51
Salpeter pan	SP06/1/9	3.14		33.16	4.25		1.40	0.69	10.33	<<	4.52		0.06	0.45	27.86	0.45	0.20	<<			86.51
	SP06/2/1	4.79		4.18	0.35		2.36	1.01	2.48	<<	0.97		<<	0.07	79.72	0.05	0.64			0.04	96.66
“<<” stands for “detected, but too low to be quantified”. Blank fields stand for “not detected”.																					

Table 4: Ratio of resistant compounds to mobile/soluble compounds and CIA values

Site	Field code	Ratio	CIA
<i>Morgenzon Pan</i>			
Capping dune	MZ05/1/11	1.06	42.04
	MZ05/1/12	1.26	45.15
Profile A	MZ05/1/1	1.39	51.66
	MZ05/1/2	1.33	52.83
	MZ05/1/3	1.44	54.51
	MZ05/1/4	1.40	55.53
	MZ05/1/5	1.29	51.73
	MZ05/1/6	1.21	50.63
	MZ05/1/7	0.99	44.70
	MZ05/1/8	1.03	44.33
	MZ05/1/9	1.07	47.86
	MZ05/1/10	1.25	52.51
Capping dune	MZ05/2/8	1.26	45.00
	MZ05/2/9	1.17	45.20
Profile B	MZ05/2/1	1.16	46.04
	MZ05/2/2	1.08	46.07
	MZ05/2/3A	1.11	47.53
	MZ05/2/3B	0.78	41.80
	MZ05/2/4	1.14	46.21
	MZ05/2/5	1.12	45.75
	MZ05/2/6	1.10	46.65
	MZ05/2/7	1.29	46.79
Dune mound	MZ05/3/1	1.32	47.36
	MZ05/3/2	1.14	47.36
<i>Sunnyside Pan</i>			
	SS06/1/1	0.91	45.72
	SS06/1/2	1.04	50.07
	SS06/1/3	0.96	46.32
	SS06/1/4	0.55	32.39
	SS06/1/5	0.25	22.05
Badland topography	SS06/1/6	0.50	31.08
Dune mound	SS06/2/1	0.88	35.67
	SS06/2/2	0.79	36.22
<i>Salpeterpan</i>			
Capping dune mound	SP06/2/1	0.89	43.46
	SP06/2/2	3.57	71.77
Profile	SP06/1/1	1.00	38.88
	SP06/1/2	1.03	39.00
	SP06/1/3	0.96	38.84

	SP06/1/4	1.13	40.59
	SP06/1/5	1.15	48.60
	SP06/1/6	1.00	38.96
	SP06/1/7	0.85	41.31
	SP06/1/8	0.97	43.57
Paleopan floor	SP06/1/9	0.09	7.51
<i>Soutpan</i>			
South western lunette	SP1	1.20	49.97
	SP2	1.28	50.40
	SP3	1.31	51.66
	SP4	1.36	51.95
	SP5	1.22	46.00
	SP6	1.40	54.49
Grab samples	SPA	2.48	67.71
	SPB	2.24	61.23
	SPC	2.69	75.41
Florisbad	FB1	3.03	72.66
	FB2	2.85	69.69
	FB3	3.34	73.38
	FB4	2.46	64.33
	FB5	2.48	65.14
		3.34	76.20
	FB10	3.09	71.66
Eastern lunette	EL1	2.18	61.62
	EL2	3.00	68.68
	EL3	2.50	67.80
	EL4	0.75	35.53
	EL5	1.77	56.05
<i>Ratio_ resistant to mobile and soluble compounds</i> <i>CIA_chemical index of alteration</i>			

Results

The XRF results are presented in a form of a table (Table 2.1 and 2.2). In all the study sites SiO₂ dominates the sediment samples followed by Al₂O₃ and Fe₂O₃ being the second most abundant compounds. Samples from Sunnyside Pan and Salpeterpan contain higher ratios of MgO, CaO, K₂O and Na₂O than the samples from the other pans. At Soutpan the south-western lunette, contain slightly higher ratios of mobile and soluble compounds than the other two dunes from this site. A slight difference in concentration of mobile/soluble compounds is also observed between Profile A and Profile B at Morgenzon Pan. Sediments from Sunnyside Pan and Salpeterpan have the lowest CIA values (Table 4).

Despite slightly higher CIA values on sediments that were taken on upper layers of the lunette at Sunnyside Pan, this site has the lowest CIA value with an average of 39. Profile A and B at Morgenzon Pan have different CIA values, profile A with higher value, suggesting a slightly stronger chemical weathering towards the northern margins of the lunette. Sediments from Soutpan have the highest CIA values compared to the other three sites. However there are major differences in the CIA values of dunes from this site, Florisbad has the highest CIA value (70), followed by the eastern lunette with 58 and the south-western lunette has the lowest value (51) from this site (Table 4).

Sunnyside Pan is the only site where sediments from the pan fringing lunettes contains barium oxide (BaO). BaO was also detected on the sample from the pan floor of Salpeterpan but not on samples from the lunette (Table 2). Similar to BaO, sulphur trioxide (SO₃) was present in all the sediments from Sunnyside Pan and only detected on two samples from the Salpeterpan, one sample at the bottom of the dune profile, closer to the base of the pan floor and one taken from the actual pan floor. It is also important to note that from the samples that were scanned after the first analysis (Table 3), Chlorine (Cl) was either present or detected in all the samples. Because few samples were scanned it will be premature to generalise or to make any scientific explanations about this. However the occurrence of chlorine in all the sediments from all three sites, the occurrence of Zinc (Zn) in a sample from Morgenzon Pan, the occurrence of vanadium (V), in one sample from Salpeterpan and chromium (Cr) at Sunnyside Pan warrant scanning of all samples (Table 3). At Morgenzon Pan there is some noticeable differences between the two profiles, for example, sediments from profile A have slightly higher concentration of manganese (Mn). Most of the sediments taken from profile A contains diphosphorus (P₂O₅) pentoxide which is not present in any of the samples from the other profile (Table 2).

Discussion

Although the XRF results seems to indicate that the sediments from lunette dunes from all four sites investigated have similar mineralogy, it is also clear that Sunnyside Pan is quite different. Geochemical analysis have clearly revealed differences in mineral composition of dunes in different sites. Besides the differences in dunes at various sites, what is more important is that in pans where multiple dunes were sampled, it is quite clear that the dunes are not mineralogically identical.

CIA values indicate weaker chemical weathering at Sunnyside Pan and Salpeterpan than at Soutpan and Morgenzon Pan. It is also important to note that the dunes with lowest CIA values also display similar characteristics because they have no clear stratigraphy, are heavily eroded and contain structureless sand. The two sites are only ~5km apart and the two pans are found on the same drainage lines. Their similarity in terms of dune orientation, morphology and mineralogy may be an indication of that these two dunes were either formed around the same period or have evolved under similar environmental conditions. The OSL ages also reveal comparable dune sediments accumulation and stabilisation phases for these two sites (Holmes *et al.*, 2008).

At Soutpan and Morgenzon Pan, where some dune profile have higher or slightly higher CIA values than other dunes in the same site, the dunes with higher values appear to be less eroded, though they lack clearly defined sedimentary structure, there is obvious colour changes within the dune facies. Higher CIA values suggest stronger chemical weathering (Yang *et al.*, 2004; Yang *et al.*, 2008; Sun *et al.*, 2009). Since chemical weathering to a large degree is linked to climatic conditions or availability of moisture, these results can be used to reconstruct paleoenvironmental changes in aeolian sediments.

XRF results of three dunes from the Florisbad site has been previously discussed by Rabumbulu and Holmes (2012), the findings are quite similar to the other three site. The variation in distribution of soluble and mobile elements can also be used to explain the difference in appearance of dunes from different sites as well as dunes from the same site (see Figure 3). On the photographs (Figures 3), it is quite clear that the western and eastern lunette dunes appear to be excessively eroded, as compared to the Florisbad dune. In this case the lunette dunes are probably older than the Florisbad dune. Florisbad dune (Soutpan) with the highest CIA value is presently and highly likely that even in the past was located closer to a water course. Almost all the alkali and alkaline earth elements have been removed in sediments at the Florisbad dune. The CIA values (table 4) seem to suggest that chemical weathering is stronger in dunes that are presently closer to ephemeral drainage lines.

The ratio of soluble and mobile together with CIA values indicates that the lunettes at Soutpan had undergone more weathering cycles than at the other three pans. Based on the findings from this study, the lunettes from Sunnyside Pan and Salpeterpan are the youngest because they have undergone fewer weathering cycles and this is in agreement with existing published OSL ages (Holmes *et al.*, 2008). Available OSL ages of sediments from exposed faces of the south-western lunette were established from reworked sediments (Rabumbulu and Holmes, 2012), although the geochemistry of this lunette seem to suggest that it is the youngest of the three dunes from this site, coring and analysis of those sediments must be done to confirm. The average CIA value (51) and chemical composition of sediments from the south-western lunette at Soutpan is very similar to the value (50) of



Figure 3: Photographs showing the differences in appearance of four dunes from the same site (Soutpan)

Top Left: South western lunette, long upslope fetch and highly dissected.

Top right: Florisbad dune, the only dune on this site with clear pronounced stratigraphy.

Bottom Left: The eastern lunette dune, with no clear stratigraphy but noticeable colour changes

Top Right: A possible outer lunette that will need to be confirmed through drilling, because the lunette is blanketed by young red aeolian sediment

Conclusion

Experimental laboratory results have indeed shown that physical and chemical analysis provide some insight into the history of the sediments. The history of sediments in the western Free State Panfield, as with most natural environments is highly complex. From the XRF results it is quite evident that mineralogy of sediments can be useful when trying to reconstruct the paleodepositional environment in this region. The results suggest that in cases where multiple dunes are present in one pan, it is important to pay closer attention to each dune because each dune could be different. The geochemistry of all the dunes, from different sites and within a site shows that the sediments are different, indicating either differences in terms of evolution of these features or origin of sediments at the very least. Higher intensity of chemical weathering in some sediments indicate availability of moisture which can be associated with warmer humid phases (Sun *et al.*, 2009).

Future studies in this region must look into using geochemical analysis findings together with other techniques in order to fully reconstruct paleodepositional environments using different proxies. In order to make conclusive findings about paleoclimatic conditions in this region, X-ray powder diffraction (XRD) analysis of the sediments for the lunettes will be necessary, as to determine the exact minerals found in the sediments from different lunettes. XRD results will reveal how minerals have altered in the past, and that information can be used to determine the exact environmental or climatic conditions necessary for the alterations to take place. In this study, only one site (Florisbad) was subjected to coring, in future the results from this study can be used to select sites for coring in other sites.

According to Rabumbulu and Holmes (2012), the material in some of the dunes in the western Free State Panfield has undergone several kinds of transportation, which is an indication that there have been multiple stages of exposure and burial, from sediments source to current position. Although it is impossible to accurately describe the transportation and history of the sediments, the in situ cosmogenic nuclides dating ($^{10}\text{Be}/^{26}\text{Al}$) can provide useful information about the burial history of the sediments (Dehnert and Schluchter, 2008). The geochemistry results are also useful because they can be used to relatively date lunettes, and can be used to determine ages of lunette in conjunction with other chronologies.

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Appendix A: Conference programme

Monday 26 September – Conference venue: STIAS centre

Time	Auditorium 1: James Hutcheon	Auditorium 2: Piet Serton	
8:00 - 8:20	Late registrations/Coffee & Tea		
8:20 - 8:30	Welcome: SSAG President, Kevin Mearns		
8:30 - 8:50	Book launch and handover to SSAG President: <i>The Origin and Growth of Geography as a Discipline at South African Universities</i> - Visser, Donaldson & Seethal		
8:50 - 9:10	South African geographers and the International Geographical Union - Meadows		
09:10 - 10:10	Keynote address - Jennifer Robinson : Post-colony meets post-democracy: Thinking urban politics from Johannesburg to London Chair - Parnell		
10:10 - 10:30	Coffee/Tea Break		

Time	Auditorium 1: James Hutcheon	Auditorium 2: Piet Serton	Manor House: Francis Plummer	Breakaway room: William Talbot	Seminar room: John Wellington
10:30 - 11:50	Future cities? – Chair: Pirie Parnell - The new urban agenda: implications for urban research Sitas - Towards an affective urban Studies Abrahams - The urban policy agenda in South Africa: The role of South African Cities Network Butcher - Urban Geography, meet Economic Geography: Sub-disciplinary dialogue in the age of Economic Freedom Fighters Ballard - Imagining Gauteng: A conceptual framework Session ends 12:40	EIA: past and present – Chair: Sandham Wessels - Learning from 20 years' evolutionary changes to ISO14001-based Environmental Management Systems Simpson - A capabilities approach to environmental assessment: Enhancing the justice considerations of human development and well-being Steenkamp et al - The performance of Environmental Impact Assessment (EIA) screening in South Africa Johnson et al - ISO 14001 certification - A cost benefit analysis within the South African Manufacturing Sector	Paleo and Antarctica environments – Chair: Hedding Fitchett et al - Holocene Palaeoenvironments in Eastern Lesotho: Synoptic Drivers of Rainfall Variability Rabumbulu - Paleo-depositional environment reconstruction of the western Free State panfield South Africa Rudolph et al - Towards a glacial reconstruction of sub-Antarctic Marion Island using cosmogenic nuclide dating Meiklejohn - Why Antarctica; The rationale for current research	Geographical Knowledges and Techniques: Present, Past, Future – Chair: Flugel Van Dijk & Krygsman - Mobile data collection techniques in Africa: possible futures of geographic research Pretorius et al - Tweeting for environmental awareness: Social media's contribution De Vivo - Conversation with a geographer: Exploring the discipline's past through oral history Stanley - Chance encounter and a long-term relationship	IT Tools in geographic teaching and research – Chair: Lombard Goldschagg -The potential roles of citizen science and smartphone apps in geographical and environmental education based on a study of apps currently available for use in the classroom Cilliers et al - Interactive-GIS-Tutor (I-GIS-T): Facilitating GIS learning in FET-phase Geography Munch - Using blended learning to teach geospatial techniques Okosun - Cartographic method as a tool in the illustration of research data: a case study of Delta University Abraka - Nigeria
10 min break (11:50-12:00)					

Time	Auditorium 1: James Hutcheon	Auditorium 2: Piet Serton	Manor House: Francis Plummer	Breakaway room: William Talbot	Seminar room: John Wellington
12:00 - 13:20	Session starts at 12:50 Geographies of enterprise development – Chair: Irvine Tichaawa - Business tourism in Africa: The case of Cameroon Rogerson - Re-energising South Africa's SMME economy: a place for business incubation Boekstein - A framework for thermal spring health tourism product development in the Western Cape	Spatial clustering and the urban: Part 1 – Chair: Lemanski Horn & Van Eeden - Measuring urban sprawl in the Western Cape province, South Africa: an urban sprawl index for comparative purposes Tshabalala & Mini - Spatial amalgamation of Municipalities: Theory and experiences in contemporary South Africa Geyer - Determining the micro-effects of dimensionality on agent mobility in Polycentric City Regions using fractal scaling Krygsman - Cape Town: An emerging polycentric metropolis?	Erosive processes and geomorphology – Chair: Kakembo Le Roux - Gully erosion mapping and sediment yield contribution modelling in South Africa's only large river network without a dam Mokgoebo - The investigation of the factors driving gully development at Dopeni village of the Nzhelele Valley, Limpopo Province Pretorius et al - Sediment yield modelling in the Upper Tsitsa Catchment	Urban renewal and its diverse practices – Chair: Spocter Block - Unmasking Soweto renewal: a case study of two unique streets Hoogendoorn & Gregory – Instagrammers, urban renewal and the Johannesburg inner city Martel & Sutherland – An examination of the knowledge production process in a spatial planning exercise: The case study of the Back of Port Project in Durban, South Africa Scott - Neoliberalising historic urban cores: A comparative study of urban heritage planning in Europe	Geographies of adaptation – Chair: Magagula Stander et al - Vaalharts: Environmental aspects of agricultural land and water use practices Fajji et al - Relevance of climatic variables and management systems to spatial variation in rangeland productivity in semi-arid environments Ebhuoma & Simatele - 'We know our terrain': Indigenous knowledge systems preferred to climate change risk communication in adapting to climate variability and change in Nigeria
13:00 - 14:00	Lunch				
14:10 -	Wine or craft beer tour (Busses depart at 14:00 from STIAS main gate)				
18:00 for 18:45	Entertainment evening - Hofmeyer Hall, Church Street. Informal evening with wine, waterblommetjie bredie, music and Mark Bank's comical take on things in life				

Tuesday 27 September

Time	Auditorium 1: James Hutcheon	Auditorium 2: Piet Serton	Manor House: Francis Plummer	Breakaway room: William Talbot	Seminar room: John Wellington
8:00 - 11:10	Tourism motivations, perceptions and strategies – Chair: Rogerson J Nhlabathi - Motivations to engage in dark tourism: the case of selected sites in South Africa Van der Merwe - Tourist guides' perceptions of cultural heritage tourism in South Africa Giddy et al - American tourists' experiences of weather in South Africa: implications for future climate change	Housing geographies and the Southern city – Chair: Horn Lemanski - Infrastructural citizen: State-subsidised housing extensions in Cape Town, South Africa Mgushelo & Darkey - Land acquisition and growth of informal settlements in South Africa: The case of informal settlements in Mamelodi, City of Tshwane, 1994-2014. Olaniran & Erwin - Mixed-income housing in Nigeria and South Africa: a comparative literature review Yakubu - Residential mobility practices: a revolving door syndrome among low-income families in the global south?	Special session: The South African economy: are we innovating or closing down? Hosted by Gina -Smith: Part 1 – Chair: Weir-Smith Green - Geographic trends in unemployment in the UK Gregory & Rogerson – Unpacking the geography of the creative industries in Johannesburg Wellman and Ferreira - Saldanha: Sea Harvest 'back [fish] bone' in the local economy Booyens & Rogerson - Global-local trajectories for regional competitiveness: tourism innovation in the Western Cape	Geographies of health and vulnerability – Chair: Rule Lindeque et al - The health and economic benefits of interventions to reduce residential solid fuel burning on the Highveld Mthembu - Traditional health care services in Umkhanyakude District Municipality: An alternative option of health care Azong & Kelso - Life history: An alternative methodology for vulnerability research?	Remote sensing applications: Part 1 – Chair: Munch Dlamini et al - Detecting and mapping the impacts of subsistence farming on floodplain wetlands using high-resolution remote sensing data Mugwena - Using remote sensing to identify and map vegetation ecotones Jaggwe & Kakembo - An assessment of the spatial and temporal changes of the Mabira tropical forest reserve in Central Uganda
	10 min break (9:40-9:50)				
	Geography in and beyond the university – Chair: Pretorius, R Bass & Houghton - Geographers beyond Geography Departments in South Africa Zweig - Awkward conversations in small towns: Experimenting with student-led research projects Wafer - Thinking geographically – redefining the discipline in the South African undergraduate curriculum Oldfield - High stakes: Building collaborative urban geographies	Coastal management and contested development – Chair: Brooks Gammage et al - Responding to a changing fishery system: insights from a place based analysis of the small scale handline fishery of the Southern Cape Sowman et al - Coasts at risk: a governance and social justice perspective of coastal erosion at Milnerton beach, Cape Town Williams - Fisheries in transition: Fishers' perceptions of the new South African small-scale fisheries policy (SSFP) and its implementation Kakembo et al - Understanding socio-political and ecosystem vulnerabilities in smallholder communities: A comparison of the Keiskamma and Mkomazi catchments in South Africa and Tanzania	Special session: The South African economy: are we innovating or closing down? Part 2 – Chair: Ferreira Weir-Smith - Unemployment and poverty in South Africa: spatial dynamics Rogerson - New directions in the South African beer industry: neolocalism and the rise of craft beer Du Plessis - Spatial clustering trends of economic activities in South African cities Lombard & Ferreira - The spatial distribution of renewable energy infrastructure in three particular provinces of South Africa	Spatial planning and urban growth – Chair: Mwachunga Perold et al - Grounded architectural practice: Exploring spatial capacity building in informal settlement upgrading Yamungu - The theory of street-level bureaucracy: Planning professionals' discretion in the implementation of urban planning policies in the global south Van Eeden - Participatory GIS as a technique that may strengthen outcomes of public sector urban planning: Cape Town, South Africa Oteng-Ababio et al - Increased crime prevention through environmental designs and the amplification of violent crimes: a case of trust deficit	Session continues Bangira et al - Remote sensing for flood mapping: a case study of the Caprivi Basin, Namibia De Klerk et al - Using remote sensing in support of environmental management: a framework for selecting products, algorithms and methods
11:10-11:25					

	Coffee/Tea Break				
11:30- 12:25	Keynote address: Abdi Samatar - Africa's First Democrats Chair: Oldfield				
12:30 –13:30	Lunch				
Time	Auditorium 1: James Hutcheon	Auditorium 2: Piet Serton	Manor House: Francis Plummer	Breakaway room: William Talbot	Seminar room: John Wellington
13:30 - 14:45	Special session: Food: A lens to understand dynamics of African urbanism. Hosted by the Consuming Urban Poverty Project, African Centre for Cities: Part 1 – Chair: Ballard Battersby - Why food? Using food as a lens to understand urban development trajectories: An analysis of food in the New Urban Agenda Duminy - The problem of food: Examining the history of food security policy in Kenya and Zambia, c1920 to 1974 Skinner & Haysom - The informal economy’s role in feeding cities - A missing link in policy debates? Toriro - Food governance in Harare: The law vs.practice	Spatial clustering and the urban: Part 2 – Chair: Rubin Horn - The real (hi)story of spatial planning in Cape Town, South Africa Drummond - From Mafeking to Mahikeng: the growth and transformation of a South African provincial capital Brand & Verhoef - Millennia of mapping censuses – 1911 towards 2011	Special session: Urban Water Governance: Reflections from Cape Town and Durban hosted by Dianne Scott – Chair: Harris Ziervogel et al - Gravel platforms in a flood-prone informal settlement in Cape Town: Adaptive practice or short term gains? Scott et al - The making of waterscapes: the politics of water and sanitation technologies in Cape Town and Durban Rodina & Harris - Water resilience and equity in Cape Town: Trends and tensions in rethinking the urban water cycle Taylor - Governing Cape Town’s stormwater in a changing climate: Understanding adaptation as a process of decision-making Sutherland et al - Social constructions of environmental services in a rapidly densifying area of eThekweni Municipality	Drylands geomorphology – Chair: Rudolph Van der Merwe - Barchan shape as an aid to process explanation: An historical overview Von Holt et al - Aeolian dust emission in the Namib desert: Measurements of small-scale erodibility controls Odhambo & Kori - Origin of desert sands: The use of converging evidence to re-construct palaeoenvironments Earth surface processes Denis & Kakembo - Characterization of the morpho-hydrological, pedological and anthropogenic parameters underpinning spatial landslide hazard occurrence in Kigezi highlands south western Uganda	Land and the politics of access – Chair: Mini Werner - Transforming Namibia’s communal lands: from ‘illegal’ fencing to legal enclosures Thakoli - Grabbing land in the frontier, a land tenure regime perspective Davis - Inclusive business models in South African land restitution: great expectations and ambiguous outcomes explored. Bwalya - Underclass by choice: Speculative land occupation in Ichimpe, Kalulushi Narsiah - Land tenure and access to water and sanitation in Chatsworth, Durban
14:45 - 15:10	Coffee/tea break				

Time	Auditorium 1: James Hutcheon	Auditorium 2: Piet Serton	Manor House: Francis Plummer	Breakaway room: William Talbot	Seminar room: John Wellington
15:15 - 16:35	Special session: Food: A lens to understand dynamics of African urbanism. Hosted by the Consuming Urban Poverty Project, African Centre for Cities: Part 2 – Chair: Wafer Haysom - Urban food economies, for whom, why and who plans such economies? Tawodzera - Tracking basic foodstuffs central to household food security in Epworth, Zimbabwe Sibanda & Von Blottnitz, - Studying food value chains in secondary African cities: The example of fish in Kisumu, Kenya Final slot: A roundtable discussion	Debating development: Rhetoric vs reality – Chair: Butcher Benjaminsen TA & Svarstad - HNorway and REDD+ in Tanzania: Knowledge claims, concealed practices and the creation of a success story Mashinini - Sustainable development goals in Lesotho: reality or rhetoric?	Urban governance: Limits and possibilities – Chair: Sutherland Marrengane - Local governance in the context of HIV and AIDS in one African City: The case of Mbabane, Swaziland Rubin - The limits of litigation: Court cases and urban governance in Delhi and Johannesburg Rule - Geography and voting: the growth of urban opposition two decades after South African democratisation Spocster - Privatisation of municipal golf courses in small towns in the Western Cape	Land and the politics of conservation – Chair: Williams Rowntree - Transforming landscapes from the village level to the catchment: an achievable outcome or wishful thinking? Kamuti & Brookes - The changing geography of wildlife conservation in contemporary South Africa under private game farming Sekhele - Assessing cumulative environmental and socio-economic impacts of livestock grazing in the Clarens Nature Reserve Sinthumule - Contested land in peace parks: The case of Greater Mapungubwe	Geography: Literacy and learning – Chair: Goldschagg Carolissen & Dyssel - Traversing first year students' mental maps: The quest for graphicacy and numeracy competence Pretorius - Teaching and learning in Geography? How, why? Smit - Military environmental literacy in the South African Army Raselimo - Situating the Lesotho secondary school geography in curriculum relevance debate Milaras - Action research driving a scaffolded Pedology curriculum
10 min short break					
16:45 - 17:45	Political Geography Journal Plenary Lecture Ramutsindela - Greening Africa's Borderlands: the Symbiotic Politics of Land and Borders in Peace Parks Chair: Benjaminsen Sponsored by Elsevier				

Wednesday 28 September

Time	Auditorium 1: James Hutcheon	Auditorium 2: Piet Serton	Manor House: Francis Plummer	Breakaway room: William Talbot	Seminar room: John Wellington
8:00 - 11:10	Geographical Information Technology development and techniques – Chair: Mashimbye Van Niekerk - Lessons learned in developing a 2m resolution digital elevation model of South Africa Mtshawu - Estimating the distribution of surface soil texture using LANDSAT 8 data Van Niekerk et al - Developing and verifying an irrigated agriculture map of South Africa using earth observation methods	Informality and the everyday city: Part 1 – Chair: Darkey Mehlomakhulu et al - Forgotten places: Setting the context for a forgotten relocation camp Rink & Klaas - Living with aeromobility: Relational geographies of flying and informality in Freedom Farm, Cape Town Mwathunga - Henri Lefebvre in a postcolonial city of Lilongwe in Malawi Siyongwana - Post-apartheid transformation of the South African 'hidden urbanites': Reflections from Mdantsane township, Buffalo City	Rural geographies: development dynamics – Chair: Bwalya Van Rooyen & Van Westen - "Translocality" – contributing to rural change Mzitshi - The changing rural economy and development: The case of selected rural areas in the Eastern Cape Ndimande - Rural governance and space production in the City of UMhlathuze, South Africa Todani - An evaluation of institutional capacity for implementation, coordination and monitoring of comprehensive rural development programme at Muyexe	African regional climatology – Chair: De Waal Abiodun et al - Potential impacts of climate change on extreme rainfall over three African coastal cities Kabanda - Long-term rainfall trends over the Tanzania Coast (1950-2011) Sibanda et al - Spatio-temporal trends and variability in temperature and extreme weather events in Mzingwane catchment, Zimbabwe Van der Walt & Barker - A spatial-analytical investigation of seasonal rainfall and temperature patterns over southern Africa	Critical environmental dynamics: Climate, air, water – Chair: Abiodun Hardy & Nel - MODIS Land Surface Temperature Reconstruction Based on Local Climate Zone Classification Lawal et al - Climate variability and carbon flux in Southern African semi-arid ecosystems Piketh & Burger Characterizing ambient air quality in dense, low-income areas in South Africa
	10 min break (9:40-9:50)				
	GIS application: Mapping and analysis – Chair: De Klerk Kemp - Growing applications of spaceborne radar imagery for mapping and monitoring South Africa's land and ocean surfaces Mashimbye - Salinity mapping at catchment scale using terrain attributes Mbatha et al - Stratosphere-troposphere exchange climatology over Southern Africa using ERA-Interim data set and AIRS/Aqua satellite data Munch - Evaluating temporal landscape change through intensity analysis and trend analysis	Informality and the everyday city: Part 2 – Chair: Seethal Gama - Violence and insecurity at the hostel in KwaZulu Natal Willemse - A new lease of life, or not? Determining the changes in the living conditions of SADC migrants in four metropolitan areas from 2001 to 2011 Memela & Maharaj - Changing gender division of labour, place and hardships: A case study of single refugee women in Albert Park area, Durban Dawson & Culwick - Making a life in Gauteng: Changing economic and household arrangements in a context of rapid urbanisation Olaniran & Erwin - Factors responsible for the shaping of low-cost housing in South Africa: a literature review	Contested urban social dynamics – Chair: Rink Ah Goo - Gentrification and displacement: a phenomenological approach Darkey & Ibsen - 'The path of the mother is trodden by the daughter': Stepping stones for entry into the middle class in the new South Africa. Hamann - The central-south citadel and the dynamic periphery: (De)segregation and inequality in the City of Tshwane, South Africa Irvine - Town and gown: Studentification, urban restructuring and contested spaces in Grahamstown, South Africa	Tourism governance – Chair: McKay Khuzwayo - Governance of tourism in KwaZulu-Natal Hoogendoorn & Fitchett - Tourism and climate change: Threats and adaptation strategies for South Africa Visser - The South African tourism system: Reflections on student research Rogerson - Tourism planning of the past: Apartheid on the beaches of South Africa Bordelon & Ferreira - Reading the Winelands through the tourist lens	Environment and the question of security – Chair: Piketh Cavanagh - Critical ecosystem infrastructure: Securitized the forests-water nexus in the Kenyan highlands Kelso - Environmental history and vulnerability: Lessons from the past Nel - Anarchy in the forest: Conflict, warmachines and forest management Nel et al - Towards understanding the effects of informal harvesting of Sand Forest in Maputaland, South Africa Urban ecology Anderson - Domestic gardeners as key 'actors' in the urban ecological fabric of the City of Cape Town
Time	Auditorium 1: James Hutcheon	Auditorium 2: Piet Serton	Manor House: Francis Plummer	Breakaway room: William Talbot	Seminar room: John Wellington

11:10 - 11:25	Coffee/tea break				
11:30 - 12:30	ESRI Keynote address and special session Keynote: Patrick McKivergan (Managing Director Esri South Africa) - Why GIS needs Geographers Sanet Eksteen, Education and Training Manager - Empowering GISc education in South Africa Rentia McLaughlin, GIS Specialist - Geography, your location platform Chair: Van Niekerk Sponsored by ESRI South Africa 				
12:35 - 13:20	Serton memorial lecture: Etienne Nel - Dealing with difference: responses to uneven geographical development, reflections from South Africa and beyond Chair: Maharaj				
13:30-14:25	Lunch				
Time	Auditorium 1: James Hutcheon	Auditorium 2: Piet Serton	Manor House: Francis Plummer	Breakaway room: William Talbot	Seminar room: John Wellington
14:30 - 15:50	Special session: Geographical perspectives on corruption hosted by Seethal – Chair: Davis Maharaj – Corruption: A geographical perspective: South African reflections Ellero - Crumbling housing and failed promises: A critical study of corruption in low cost housing in Phoenix, eThekweni Municipality Rajah - Collusion, cadres and corruption: A critical study of the procurement sector and corruption in local government - the case of eThekweni Municipality Seethal & Ngwira - Governance and the just city: The case of the Buffalo City Metropolitan Municipality, South Africa (c2000-2015)	Transport, mobility, and the city - Chair: Narsiah Baffi - Public transports in South Africa: From segregation to inclusion tools? Lockhat & Kotze - Rea Vaya in Johannesburg: the reality of an underperforming Bus Rapid Transit System Mpungose - Geographies of megaprojects: What will be the Impacts of port expansions in Durban? Olanibi & Olafiaji - Impacts of land-use pattern on road traffic in Akure Metropolis, Nigeria	Critical environmental dynamics: Air, water, sand – Chair: Barker Mulaudzi - An evaluation of the feasibility of establishing Regional Waste Facilities in Bojanala Platinum District Municipality Ruhiiga - Interface management in municipal waste delivery systems Mudau & Ruhiiga - A waste process interface response framework Schoeman & Schmidt - Household recycling behaviour in the City of Johannesburg	Tourism and tourism product type – Chair: Hoogendoorn Van der Merwe - The geography of heritage tourism in South Africa Stander - Arts festivals in the South African context: what we know and what we don't Tichaawa - The geography of festival and tourism development: The Case of Cameroon McKay - The geography of the South African adventure tourism industry	Governing poverty, building security? – Chair: Tawodzera Wuyep & Kotze - The contribution of urban poultry farming to food security and employment in Jos, Nigeria Yakubu et al - Impact of urban agriculture in poverty reduction in Osogbo, Nigeria Iortyom & Pillay - The economic impact of Fadama III Project on beneficiaries in Benue State: A Case of Makurdi Local Government in Nigeria
16:00 - 17:00	Venue: Manor House: Francis Plummer - SSAG Biennial General Meeting				
18:30 for 19:00	Conference banquet: STIAS Banquet Hall				

Poster presentations (throughout conference)	Angula et al - Understanding pastoralists knowledge of environmental and climate change in arid Namibia; Dhau et al - Comparative analysis of random forest forward variable selection and guided regularized random forest techniques for optimum band selection; Donaldson & Lombard - Cultural mapping of the creative arts industries in Cape Town; Flugel - Mapping Axis submarine attacks off the coast of southern and eastern Africa during the Second World War (1939 – 1945); Fox - The expanding horizon: Geography theses Rhodes University 1950-2015; Hansen et al - A note on frost mounds observed in the Jutulssessen, Antarctica; Hedding et al - Intra-annual variations in aeolian sediment movement rates at sub-Antarctic Marion Island; Knox - An investigation into chemical weathering on selected nunataks, in Western Dronning Maud Land, Antarctica; Magagula - Persistent challenge: Environmental protection and military activities; Manjoro - Use of sediment source fingerprinting to assess the role of subsurface erosion in the supply of fine sediment in a degraded catchment in the Eastern Cape, South Africa; Masebe - Fundamental atmospheric drivers that affect ground thermal regimes in Dronning Maud Land, Antarctica; Massey & Pretorius - The Green Box project: Environmental education in a crate; Meiklejohn et al - Two decades of geographical research in the Antarctic and Sub-Antarctic; Nsubuga - Detecting changes in surface water area of lake sub-basins found in climate change impacted areas of Sub-Saharan Africa; Potgieter - Adaptation to rainfall variability and drought of commercial dairy farmers in the Tugela catchment for the period between 1982-2015, Kwa-Zulu Natal, South Africa; Rowntree et al - Guiding landscape rehabilitation through research in the Tsitsa catchment; Smart et al - Rainfall variability on drought in the central and northern Drakensberg; Tawodzera et al - Surviving on the margins: Poverty and food insecurity among the poor in Polokwane; Van der Merwe - Geography of a cosmic event in South Africa: the Koue Bokkeveld meteor fall (1838); Wilmot - The periglacial geomorphology of selected Nunataks in Western Dronning Maud Land, Antarctica

