



Understanding Durban University of Technology Students' Perceptions of Biodiversity Loss

Jonathan Foley, Himansu Baijnath and Donal P. McCracken,
University of KwaZulu-Natal, South Africa

Abstract

Biodiversity loss has been recognised as a global and local problem of increasing magnitude. As future leaders, university students may play an influential role in alleviating this serious and multifaceted problem. This particular research focuses on a relatively new area of study not yet covered in the literature, that of South African university students' perceptions and understandings of biodiversity. This paper seeks to describe the knowledge, attitudes and perceptions of students at Durban University of Technology towards biodiversity and to consider some of the socio-cultural causal factors. Student opinions were sampled using an appropriate survey modelled after European biodiversity surveys and adapted to meet the unique challenges of South African conditions and rich biodiversity found in Durban's urban green spaces. The quantitative data were then merged with qualitative data drawn from four focus groups sampled across selected faculties at the institution. The focus groups involved guided discussion on the relevance of biodiversity, viewing of video clips and local field visits to Pigeon Valley Nature Reserve and the Durban Botanic Gardens. The results indicated high levels of concern for biodiversity loss and strong cultural connections with traditional African medicinal plants.

Keywords: Biodiversity loss, traditional African medicinal plants, culture, tertiary student perceptions.

Introduction

Purpose and aims

This study deals with the intersection of two global influences that are rapidly changing our world: firstly, an environmental crisis accelerated by widescale loss of biodiversity; and secondly, the growing influence of a new generation of university students who possess the ability and power to reshape the socio-political, economic and cultural landscape (CBD, 2014; Stein, 2013). Mindful of these global themes and context, this particular research focuses on South African university students' knowledge, attitudes and perceptions of biodiversity and nature. Since literature on the topic is sparse, this study has significance in informing science communicators, including teachers and environmental educators within the higher-education ambit, and adding value to curators and outreach staff from botanic gardens and other conservation organisations seeking to communicate biodiversity issues to South African youth. The research presented here forms part of a larger doctoral study that examined student connections with local biodiversity in urban green spaces and different modes of communication with students (Foley, 2016).

This paper proposes that while university students may be unfamiliar with the exact scientific meaning and significance of the term 'biodiversity', they respond positively when the word is explained and expanded in less specialist language that they can understand. Furthermore, the data presented demonstrate that students' constructs of nature are directly shaped by culture, background and African tradition.

Biodiversity and the significance of its loss: Scientific definitions

The word 'biodiversity', or 'biological diversity', is defined by the Convention on Biological Diversity (CBD) as '[...] the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems' (CBD, 2010:15). Biodiversity champion Edward Wilson explains the term more simply as 'the variety of all living organisms, the nature of their inherent genes or traits and the habitats in which they are found' (Wilson, 2013:1).

Biodiversity is crucial to human survival in the areas of agriculture, science and medicine, industrial materials, ecological services, in leisure, and in cultural, aesthetic and intellectual value (CBD, 2014). Biodiversity as a life support system is failing and writers concur that the scale of destruction taking place in the 21st century is unprecedented (Butchart *et al.*, 2010; CBD, 2014). Recent global extinction figures reported in *Nature* journal are that since the year 1500 approximately 765 extinctions have occurred (Monastersky, 2014:160). Reports indicate that a total of 5 522 mammals, birds, amphibians and insects are currently under threat (Monastersky, 2014:160).

Biodiversity loss in South Africa has serious implications, particularly since the country is considered to be one of the most biologically diverse in the world due to its species richness and endemism as well as its diversity of ecosystems (DEA, 2014). South Africa has over 95 000 known species of plants and animals with a further 50 000, conservatively estimated, yet to be discovered and described (Driver *et al.*, 2012). The country occupies only 2% of the world's land surface area yet is home to 10% of the world's plant species and 7% of the reptile, bird and mammal species (DEA, 2014). Sixty-five percent of its 23 000 plant species are endemic to South Africa (DEA, 2014).

Taken in its entirety, this vast community of plants and animals silently provides a range of indispensable ecosystem services that form the base of the South African agriculture, horticulture and tourism industries. The South African National Biodiversity Institute (SANBI) highlights national examples such as wild pollinators in the Western Cape which service the deciduous fruit industry to the value of R2500 million each year (SANBI, 2013:9). The natural veld itself supplies grazing for livestock and was valued at over R8 000 for every square kilometre annually (SANBI, 2013:9). The Durban region in which this study was conducted contains 11% of the total number (682) of rare and threatened plant species in KwaZulu-Natal yet the eThekweni Municipal Area covers only 1.4% of the province (eThekweni Municipality, 2007). These figures illustrate, in part, the scope of the economic and scientific richness that biodiversity provides as an irreplaceable national and local asset.

Biodiversity loss and the challenge of public engagement

Given the value of this asset, it makes sense to communicate the value of biodiversity to all citizens so they too can play a role in its protection and use. The term 'biodiversity', however, is not easily accessed by the general public, who may feel excluded by the scientific literacy and ecological language required to understand the term. Student respondents expressed the following:

It's too scientific and sounds too serious like a difficult module or subject.

I think I prefer the term nature because when you hear the term biodiversity it makes you think long and hard. Like what is this now? What has it got to do with me?
(FG1; Foley, 2016:175)

Novacek (2008) stated that the word requires repeated and vigilant explanations in order to be heard in today's modern media. Interpretations of biodiversity remain elusive, a dilemma aptly described by Reed Noss in the following way: '[...] a definition of biodiversity that is altogether simple, comprehensible and fully operational [...] is unlikely to be found' (cited in Jeffreys & Willison, 2009:3). Swiss surveys of the public by Lindemann-Matthies and Bose (2008) indicate that the majority of respondents have never heard of biodiversity or ecosystem services and do not know what either term means. Subsequent public surveys such as the World Wide Views on Biodiversity revealed a more positive response, with seven out of ten respondents indicating some level of biodiversity awareness and environmental concern (WWViews on Biodiversity, 2012:14).

Millennial students: A new force to be reckoned with

Having briefly identified the significance of biodiversity loss both globally and locally, I now establish the link between the topic of biodiversity loss and the influential power and potential of students in the higher-education ambit. These students are a new generation of young people called Millennials or Generation Y: those individuals born between 1981 and 1999 (Tapscott, 2009). Worldwide, Millennials have demonstrated their ability to mobilise mass movements and to generate political, economic and environmental opinions (Goneos-Malka, 2012; Stein, 2013).

Youth in South Africa comprise 36% of the country's population of nearly 56 million (Stats SA, 2016). Of those able to access tertiary education, many young South Africans currently studying at the 25 public universities nationwide are becoming increasingly politically active, often violently disrupting campuses as they express their frustration with dysfunctional funding systems, educational inequalities and perceived and actual socio-economic class distinctions (Chetty & Knauss, 2016; DHET, 2015; Soudien, 2010). Within this broad context it is unclear exactly how biodiversity issues are perceived by South African students as they appear to be eclipsed by other competing interests, and it may be easy to dismiss notions of biodiversity loss as a minor issue of secondary importance. This paper posits that attending to the significance of South Africa's natural heritage and rich biodiversity is more relevant than ever. To this end, the paper describes Durban University of Technology (DUT) students' perceptions of

biodiversity loss, elicited through honest campus dialogues with a view to informing teachers and communicators on how to contextualise this vital topic in an interesting and relevant way to their audience. The end goal is for the significance of the biodiversity and conservation message to be communicated in a clear and easily understood manner across the barriers of race, age, gender and culture.

Better scientific communication through awareness of cultural cognitions

Scientists and ecologists acknowledge a serious communication disconnect between themselves and the public (Kahan, 2010). Writing in the journal *Nature*, Dan Kahan states that science needs 'better marketing' but points out that, unlike commercial advertising, the goal of these strategies is not to induce public acceptance of any particular conclusion but rather 'to create an environment for the public's unbiased consideration of the best available scientific information' (Kahan, 2010:297). He explains that 'cultural cognitions' cause people to interpret new evidence in a biased way that reinforces their predispositions. To overcome these inherent halo effects, Kahan (2010: 297) suggests presenting information in a manner that affirms rather than threatens people's values. This approach has been confirmed by European communication specialists such as Futerra (2010), and in South Africa with SANBI's *Making the Case for Biodiversity* (DEA & SANBI, 2011).

Futerra (2010) maintain people are tired of hearing about gloom and doom extinction scenarios, and want to understand how biodiversity and conservation are relevant to their own lives. Messages about 'love not loss' are therefore key (Attenborough, 2010).

Communication specialists Weber and Schell (2001) agree that the lay public may guide its interpretation of scientific information *through the social context rather than the underlying science itself*. They note that our reasoning about science is influenced by personal and social beliefs and is often guided by community norms and the social context in which the information is offered. Differing and often conflicting frames of reference can be problematic but must nevertheless be included in the dialogue (Weber & Schell, 2001).

Data Presentation

Description of the three study sites

The research was conducted with students at DUT, the primary study site. Arising from the merger of the former Technikon Natal and the ML Sultan Technikon in 2002, DUT presents a range of career-focused diplomas and degrees in various faculties including Engineering, Health Sciences, Applied Science and Arts and Design. Students comprise a diverse range of backgrounds, coming from rural, peri-urban and urban environments throughout KwaZulu-Natal (DUT HEQC Audit, 2011). The institution is centrally located at the base of the Berea ridge in Durban and is within five minutes' walking distance of the second study site, the Durban Botanic Gardens, and approximately 2.5 kilometres from the third study site, Pigeon Valley. DUT is home to 26 417 students with a racial composition of black Africans (21 325), Asians (3 941), whites (765) and coloureds (386) (DHET, 2015:21). The genders are split fairly evenly with slightly more males (13 726) than females (12 746) (DHET, 2015).

Study sites two and three are readily accessible urban green spaces which offer potential for students to connect with local biodiversity. Pigeon Valley Nature Reserve is a ten-hectare remnant of coastal forest on Durban's Berea (Hemson, 2015). Surrounded by a sea of suburbia, this urban green space is now a refuge for birdlife and endemic forest plants, bounded by busy motorways on each side. Not only is this urban reserve of high conservation value, its forest is also a natural haven of peace and refreshment. All students involved in the field visits to Pigeon Valley remarked on rediscovering themselves in this intimate urban forest space, confirming what Crispin Hemson (2015) articulated as a strong identification with the sights, sounds and smells of this suburban forest refuge.

The Durban Botanic Gardens, established in 1849, is Africa's oldest surviving botanic garden and has collections of indigenous cycads and an arboretum of exotic trees and palms (McCracken, 1996). Botanic gardens provide important arenas for plant conservation, biodiversity learning and community outreach (Tidball & Krasny, 2010; Williams, Jones, Gibbons & Clubbe, 2015).

Research Methodology

The selection of appropriate methodology was informed by the main research objective, namely to discover the knowledge, attitudes and perceptions of biodiversity amongst students currently studying at DUT. This umbrella objective was unpacked into three research questions which guided the study: *1. What are the students' current levels of knowledge regarding the term 'biodiversity' and how is it important and significant to their lives? 2. What are the students' levels of concern regarding biodiversity loss? 3. What role does race and culture play in student perceptions of biodiversity?*

To interrogate these questions further, a mixed-methods research methodology was adopted consisting of a survey questionnaire issued to a sample population of 428 students, followed by in-depth discussions with four focus groups. Conceptually, a mixed-methods approach has been defined as 'the collection or analysis of both quantitative and qualitative data in a single study in which the data are collected concurrently or sequentially, are given a priority, and involve the integration of the data at one or more stages in the process of research' (Hanson, Creswell, Clark, Petska & Creswell, 2005:212). A mixed-methods approach allows for the complementary use of both qualitative and quantitative data where each could uncover some unique variance that might have been neglected (Jick, 1979).

Phase one: Survey

A cross-section of 428 students were surveyed across six faculties to establish the extent of interest in and knowledge of the term 'biodiversity'. A non-probability or convenience sampling method was employed. The target sample size was considered adequate to produce reliable datasets for correlation and analysis of the factors, since statistically a larger sample size would not influence the results in terms of confidence level or margin of error (Mouton, 2001). The survey instrument was developed in relation to the issues raised in the literature review and was designed to satisfy the three research questions.

The questionnaire included closed- and open-ended questions, multiple choice items and five-point Likert scale ratings. The Eurobarometer survey of 2010 was adapted to the South African context. Statistical data were then analysed using the social sciences software package SPSS V 24.00. Phase one then established indicators for the primary research questions, namely the nature and extent of student interest in and awareness of biodiversity and its associated loss.

Phase two: Focus groups

This phase deepened the discussion with the use of selected focus groups to interrogate the issues raised in phase one and to elicit honest and critical feedback in a relaxed setting. Focus groups are used in exploratory and descriptive research when investigating highly phenomenological constructs – in this case attitudes towards nature (Kress & Shoffner, 2007; Roller, 2011). The focus groups involved guided discussion on the relevance of biodiversity, viewing of video clips and local field visits to either Pigeon Valley Nature Reserve or the Durban Botanic Gardens. Four focus groups were convened at DUT, sampled from three different faculties representing the departments of Video Technology (n=10), Horticulture (n=12), Child and Youth Development (n=15) and Maritime Studies (n=20). Such a selection ensured that the results were not skewed or biased in terms of favouring a conservation ethic.

Results and Findings

Findings from phase one survey

The first section of the survey examined student demographics, which were congruent with the overall student population of DUT (DHET, 2015). The greatest number of respondents (57%) were in the 17–21-year age group followed by a slightly older population of 22–25 year olds (37%). Gender responses in this survey were split at 56% male and 44% female. In terms of racial distribution, the highest percentage of students were black Africans (78%) with a much smaller cohort of Indians (17%) and a minority of whites (3%) and coloureds (2%). Regarding home language, most respondents were isiZulu speakers (63.8%) followed by English (22.9%) and Afrikaans (0.7%), Xhosa (7%) and other African languages (5.6%). Nearly a third of respondents came from suburbs and city centres (33%); another third came from township homes (33%) and the final third cited small towns and rural villages as their home town. Differing viewpoints informed by these heterogeneous backgrounds were reflected strongly in the focus groups – rural dwellers claimed an inherited cultural conservation code while city dwellers admitted they had a lot to learn about conservation.

The survey's opening question focused on biodiversity knowledge: *Have you ever heard of the term 'biodiversity' before receiving this survey?* This required some prior explanation of the term in order for respondents to proceed, as they would have found the rest of the survey confusing if they did not know what the term meant. Four options were presented (Table 1).

Table 1. Biodiversity definitions

1	Biodiversity and climate change are essentially the same thing.
2	Biodiversity is the richness of plant and animal life on planet Earth.
3	Biodiversity is the richness of plant and animal life and includes diversity between species at physical, genetic and ecosystems levels.
4	Biodiversity is only concerned with genetic engineering and stem cell research.

The majority (91%) of students circled item 3 as the correct answer. Whilst encouraging, this result in itself does not indicate that students are familiar with the real significance of the term ‘biodiversity’; neither is their ability to pinpoint the precise answer the main objective. Buijs and colleagues (2008) argue that using the dominant scientific discourse of educating the public and so raising biodiversity awareness is in itself a flawed premise. This ‘information deficit’ model of public understanding and action does not take cognisance of an individual’s personal experiences, knowledge and emotions concerning biodiversity that do not fit into the scientific definitions of the term as provided by the CBD.

Students’ understanding of the term was then probed in more depth with the next question: *How would you best describe what biodiversity loss means to you?* Respondents could circle more than one statement. This led to a ranking order of statements, which was instructive. Results are depicted in Table 2.

Table 2. Ranked student perceptions of biodiversity loss

Rank	Criteria/Statements	%
1	Decline in natural habitats/less variety in general	61
2	Certain animals and plants are/will become endangered	55
3	Loss of natural heritage like nature parks/endemic species/natural areas	52
4	Problems with the clean air, water/CO ₂ emissions	38
5	Forests will disappear/decline	37
6	Change of the climate	34
7	Loss of potential for producing medicines, food and fuel	27
8	Less opportunities for tourism	23
9	Problems for the economy/loss of material wealth	18
10	Problems in my garden	4
11	Other factors	1
12	Don’t care about this issue	0.5

As the European Union biodiversity survey (Eurobarometer, 2010) points out, the terms 'biodiversity' and 'biodiversity loss' are both multidimensional concepts and are generally understood to mean either habitat or species loss. DUT students responded in a similar fashion, with these two criteria scoring 61% and 55% respectively. DUT students also expressed concern for air and water quality (38%), disappearance of forests (37%) and climate change (34%).

Biodiversity loss through climate change was fairly low on the student agenda, with just over one-third responding positively to the linkage between the two topics. Underexposure to environmental media may account for this, as well as conflicting opinions voiced by prominent scientists that give the sceptics more power. Students ranked ecosystem goods and services lower, since they might not be aware of these: loss of medicines, food and fuel (27%), lost opportunities for tourism (23%) and decline in the economy (18%).

Half of the respondents stated that biodiversity loss was a very serious problem on a national, continental and global level, yet when questioned on what effect the decline and possible extinction of plant and animal species would have on them personally, students felt this loss would not impact them immediately (49%). Biodiversity loss would affect their children to a greater degree (10%). One-third of respondents (33%) stated biodiversity loss would not impact them personally at all.

The survey then sought to probe cultural connections with the natural world. Students demonstrated strong cultural linkages with nature through the traditional use of African medicinal plants. In terms of plant knowledge, 65% of respondents claimed to use traditional herbal medicine and had some idea of the ingredients used. Many respondents (60%) were unaware that these plants faced possible extinction. The use of traditional African plants was a source of student pride, with one respondent remarking: 'The role traditional medicine plays is one of the undiluted things that is held dear by the Africans' (FG4 respondent; Foley, 2016:344).

Findings from phase two: Focus groups

Most respondents believed that 'biodiversity' had value but only once the term had been explained fully. They felt the term was inaccessible to the average uninformed person and that the word 'nature' was a more understandable substitute. One student commented: 'No, the name itself is scientific, one needs to Google it first before trying to answer any question related to it.'

On discussing the importance of biodiversity to the students' daily lives, conservation had limited appeal for some respondents, while others expressed strong support:

Realistically for black people it's not that important, it comes last, people need to be fed.

It's not that we don't care, it's just it's the least of our worries.

Every group has financial cares and needs; we need to have a balance so we need to give attention to conservation. (FG1 respondents; Foley, 2016:170)

When asked how they would prefer to connect to local biodiversity, the beach, Drakensberg Mountains and farm destinations dominated, with many rural dwellers expressing their delight in simple pleasures such as swimming, fishing, hunting and fruit gathering. Respondents evidenced a clear sense of identity centred on upbringing, cultural norms and place, in both urban and rural settings. For example, a student explained: 'Engaging with nature physically is always the best way. Going to rural areas is always best. There the biodiversity is untainted and pure' (FG4 respondent; Foley, 2016:345).

Cultural identifications linked to upbringing and childhood education experiences were acknowledged by students as significant factors likely to influence their attitudes toward nature. Unafraid to shy away from race and class issues, the student focus groups added some helpful perspectives to the uniquely South African biodiversity narrative. These included African insights on traditional medicinal plant use, the removal of established trees in transforming suburbs, and attitudes towards animals: 'Black people cut down trees for two reasons; they believe some trees attract lightning and in rural areas trees are cleared traditionally for visibility to spot the enemy' (FG2 respondent). 'White people treat their animals [dogs] better, treating them like humans while blacks generally mistreat them' (FG3 respondent; Foley, 2016:343). Black students were unanimous in their perception that whites were more concerned about and conscious of biodiversity and conservation issues. Others were against stereotyping, stating: 'I think we need to be united because nature involves all of us and leave behind this mentality that says Zulus destroy nature and it belongs to the Whites only' (FG4 respondent; Foley, 2016:347). Given the opportunity and exposure to these issues, most students expressed a desire to make a difference as individuals and to counter biodiversity loss.

Analysis and Discussion

The results from the survey phase (largely statistical) were analysed separately from those of the focus groups (largely qualitative) then merged using common thematic denominators correlated with the literature. The survey confirmed the nature of the student audience in terms of the university's overall demographics. Results are now discussed in relation to the research questions posed earlier.

Research Question 1: What are the students' current levels of knowledge concerning the term 'biodiversity' and how is it important and significant to their lives?

Analysis of data related to this question indicated that students were reasonably knowledgeable about the term 'biodiversity' and the majority felt it was significant to their lives on a personal level. Buijs *et al.* (2008), however, remind conservationists it is the public's perception and interpretation of the biodiversity concept that is important, not just the exactitude of scientific definitions. The general student understanding was that rural black South Africans are aware of their dependence on nature and biodiversity but they do not articulate it in a Western manner (these thoughts are expanded in Research Question 3). scientific information is interpreted through the social context rather than the underlying science itself. This research validated

the notion that cultural lenses play a powerful role in filtering and analysing and ultimately accepting or rejecting information that is presented.

Research Question 2: What are the students' levels of concern regarding biodiversity loss?

The survey data indicated high levels of student concern for biodiversity loss, with them recognising consequences at individual and national levels. However, the majority felt that biodiversity loss was more of a long-term problem that would not immediately affect their well-being. The limitations of a single survey, no matter how well considered and executed, make it difficult to respond to Research Question 2 because the method can at best only provide fragments of the entire puzzle. It is also likely that the survey was prone to a 'halo effect', that is, students wanted to present themselves as environmentally friendly and so provided what they perceived to be the desired answer.

Research Question 3: What role does race and culture play in student perceptions of biodiversity?

Students referred to cultural differences in upbringing and childhood education experiences as significant factors likely to influence their attitudes toward nature. Black students were almost unanimous in their perception that whites were more concerned about and conscious of biodiversity and conservation issues. Some students, however, felt that issues of race and culture were divisive and that together all young people should advance in their knowledge of conservation regardless of pigmentation or backgrounds.

Amid the current cries for a 'decolonised education' it may well be wise for environmental educators to consider differing ways of knowing and seeing that do not follow the Western scientific paradigm. Overson Shumba (1999) critically investigated the role of Western science and technology in the Southern African Development Community region. He argues that for effective science education and communication to take place, cognisance must be taken of locally acquired indigenous thought and belief systems, positing that these cannot be easily supplanted by Western scientific rationality. Similarly, according to Saljao (1991:184), 'Human experiences are inescapably cultural by nature, learning and growth take place within cultural boundaries.' Findings from both qualitative and quantitative research conducted for this study have proved the validity of these sentiments.

Conclusions

The initial position of the researcher was that university students cared little about biodiversity since they were preoccupied with other pressing concerns. Analysis of empirical data from the surveys and honest dialogue during the focus groups indicated that students are indeed concerned about biodiversity loss and that their traditional African upbringing and involvement with plants provides an immediate and familiar connection with nature. This prior knowledge provides a strong link and basis for future learning on biodiversity. These findings suggest that South African science communicators and environmental educators need good understandings of their students' cultural backgrounds and current concerns. Since young people are tomorrow's conservation champions, biodiversity conservation messages should be culturally nuanced and relevant to young people's lives.

References

- Attenborough, D. (2010). Keynote speech, British Natural History Consortium, Communicate conference 'Connecting with Nature', Bristol, UK.
- Buijs, A.E., Fischer, A., Rink, D. & Young, J.C. (2008). Looking beyond superficial knowledge gaps: Understanding public representations of biodiversity. *The International Journal of Biodiversity Science and Management*, 4(2), 65–80.
- Butchart, S.H., Walpole, M., Collen, B., Van Strien, A., Scharlemann, J.P., Almond, R.E., ... Watson, R. (2010). Global biodiversity: Indicators of recent declines. *Science*, 328(5982), 1164–1168.
- CBD (Convention on Biological Diversity). (2010). *Global biodiversity outlook 3*. Montréal: Secretariat of the Convention on Biological Diversity.
- CBD (Convention on Biological Diversity). (2014). *Global biodiversity outlook 4*. Montréal: Secretariat of the Convention on Biological Diversity.
- Chetty, R. & Knaus, C. (2016, 13 January). Why South Africa's universities are in the grip of a class struggle. *The Conversation*. <https://theconversation.com/why-south-africas-universities-are-in-the-grip-of-a-class-struggle-50915>, visited 22 April 2018.
- DEA (Department of Environmental Affairs). (2014). *South Africa's fifth national report to the Convention on Biological Diversity*. March 2014. Pretoria: DEA.
- DEA & SANBI (Department of Environmental Affairs & South African National Biodiversity Institute). (2011). *Making the case for biodiversity: Final draft project summary report*. Pretoria: DEA.
- DHET (Department of Higher Education and Training). (2015). *Statistics on post-school education and training in South Africa: 2014*. Pretoria: DHET.
- Driver A., Sink, K.J., Nel, J.L., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. & Maze, K. (2012). *National biodiversity assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis report*. Pretoria: South African National Biodiversity Institute & Department of Environmental Affairs.
- DUT HEQC Audit. (2011). Available from DVC Academic. Durban University of Technology. eThekweni Municipality. (2007). *Ethekewini municipality biodiversity report 2007*. Durban: eThekweni Municipality.
- Eurobarometer. (2010). Attitudes of Europeans towards the issue of biodiversity: Analytical report Wave 2. http://ec.europa.eu/public_opinion/flash/fl_290_en.pdf, visited 22 April 2018.
- Foley, J.B. (2016). Biodiversity messaging to Generation Y students at the Durban University of Technology, KwaZulu-Natal. Unpublished doctoral thesis, University of KwaZulu-Natal.
- Futerra, (2010). Branding biodiversity: The new nature message. https://www.wearefuterra.com/wp-content/uploads/2015/10/Branding_Biodiversity.pdf, visited 22 April 2018.
- Goneos-Malka, A.C. (2012). Marketing to young adults in the context of a postmodern society. Unpublished doctoral thesis, University of Pretoria.
- Hanson, W.E., Creswell, J.W., Clark, V.L.P., Petska, K.S. & Creswell, J.D. (2005). Mixed methods research designs in counselling psychology. *Journal of Counseling Psychology*, 52(2), 224–235.
- Hemson, C. (2015). How it grows on us: Human interaction with the Durban Forest. In Mark Mattson (Ed.), *The Durban Forest*. Durban: Durban Botanic Gardens Trust. pp.159–173.

- Jeffreys, D. & Willison, J. (2009). It's the International Year of Biodiversity in 2010 but who's coming to the party? *Roots*, 6(2), 2–4.
- Jick, T.D. (1979). Process and impacts of a merger: Individual and organizational perspectives. Doctoral dissertation, New York State School of Industrial and Labor Relations, Cornell University.
- Kahan, D. (2010). Fixing the communications failure. *Nature*, 463(7279), 296–297.
- Kress, V.E. & Shoffner, M.F. (2007). Focus groups: A practical and applied research approach for counselors. *Journal of Counseling and Development*, 85(2), 189–195.
- Lindemann-Matthies, P. & Bose, E. (2008). How many species are there? Public understanding and awareness of biodiversity in Switzerland. *Human Ecology*, 36(5), 731–742.
- McCracken, D.P. (1996). *A new history of the Durban Botanic Gardens*. Durban: Durban Parks Department.
- Monastersky, R. (2014). Life: A status report. *Nature*, 516(7530), 158–161.
- Mouton, J. (2001). *How to succeed in your master's and doctoral studies: A South African guide and resource book*. Pretoria: Van Schaik.
- Novacek, M. (2008). Engaging the public in biodiversity issues. *Proceedings of the National Academy of Sciences*, 105(1), 11571–11578.
- Roller, M. (2011) Qualitative research design: Selected articles from *Research Design Review*. <http://www.rollerresearch.com/MRR%20WORKING%20PAPERS/Qualitative%20Research%20Design.pdf>, visited 22 April 2018.
- Saljao, R. (1991) Introduction: Culture and learning. *Learning and Instruction*, 1, 179–185.
- SANBI (2013). *Life: the state of South Africa's biodiversity 2012*. Pretoria: South African National Biodiversity Institute.
- Shumba, O. (1999). Critically interrogating the rationality of western science vis-à-vis scientific literacy in non-western developing countries. *Zambezia*, 26(1), 55–75.
- Soudien, C. (2010). *Transformation in higher education: A briefing paper*. Pretoria: Development Bank of Southern Africa.
- Stats SA (Statistics South Africa). (2016). *Community survey 2016, statistical release P0301*. Pretoria: Stats SA.
- Stein, J. (2013, 20 May). Millennials: The me me me generation. *Time*. <http://content.time.com/time/magazine/article/0,9171,2143001,00.html#ixzz2mK8BSdnd>, visited 22 April 2018.
- Tapscott, D. (2009). *Grown up digital: How the Net generation is changing your world*. New York: McGraw-Hill.
- Tidball, K.G. & Krasny, M.E. (2010). Urban environmental education from a social-ecological perspective: Conceptual framework for civic ecology education. *Cities and the Environment*, 3(1). <http://digitalcommons.lmu.edu/cgi/viewcontent.cgi?article=1057&context=cate>.
- Weber, J.R. & Schell, C. (2001). The communication process as evaluative context: What do nonscientists hear when scientists speak? *BioScience*, 51(6), 487–495.
- Williams, S.J., Jones, J.P.G., Gibbons, J.M. & Clubbe, C. (2015). Botanic gardens can positively influence visitors' environmental attitudes. *Biodiversity and Conservation*, 24(7), 1609–1620.

Wilson, E.O. (2013, 18 November). Beware the age of loneliness. *The Economist*. <http://www.economist.com/news/21589083-man-must-do-more-preserve-rest-life-earth-warns-edward-o-wilson-professor-emeritus>, visited 22 April 2018.

WWViews on Biodiversity (World Wide Views on Biodiversity). (2012). *World Wide Views on Biodiversity: Results report: From the world's citizens to the biodiversity policymakers*. Copenhagen: Danish Board of Technology.