

**AN INVESTIGATION OF ENABLING AND CONSTRAINING FACTORS  
AFFECTING THE SUPPLY AND DEMAND OF SPECIFIC BIODIVERSITY  
SCARCE SKILLS TO THE BIODIVERSITY SECTOR**

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**by**

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## **Abstract :**

This study is situated within the context of the emerging South African Biodiversity Sector and focuses on the supply of and demand for scarce skilled biodiversity professionals. It does so through investigating the transition a young biodiversity professional makes from a higher education institution to the workplace by drawing attention to the factors encountered or perceived to be encountered during this development.

The study forms part of a research programme established between Rhodes University, GreenMatter and the Culture Arts Tourism Hospitality Sport Education and Training Authority (CATHSSETA), which seeks to contribute to the body of knowledge pertaining to ‘green’ skills development and retention within the South African biodiversity sector. It is a qualitative study, comprising nested case studies within two larger case studies of scarce skills – those of wildlife veterinarians and freshwater ecologists – as identified by the biodiversity priority scarce skills list (SANBI & Lewis Foundation, 2012). The study is supported by Bronfenbrenner’s (1979) Ecological Systems theory and underpinned by the principles of basic critical realism and emergence (Archer, Bhaskar, Collier, Lawson, & Norrie, 1998).

Data was generated through a range of data collection methods, including semi-structured interviews, participant observation and document analysis. The aim of these methods was to enable a greater understanding of the factors influencing transitioning and the unique transitions of selected individuals. Findings revealed that the transitions of the participants, although unique to each of them, included the following commonalities: exposure to biodiversity at an early stage in an individual’s life paved the way for the development and nurturing of an interest or passion in biodiversity; experience gained prior to entry into the workplace is a powerful enabling factor; the presence or absence of a mentor can be pivotal in the transition of an individual; the gap in knowledge pertaining to demand side or workplace information is a large constraining factor; workplace dynamics affect the demand for, and eventual supply of, biodiversity professionals; the presence of human capital development strategies and structures is beneficial to the individual’s transition, and the overall ecosystemic development of an individual has an effect on the supply of specific scarce-skilled individuals to the workforce.

This study demonstrates that through the employment of nested case studies, similar research focussing on other scarce skills within the biodiversity sector, as per the GreenMatter Priority Skills List of 2012, can be produced, which would help to address the knowledge gaps pertaining to scarce skills, as indicated by the Biodiversity Human Capital Development Strategy (2010).

## **Dedication**

This thesis is dedicated to all those individuals who have been instrumental in my life, especially in my education, career and this thesis.

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“I may not be a full blooded African, but I am born with something every African is born with... and that is Hope”.

L.J. Mckrill 2003

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## Acronyms

BSc	Bachelor of Science
BVSc	Bachelor of Veterinary Sciences
CATHSSETA	Culture Art Tourism Hospitality and Sports Sector Education and Training Authority
CSIR	Centre for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DHET	Department of Higher Education and Training
DWAF	Department of Water Affairs and Forestry
GIS	Geographical Information Systems
HEI	Higher Education Institute
HCD	Human Capital Development
HRD	Human Resource Development
HSRC	Human Sciences Research Council
M. Med.Vet	Masters in Veterinary (Specialist)
NEMA	National Environmental Management Act
NSFAS	National Student Financial Aid Scheme
NRF	National Research Fund
OECD	The Organisation for Economic Co-operation and Development
RAMSAR	Convention for the Protection of Wetlands (Formed in Ramsar, Iran)
SACNASP	South African Council for Natural Scientific Professions
SAIAB	South African Institute for Aquatic Biology
SASS	South African Scoring System
SASAqS	Southern African Society of Aquatic Scientists
SETA	Sectoral Education Training Authorities





## **Chapter 1: Introduction to the study**

*“Don’t ask yourself what the world needs; ask yourself what makes you come alive. And then go and do that. Because what the world needs is people who have come alive.”*

— **Harold Whitman**

### **1.1 INTRODUCTION:**

Biological diversity is the framework necessary for all life on earth so the management, protection and wise usage of its ecological services and systems should be at the forefront of all economies. This is especially true with the ever increasing pressures of climate change, overpopulation, and the historical and continuous exploitation of natural resources. It is imperative that sufficient numbers of adequately trained professionals are equipped to carry out and administer the vast spectrum of environmental tasks, especially those related to biodiversity management. This will make it possible to correctly manage the environment and biodiversity, and integrate these issues into everyday policies and societal mindsets across different sectors. There are, however, problems in attaining and supporting the supply and overall demand for these individuals, as described in this study.

A key element in responding to the supply and demand for biodiversity skills is to understand the various dynamics that influence these skills. This will also serve to decrease the evident knowledge gap that exists between the supply and demand of scarce skills in the biodiversity sector (Rosenburg, Personal communication, 2013). This study aims to address these issues within the context of the dynamic and growing South African environmental and the closely related biodiversity sector as well as at a more nuanced level.

I begin by describing the history of the environmental sector and move on to recent developments in the sector with a focus on skills development and sectoral training. Furthermore, the important cross-cutting role of the environmental sector within other sectors is considered especially with regard to their sustainable practices which contribute to South Africa’s newly emerging green economy.

In the introductory chapter, the emphasis is on addressing the needs, specifically high level scarce skills, of supply and demand in the biodiversity sector, and how this contributes to South Africa’s emergence into a green economy. The chapter concludes with a synopsis of the other chapters.

## **1.2. GLOBAL SIGNIFICANCE OF THE STUDY**

The green economy, as discussed by Borel-Saladin and Turok, has become an increasingly important phenomenon, which initially featured within the context of environmental economics, and has gradually been adopted into global mainstream politics (2013). This shift is in response to interrelated economic crises and climate change issues. One of the green economy's chief aims is to create and provide jobs through the implementation of environmentally friendly measures for the management of natural resources and the mitigation of climate change related issues (OECD, 2012). Through these efforts, traditional brown economies, namely countries dependent upon fossil fuels and environmentally damaging practices, can gradually convert to green economies, thus employing and promoting cleaner, more environmentally cognisant practices (United Nations Development Programme. [UNEP], 2011).

### **1.2.1 The context and background of the study**

South Africa is a relatively recent member of the global green economy and as a result has lagged behind in implementing environmentally focused principles in line with the outcomes adopted at the Rio+20 conference. The Rio 1992 global conference was held to address environmental and climate change related issues. Resulting from this was the formulation and implementation of specific environmental goals and targets to be achieved by 2012. Two decades later at the Rio+20 conference, the progress achieved for the previously set goals and aims was investigated. The outcomes of which resulted in globally positioned frameworks and legislations, and the move toward establishing the global green economy. South Africa has had progressive environmental legislation in place since the inclusion of environmental clauses in the Constitution of 1996 and the National Environmental Management Act of 2009 and its subsidiary legislation. However it has taken time for this to manifest in the skills development policy landscape and strategies to assist the country in becoming a green economy (For further insight into the green economy both from a South African and a global perspective, see section 2.2.2).

However, biodiversity management is not only about green economy development, although traditionally discussions on skills supply and demand are related to economic thinking. Biodiversity management is also a matter for the public good, and some careers are therefore not highly valued from an economic development perspective, and in South Africa these skills have not been 'taken care of' via the economic sectors. Thus, to a large extent, even

though progressive environmental policy is in place, environmental skills development has been largely excluded from the skills development policy, with the environment and its related skills being omitted from the primary and secondary National Skills Development Strategy (NSDS) documents, namely: NSDS I, (2001 -2005) and II (2005- 2010), (South African National Biodiversity Institute & Lewis Foundation, [SANBI/Lewis], 2010). Formal curriculum policy, however, included a focus on the environment from as early as 1996.

Consequently, this omission in the earlier skills development policy has been the focus of much recent policy discourse, and there is evidence of this within government level documents such as the Environmental Skill Sector Plan, 2010 (ESSP) (South Africa. Department of Environmental Affairs, [DEA], 2010) (hereafter referred to the DEA, 2012 as opposed to the Department of Environmental Affairs, Environmental skills strategy, 2010) and the Biodiversity Human Capital Development Strategy, (SANBI/Lewis, 2010). Thus, the environment and the green economy have been noted as a contemporary and important theme in the National Skills Development Strategy III (2010 -current) (SANBI/Lewis, 2010). Even though issues regarding the environment and its related fields are integral across many sectors, prior to 2009, there was no officially recognised skills planning for the environmental sector, or the biodiversity sector (which is a sub-sector of the broader environmental sector). Furthermore, there was no dedicated Sectoral Education Training Authority (SETA) for the environment. This has resulted in a skills development regime which has been reactive to legislation (SA.DEA, 2010), leading to serious ramifications evident throughout the sector; such as issues influencing the leadership and development of the sector and its skills (More detail is provided in chapter 2).

However, this was addressed during 2009 and 2010, when the Department of Environmental Affairs embarked upon an effort to uncover and address skills development needs in the environmental sector and the outcome of this was the Environmental Sector Skills Plan (ESSP) for South Africa (DEA, 2010). In this document, information pertaining to the supply and demand of the environmental sector (including biodiversity related skills) is detailed, including a focus on scarce and critical skills. Concurrently, the biodiversity sector also undertook research to uncover skills related concerns for the biodiversity sector, a process that was implemented in tandem with the ESSP research (Berier & Erasmus, 2009; SANBI/Lewis, 2010).

The pioneering ESSP of South Africa provides an overview of the emerging environmental sector and its challenges, one of which is the lack of biodiversity skills to match the demand required for a functional green economy (DEA, 2010). Moreover, the mismatch between the number of skilled professionals produced and those needed to fill positions, is a stark reality which hinders the accurate utilization and preservation of natural resources and sensitive ecosystems.

The ESSP and the subsequent interlinked documents provide a variety of recommendations to tackle these skills needs which are then listed as strategic objectives, to be achieved within a given timeframe. An example of this is present in the Human Capital Development Strategy for the Environment 2010, where the four main strategic objectives are listed:

1. Support skills development for green jobs and a green economy;
  2. Strengthen and retain leadership skills in the environmental sector;
  3. Address the scarce and critical skills that currently exist in the environmental sector to enhance vertical and horizontal governance;
  4. Strengthen the human capital development pipeline for the environmental sector.
- (South Africa:Department of Environmental Affairs, 2010)

This study focuses on the third strategic objective, namely that of addressing the “scarce and critical skills that currently exist in the environmental sector” (South Africa. Department of Environmental Affairs, 2010). The NSDS III progress report provides the following comment pertaining to the establishment of a green economy, as well as the creation of green jobs: “The growth of a green economy presents an opportunity for the creation of new employment, without sacrificing the quality of employment overall.” (Montmasson-Clair, 2012, p. 16 ;South Africa. Department of Higher Education and Training, 2014). Thus the aim of this study is to identify and gain a greater understanding of skills supply and demand, especially regarding scarce skills, within the biodiversity sector. Many of the biodiversity professionals required to carry out specific jobs can be classified as individuals with scarce skills. As will be alluded to, gaps in knowledge pertaining to the supply and demand of such skills are evident. This study aims to address that gap through its consideration of enabling and constraining factors in the supply of these skills. However, in order to do so, a definition

and understanding of scarce and critical skills is imperative (See Chapter two for further detail).

**Scarce skills** are described by the Human Science Research Council (HSRC), drawing on national official descriptions of scarce skills as used by the Department of Labour, as *occupations* where there is a perceived or observed scarcity of qualified and experienced individuals (South Africa. Department of Environmental Affairs, 2010). The Biodiversity Human Capital Development Strategy (South Africa. Department of Environmental Affairs, 2010), informed by the HSRC's definition, further defines scarce skills as *competencies associated with occupations* which are in short supply. The Environmental Sector Skills Plan (SA.DEA,2010) further describes the phenomenon as the current or future scarcity of qualified individuals or experts (using occupational framing as well). Scarce skills are further broken down into two subdivisions: absolute and relative scarcity, depending on the availability of the specific skill/s (ibid). This study draws attention to the scarce skills of a wildlife veterinarian and a freshwater ecologist, and refers to these from within an occupational framing, as is consistent with national policy.

**Absolute scarcity** is indicative of skilled individuals being absent from the current workforce within the foreseeable future. This could be due to the following reasons: the industry or occupation being relatively new or emerging; or simply the absence of adequately skilled individuals within the industry (Kraak, 2009). The wildlife veterinary field would fall into this category.

**Relative scarcity** refers to skilled individuals being in the sector but not being able to provide the skilled input needed due to, for example: geographical placing; transformation objectives; familial commitments; or a lack of critical skills required within the occupation (NSDS, 2011; NSSL, 2007). The fresh water ecology field would fall into this category, as per the biodiversity human capital development strategy (South Africa. Department of Environmental Affairs, 2010)

**Critical skills** are defined by Breier & Erasmus (2009) and Kraak & Press (2008), as skills and *specific competencies* possessed by individuals which are mandatory within the workforce. These can be further divided into specific *operational skills and generic skills*.

Generic skills such as staff management, communications and computer competencies are applicable across different biodiversity related vocations. However, particular operational skills, such as bloodletting, pH testing and vegetation analysis apply to a specific biodiversity vocation, such as wildlife veterinary science or fresh water ecology.

(See section 2.3 for further detail on the definition of scarce skills and critical skills, in addition to further explanation as to why they have been specifically selected for this study).

### **1.3 RATIONALE FOR THE STUDY**

This section includes a description of the broader research programme in which this study is located, as well as the study rationale, its aim, objectives and research questions.

This study forms part of a research programme established between Rhodes University, GreenMatter and Culture Arts Tourism Hospitality Sport Education and Training Authority (CATHSSETA) pertaining to skills development and retention in the South African biodiversity sector. In this section, the organizations are briefly introduced, GreenMatter and CATHSSETA, and are further expanded upon in Chapter Two.

GreenMatter is a project involving multiple partners which aims to support various biodiversity mandated organisations in responding to the challenges of skills development, transformation and the greening of the South African economy (Lotz-Sisitka, Personal communication, 2013). Co-founding partners within the organization, namely the South African National Biodiversity Institute (SANBI) and the Lewis Foundation piloted the development of a Biodiversity Human Capital Development Strategy (BHCDS) in 2009-2010 (see section 1.2). This has ensured that GreenMatter is well-positioned to make a valuable contribution to the sector. GreenMatter takes the Biodiversity Human Capital Development Strategy as its main focus and supports its implementation.

CATHSSETA is one of the 21 SETAs established under the National Qualifications Framework and the National Skills Act no 97 of 1998. This education and training authority is comprised of seven different chambers, namely: conservation; culture and arts; tourism and hospitality; sport and recreation and fitness; and lastly gaming and lottery. Of all of the chambers, the conservation chamber is the fourth largest and it covers four Standard Industrial Codes. See table 1 below.

Table 1: Standard Industrial codes, SIC, as per CATHSSETA. (Source: CATHSSETA SSP, 2013, p. 7 )

Group	SIC Code	Conservation
(4 SIC Codes)	11520	Hunting and Trapping including related services
	96333	Game Parks, Reserves incl. but not limited to wildlife, parks, zoological or animal parks and botanical gardens
	96334	Activities of conservation bodies
	96335	Wildlife conservation incl. wildlife, game, parks, game reserves, zoological establishments, botanical gardens etc.
Source: CATHSSETA SSP 2013		

Insights from this research programme (involving four Master's projects and three PhDs) will contribute to the further implementation of the GreenMatter South African BHCDS, among other human capital development related initiatives (Rosenburg, 2013).

This particular study represents one of the Master's projects in this research programme and the insights gained here will contribute to the strategic objectives of the programme. It is aligned with GreenMatter and the BHCDS where the focus is on addressing the need for high level scarce skills. The two specific scarce skills selected for this research are: a wildlife veterinarian and a freshwater ecologist, as both skills were identified as scarce skills in the GreenMatter Priority skills list 2012. Further detail pertaining to both skills is available in sections 2.3.3 and 2.3.4 of this study.

In particular, this study focuses on the transition of selected scarce-skilled biodiversity professionals (wildlife veterinarians and freshwater ecologists) from higher education to the workplace. In order to study this transition, a deeper understanding of the sector and its relation to the green economy is required, as well as additional understanding of the transition dynamics associated with the enabling and constraining factors affecting their transition and lastly, the supply and demand dynamics of the relevant scarce skills (Lotz-Sisitka, Personal communication, 2013).

This study aims to contribute new knowledge to the current perceptions of the supply and demand issues for scarce skilled individuals, while also gaining a deeper understanding of what factors and structures help or hinder a person in attaining their place within the sector as a biodiversity professional. This was made possible by the creation of a framework of questions and sub-questions, which guided the enquiry, enabling the researcher to tease out

and uncover the factors affecting this transition. Below are the primary research questions and the supporting sub questions.

### **1.3.1 Research Questions**

#### **Main Research Questions:**

The main research question has been divided into two parts namely:

1. How do enabling or constraining factors influence the transition of scarce skilled biodiversity professionals from a higher education institute (HEI) to the workplace?
2. How does this affect the supply and demand dynamics associated with the scarce skills within the biodiversity sector?

#### **Sub-questions:**

- a) What factors enable the supply of wildlife veterinarian and freshwater ecologist scarce skills to the biodiversity sector?
- b) What factors constrain the supply of wildlife veterinarian and freshwater ecologist scarce skills to the biodiversity sector?
- c) What demand-side practices influence the scarcity (relative or absolute) of wildlife veterinarians and freshwater ecologists?
- d) To what extent do the HEI curricula for the specified scarce skill occupations reflect and respond to demand-side critical skills?
- e) How are the scarce skilled graduates' individual transitions between the HEI and workplace affected by enabling and constraining factors?

### **1.4 THE THEME OF TRANSITION IN THIS STUDY**

Transition is an overarching theme, which begins at a broad contextual level in the introduction to the history and development of the South African green economy and the socioeconomic aspects of transition. Once the reader has been oriented to the socioeconomic transitions, a focus on individual level transitions is then introduced through the utilisation of Bronfenbrenner's ecological systems model. This model explains the different systems influencing the development and transition of an individual, taking into account direct and indirect influences, such as the role of the family and education. In this way the study provides some background for each participant, describes the practising individuals' pathways and career trajectories, and illuminates factors affecting these trajectories within the



various ecosystemic levels; thus giving the reader insight into the individuals' transitions. The concept of transitioning is discussed in further detail in Chapter Two along with the theoretical framing of the concept as briefly introduced here.

## **1.5 OVERVIEW OF THE STUDY AND SYNOPSIS OF THE SUBSEQUENT CHAPTERS:**

Chapter Two presents the literature review that informed the study. This chapter begins with an overview of the South African Biodiversity Sector, and its relatively recent inclusion into the Green Economy. Thereafter, the focus is placed on specific governmental and local documents and research, especially those pertaining to the green economy, skills supply and demand, and particularly scarce skills within the biodiversity sector. The literature utilised throughout this study, including the policy documents mentioned within section 1.2, are discussed in this chapter. Scarce and critical skills are introduced and investigated by utilizing a theoretical framework comprising of transition theory, based on Bronfenbrenner's ecological systems principles and basic critical realism.

Chapter Three explores the methodological framework and explains the specific methods employed in this study. The overall design and processes associated with the study are discussed, as are their limitations. The analytical process is also described, as are issues of validity, ethics and quality.

Chapter Four presents the data drawn from the nested case study of the wildlife veterinarian. This chapter presents the individual participants' narratives with special emphasis on the factors which affected their transitions, guided by the principles of Bronfenbrenner's ecological systems model and the critical realism principles of emergence.

Chapter Five presents the data drawn from the nested case study of the freshwater ecologist. This chapter presents the individual participants' narratives with the same emphasis as in Chapter four.

Chapter Six: analysis of the data presented in Chapter Four and Five is discussed using the literature presented in Chapter Two. The chapter concludes with the recommendations that emerged from this study, critical reflections and possible areas of enquiry for future study.

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## **Chapter 2: Contextualising the problem: Scarce skills and transitions**

### **2.1 INTRODUCTION: CHAPTER OVERVIEW**

This chapter introduces the South African Biodiversity sector and the current and historic issues facing it. It provides a background literature review for the thesis supported through the use of key international and local documents and research. The literature highlights important issues of South Africa's unemployment problem, the chronic lack of skills within the biodiversity sector and the urgent need to address both (Lotz-Sisitka, 2013). It provides an overview of previous research pertaining to the skills supply and demand for biodiversity skills within the South African context. This chapter focuses on scarce and critical skills in the biodiversity sector as introduced in Chapter One, namely wildlife veterinarian and freshwater ecologist, which were selected for this study. The theoretical frameworks of critical realism and transition theory are explained and introduced in the chapter.

### **2.2 BIOLOGICAL DIVERSITY IN SOUTH AFRICA AND HUMAN CAPITAL DEVELOPMENT**

*There is growing evidence that biodiversity has a vital role ... [in development] ... it contributes to poverty reduction and to sustaining human livelihoods and well-being through, for example, underpinning food security and human health, providing clean air and water, and supporting economic development . (UNEP 2005, cited in UNEP 2012)*

Biodiversity, or biological diversity, is defined by Cowling and Richardson (1995) as the diversity of life, and the extraordinary range of ecosystems comprised of particular floral and faunal species and their unique genes and habitats present on earth. On a global scale, biodiversity faces a myriad of challenges, anthropogenically derived and naturally occurring. Such challenges include: climate change and global warming, over-fishing and disease, the expansion of human population, excessive lifestyles and rapid urbanisation placing expanded demands on natural resources (Sandwith, 2002). In South Africa, such challenges and issues are prevalent, threatening local biodiversity (SANBI/Lewis Foundation, 2012). South Africa is world renowned for its biodiversity hotspots, areas of great intrinsic beauty and biotic, floral and faunal, species richness and diversity. The country is also home to nine unique biomes, which include: Albany Thicket, Forests - including Afromontane, Indian Ocean Coastal Belt, Savanna, Desert, Succulent Karoo, Nama-Karoo and finally Fynbos. An example of the array of species diversity within South Africa is the Cape Floral Kingdom, also referred to as the Fynbos Biome, one of the six recognised Floral Kingdoms on earth,

which alone, hosts in the region of 9000 different botanical species (Cowling. et al., 2002). This small area and the ecological services it yields also contribute greatly to the economic and intrinsic wealth of the country as a whole so is reliant on biodiversity minded and educated individuals to protect and preserve it. However, despite the challenges, conservation in South Africa has advanced substantially over the last three decades (Cowling *et al.*, 2002; Harley, Personal communication, 2006).

### **2.2.1 The history and current status of biodiversity in South Africa**

Historically, conservation and the South African biomes have been handled as expendable resources and were, by and large, integrated into the agriculture and forestry sectors, as were the associated environmental skills (Harley, Personal communication, 2006). This integration resulted in a multitude of problems, and the effects of this mismanagement are still evident up to the present day. Many of these areas remain in need of repair and additional attention, for example: rampant alien invasive plant dispersal, extensive soil erosion, nitrification of traditionally nutrient poor soils, extreme wildfires and landslides (Hoffman & Meadows, 2002).

Along with these inherited problems, the Environmental sector and its related biodiversity sector remain underdeveloped in spite of their rapid emergence and cross cutting significance across different sectors (SA.DEA,2010). This lack of development, in the skills development arena (see section 1.2.1) , has been reflected in the absence of an official Sector Education and Training Authority focussing on the environment, as well as the lack of adequate support given to the need for the integration of the environment into and across all SETAs (SA.DEA,2010).

According to studies conducted by the South African National Biodiversity Institute and the Lewis Foundation, the need for more ecological and environmentally focussed jobs and skills has increased, and it is these studies which have informed the ESSP (SA.DEA,2010; SANBI/Lewis, 2010) Moreover the environmental sector and particularly the biodiversity sector, has begun to gain greater governmental attention, especially pertaining to the sustainable usage of natural resources, the green economy and human capital development opportunities within the environmental and biodiversity sectors. (Rosenburg, Personal communication, 2013). The next section, presents an overview of the green economy from both a South African and international perspective.

### **2.2.2 The green economy: a local and global perspective**

A green economy is defined as: “An economy that strives to achieve improved human well being and social equity, whilst significantly reducing environmental risks and ecological scarcities” Maia, (2012 p.1, citing UNEP, 2011). Furthermore, the term green economy underlines the key values of promoting ecologically sound methods of natural resource management and various greening practices. During this process the environment and many previously marginalised communities are supported whilst avoiding potential risks, such as natural disasters (UNEP, 2011).

Since the 1992 Rio Summit, the concept of a green economy has been developed through extensive research into the man-made practices of wealth creation and sustainment (Borel-Saladin & Turok, 2013). Over the decades, wealth has been created and distributed largely at the expense of the environment and vulnerable communities, resulting in the destruction of fragile ecosystems and the exploitation of natural resources for human consumption (UNEP, 2011). The unsustainable usage of natural resources and the underlying risks to humanity have been increasingly recognised, leading to a conglomeration of high level environmentalists, global leaders and environmental professionals voicing these concerns collectively at the 1992 Earth Summit in Rio, and subsequent international forums. These forums have sought to bring about change through the generation of awareness and various governmental initiatives in response to increased analysis and awareness of environmental risk and anthropogenic changes affecting global earth systems (Borel-Saladin & Turok, 2013). Currently, the green economy is being cited as one of the three most lucrative sectors globally, with the two other sectors being Health and Human Capital Development sectors (Borel-Saladin & Turok, 2013). At the subsequent Rio +20, two decades later, the green economy was cemented.

The green economy was founded on the ideals of the Rio Earth Summit of 1992, as well as the revised Millennium Development Goals and has been incorporated into the Sustainable Development Goals, 2015. The aim behind the Millennium Development Goals and now, continued into, the Sustainable Development goals was to take on issues associated with poverty, inequalities, marginalised communities, and climate change, unsustainable exploitation of natural resources, as well as human dignity, justice and equality and prosperity for all.

The Millennium Development Goals are supported and underpinned by numerous international biodiversity and environmentally related structures of which two specific conventions are pertinent to the case studies. One is the Convention for the International Trade in Endangered Species, 1973 which shapes insights into the wildlife veterinary case study, located in Chapter Four and the RAMSAR convention for the protection of Wetlands 1975, located in Chapter Five. The original 8 Millennium Development Goals have since been revised and will be replaced by the Sustainable Development Goals, a set of 17 goals, incorporating the original 8 goals in 2015.

The goals pertinent to this study are listed below:

- Goal 6: Ensure availability of sustainable management of water and sanitation for all.
- Goal 7: Ensure access to affordable, reliable, sustainable modern energy for all.
- Goal 8: Promote sustained, inclusive and sustainable economic growth, full productive employment and decent work for all.
- Goal 13: Take urgent action to combat climate change and its impacts.
- Goal 15: Protect, restore, promote sustainable usage of terrestrial ecosystems, sustainably manage forests, combat desertification and halt reverse land degradation and halt biodiversity loss.

Over the past decade interest and concern in South Africa regarding the green economy has been increasing and been driven by a number of phenomena which highlight the need for a shift to a green economy. These phenomena include the high poverty and unemployment rates in South Africa, as well as the country's excessive carbon footprint. In fact, South Africa has been listed as the 14<sup>th</sup> highest carbon emitting nation globally and is primarily a coal and fossil fuel powered nation (Borel-Saladin & Turok, 2013). Thus, the South African economy is described as a brown economy, due to the financial system being largely dependent on fossil fuel.

These concerns led to South African proclaiming a New Growth Path in which the green economy forms one of the six priority areas of the New Growth Path document (DED, 2011). This document discusses strategies for the creation of work, the defeat of poverty and the restructuring of the South African economy, to improve its growth and development rate. This document was formulated in response to the global economic downturn in 2008, with

the Green Economy Accord being signed in 2011 by four stakeholder parties, namely, civil society, labour unions, private businesses and government (DED, 2011).

The chief aim of this initiative the New Growth Path, and of the South African green economy, is the creation of 300 000 jobs and the contribution toward greening South Africa's economy by 2020 (Borel-Saladin & Turok, 2013), many of which are related to natural resources management (which includes wildlife veterinarians and freshwater ecologists).

This social and environmental movement which has sought to find possible links between environmental management and concerns and social concern for job creation and livelihoods, has led to the creation of skills development documentation such as the Environmental Sector Skills Plan for South Africa, National Biodiversity Framework and Biodiversity Human Capital Development Strategy , which reflect commitments to the global green economy movement, as well as establishing an ethic of care for the environment and social justice. The work on the green economy approach is ongoing and the movement is gaining momentum in the country. Currently, South Africa's green economy is one of the six priority sectors which is rapidly becoming of great interest to government and the private sector, due to the extensive possibilities for growth and job creation ( Borel-Saladin & Turok, 2013; SA.DEA,2010).

The importance of having suitable professionals to carry out the vast tasks associated with biodiversity management and sustainable development is almost incalculable. These individuals add exceptional value in promoting, protecting and sustaining biodiversity and its intricate, interlinking systems (Wanless, 2013). Thus, the need for job creation is evident; yet advancing the green economy and national biodiversity management requires that these individuals need to be adequately trained and mentored. Furthermore, overall sound understanding of where skill shortages are is vital to addressing human capital development for this sector.

This study aims to provide insight into the gaps of skill related knowledge, highlighted in section 2.2.4. The next section gives an overview of human capital development for the South African biodiversity sector.

### **2.2.3 Human Capital Development in the context of the South African biodiversity sector**

The traditional definition of human capital development as used in the global arena refers to the ability of a country to add to capital or a usable good, by promoting the development of its people and their respective education(s) (Kraak & Press, 2008; Olaniyan & Okemakinde, 2008). However, in the context of this study, the use of the term human capital development is guided by sectoral interpretations. It is recognised as the contribution individuals make through their specific skills and education, which are not limited to qualifications, to achieving the overall biodiversity goals as framed by the Department of Environmental Affairs and the National Biodiversity Framework (Rosenburg, 2013; SA.DEA,2010).

As a result of the research conducted by the Lewis Foundation and SANBI (2010) it became evident that skills and education alone do not determine the success of individuals in attaining biodiversity goals. Certain external enabling and constraining factors within individual's immediate micro-sociological and ecological systems, including their companies, institutions, and higher education institutes, add to the employment, retention and deployment of individuals within the workforce (see also DEA 2010 which proposes a systems approach to HCD in the environmental sector). This led to the decision to focus on the transitions that the study's participants made, utilising Bronfenbrenner's human ecological systems theory (see section 2.4.2).

The Biodiversity Human Capital Development Strategy developed in 2010 to focus on skills demand issues in the biodiversity sector (SA.DEA,2010), identified the key gap in the system of skills provisioning for the biodiversity sector (especially from a transformation perspective) to be at the level of high skills (i.e. professionals and managers). Thus this study's focus is on skills and development at high level skills. In a South African context this refers to level six and upwards on the National Qualifications Framework. Level six denotes a diploma, primary degree, graduating to a higher degree such as a master's or doctorate. Furthermore, this study is focused at high level specialist *scarce skills* as introduced in Chapter One (see section 1.2.1), and not lower level skills even though there is much potential for skills development at this level within the emerging green economy (Maia et al., 2012).

These issues are documented in a range of policy and sector specific documents, which I review briefly below. These are the ones instrumental in the development of biodiversity skills research relevant to this study.

#### **2.2.4 Research and documents pertaining to the South African biodiversity sector and human capital development opportunities**

Each of the documents mentioned below are linked to, and integrated with one another, in the overall achievement of the goals for biodiversity and improving human capital development, as set by the Department of Environmental Affairs. They also set the stage for the upcoming Sustainable Development Goals (United Nations homepage, 2015). Furthermore the urgency to address global environmental issues is addressed succinctly in the work of Steffen et al. (2009), who highlight the impacts that anthropogenic activities have on the earth and its climate, stating that the earth has entered a new era, the Anthropocene, whereby humans act as the drivers of change which has further been facilitated by a population explosion. Steffen et al. (2009) go onto present a concept of nine planetary boundaries which will effectively measure the safe operating space for humanity and continual functioning of earth. However these boundaries include two of the nine boundaries namely, the rate of biodiversity loss and global freshwater use and they cannot be crossed or transgressed. This is to avoid irreversible environmental change, including species loss.

In light of these biodiversity issues and the new Sustainable Development Goals, the importance of possessing a clear understanding of scarce biodiversity skills, as well as the factors affecting these skills makes this research study potentially valuable.

This research is based on the studies outcomes that are captured in the following documents: the Environmental Sector skills Plan for South Africa (SA.DEA,2010), the Biodiversity Sector Human Capital Development Strategy (SANBI/Lewis, 2010) and the GreenMatter priority skills document (SANBI/ Lewis Foundation, 2012) , which are introduced in section 2.2.4.1. All of these research reports focus on the lack of adequate skills for servicing the biodiversity sector and the urgency of the need to address this, and the ability to develop skills in order to enhance human capital development. These documents also highlight common themes related to the gaps and crucial needs of the sector, including the need for high level skills, which has largely been neglected, as described in section 2.2.4.2 below (SANBI & Lewis Foundation, 2012). The focus extends to the importance of skills, and the



difference adequately skilled people with relevant tertiary qualifications can make towards solving the issues facing the biodiversity sector.

#### **2.2.4.1 A brief introduction and review of key documents pertaining to biodiversity human capital and skills development within the biodiversity sector**

In this section I briefly introduce and review the key documents pertaining to biodiversity, human capital and skills development:

- National Biodiversity Framework, 2007 (NBF):

The National Biodiversity Framework is a governmental policy document that serves as the supporting strategic document for the implementation of the National Environmental Management Act: Biodiversity (SA.DEA, 2004) one of the five Specific Environmental Management Acts, SEMAs which focus on various environmental issues, NEMBA focuses on the conservation and preservation of biological diversity. Furthermore, the NBF serves as the backbone to subsequent research on human capital development in the biodiversity sector, as it highlighted the necessity for a specific capacity building project. The rationale for this as given in the NBF is to attain specific objectives for the transformation and skills development necessary for biodiversity management in South Africa.

- Environmental Sector Skills Plan of South Africa, 2010 (ESSP)

The Environmental Sector Skills Plan of South Africa, 2010 (SA.DEA, 2010), is the first ever sector skills plan that provides overview information on the skills needs of the sector as a whole (including biodiversity skills). It provides recent information on scarce and critical skills within the overarching environmental sectors. Through the ESSP, trends influencing skills development within the biodiversity sector have been identified one of which is that the environment is a cross cutting sector, meaning that depth and scope of the skills and their respective professionals are located across a variety of different sectors, from economic to agriculture, manufacturing and education (amongst others). The ESSP also reported that the professionals and the (variety) of skills necessary for the environmental sector were not adequately supported or recognised. The ESSP has been linked to and informs a number of the Human Development Strategies; namely the Global Change Grand Challenge Human Capital Development Strategy, the Water and Energy sector HCD plans (SA.DEA, 2010).

Important for this study is the fact that the ESSP also influenced the design of the BHCDS. Both the ESSP and the BHCDS adopt a systems approach to skills development (SA.DEA, 2010; SANBI/Lewis, 2010).

- The Biodiversity Human Capital Development Strategy, 2010 (BHCDS).

The Biodiversity Human Capital Development Strategy (BHCDS) is a significant national-level strategy, aimed at responding to the aforementioned environmental challenges. The development of this document has its foundations in the 2005 National Biodiversity Skills Action Plan, The Environmental Sector Skills Plan, 2010 and the 2007 National Biodiversity Framework (Rosenburg, Personal communication, 2013). The National Biodiversity Framework highlighted the need for a specific capacity building project to drive the objectives of transformation and skills development, whilst promoting a biodiversity related mandate. The development of the BHCDS was informed by extensive research and stakeholder involvement. The then Department of Environmental Affairs and Tourism, now the Department of Environmental Affairs (DEA) authorised the commencement of the research, which would guide the eventual implementation of the BHCDS, by two biodiversity led institutions namely; South African National Biodiversity Institute, SANBI and the Lewis Foundation (SANBI/Lewis, 2010). The research to inform this document was undertaken by the Human Sciences Research Council (HSRC, 2009). The Biodiversity Human Capital Development Strategy (SANBI/Lewis, 2010) summarises current knowledge on biodiversity related skills shortages, limitations to the data collected, issues within the planning sector and the foundational knowledge regarding the scarce skills list based on the data available.

- GreenMatter Initiative and Skills Priority List, 2012

As a result of the collaboration between the South African National Biodiversity Institute, SANBI and the Lewis Foundation, the GreenMatter brand was established. This brand was initiated to foreground the importance of human capital in the biodiversity sector within the context of social transformation; adding to the opportunities for growth, development and employment and overall promotion of the South African green economy. Its key mandate is to implement the BHCDS and to mobilise sector partnerships and resources to this end. Part of GreenMatter's functioning is to support research in line with its key objectives, which include skills development and the recognition and prioritisation of the biodiversity sector

within governmental levels. Funding was made available in order to carry out such research, and bursaries in the form of six master's studies and four doctorate studies were made available to students, aiming to provide valuable research for this programme through a GreenMatter / Rhodes University / CATHSSETA partnership agreement. As indicated in Chapter One, this study forms part of the master's studies in this programme and the findings will contribute to the knowledge gaps pertaining to scarce skills, transitions of biodiversity professionals and on scarce biodiversity skills.

Following on from the BHCDS a need arose for a more refined analysis of scarce skills in the Sector. Consequently GreenMatter released a priority list of scarce skills in 2010, which provides a concise summary of the Biodiversity Human Capital Development Strategy document, whilst giving a clear definitions and explanations of the various scarce and critical skills required by the biodiversity sector. It sheds light on environmental issues and highlights the knowledge gaps within the sector pertaining to scarce skills. It also further emphasises the need for more research to address these gaps. This document is thus an important foundational document for this study, as the two scarce skills which are described in this study were drawn from this list.

#### **2.2.4.2 Threats to the success of human capital development within the South African biodiversity sector**

Currently in South Africa, the main challenges relating to human capital development include: integration of human capital development priorities into institutional frameworks, fulfilling mandatory responsibilities whilst promoting transformation within the biodiversity workforce (Breier & Erasmus, 2009; Rosenberg, 2013) and the need to meet the skills-related requirements of prospective employers who are calling for biodiversity professionals with critical skills relevant to the sector.

The problem of scarce skills and associated institutional challenges reported above are also related to the relative newness of many of the skills and occupations within the skills development landscape. Many of these skills are also highly specialised which creates scarcity. This is evident with the study's scarce skills; see Chapter Four and Chapter Five. There is also often inadequate knowledge of supply and demand for these skills as this study has discovered (Breier & Erasmus, 2009; SA.DEA,2010; South Africa. Department of Labour, 2007).

A further indication of a poorly defined skills sector is found where various job titles relevant to green occupations are inappropriately grouped together and described in the Organising Framework for Occupations, or are being recognised by the standard operating codes as being within the same industry when they are not necessarily so, as was found when librarians and museum curators and nature conservators were indicated on the OFO as similar occupations when they are in fact quite different (BHCDS, p. 2, 2010). This creates problems for skills planning in the sector, and leads to some form of ‘invisibility’ for sought after or scarce skills.

Such issues have lead to more intensive investment in human capital development as proposed in the Biodiversity Human Capital Development Strategy (South African National Biodiversity Institute & Lewis Foundation, 2010). This strategy seeks to strengthen human capital development especially at the high skills/ professional level in the biodiversity sector as this is where high levels of demand have been shown to exist (ibid). It is for this reason that the occupations that I focussed on are high skills / professional occupations.

### **2.3 SCARCE SKILLS IN THE BIODIVERSITY SECTOR**

Skills are understood to be a combination of competencies, knowledge, values and insights, allowing for individuals to conduct their work, as per the SANBI/ Lewis Biodiversity Human Capital Development Strategy (2010). According to the Health and Welfare Sector Education and Training Authority, HWSETA (2012) and the ESSP (SA.DEA, 2010), the term skills can further be used ‘loosely’ to refer to occupations in which specific skilled individuals perform work. In this research the definition of skills is aligned to that of the (South Africa. Department of Environmental Affairs, 2010), wherein *skills are defined as competencies*, knowledge and values needed to practice an occupation. In line with the Department of Labour’s definition of scarce and critical skills, the DEA (2010) document also refers to skills in occupational terms (i.e. it classifies skills required in relation to specified occupational categories). Skills can also be a result of tacit knowledge obtained through workplace learning, or can be gained through formal training (see section 2.3.2.2).

As has been mentioned, there has been a broad lack of biodiversity skills development, an issue which is mirrored in the South African governmental and private sector research. The issues is not, however, restricted to South African, and international reporting also points to the need for improved skills in the biodiversity sector, as the challenges of biodiversity

management increases with an ongoing loss of biodiversity (SA.DEA,2010; Ingram et al., 2009; UNEP, 2012).

The concept of skills within the context of the South African Biodiversity Sector, following the Department of Labour categorisation (HSRC, 2009), has been divided into scarce and critical skills (introduced briefly in section 1.2.1, and defined in more detail below).

### **2.3.1 Scarce and critical skills, and supply and demand of scarce and critical skills**

Scarce skills are identified by Breier and Erasmus (2009), as skills (or occupations) which are in chronic short supply, and for the biodiversity sector, this is a further elaboration by the GreenMatter skills priority list (SANBI/Lewis Foundation, 2010) which states that a skill refers to the ability to perform the roles and duties proficiently within an occupation, as based on the Organising Framework for Occupations (DHET, 2013). An occupation, as per the SANBI/Lewis Foundation, (2012) is understood to be a set of jobs, or specialisation, where the tasks are similar in nature allowing for them to be grouped together.

As introduced in Chapter One, scarce skills can be further broken down into two subdivisions: absolute and relative scarcity, depending on the availability of the specific skill/s. Absolute scarcity is indicative of skilled individuals being absent from the current workforce within the foreseeable future (Kraak, 2009). Conversely, relative scarcity refers to skilled individuals being in the sector but not being able to meet the employment criteria due to, for example, geographical placing, transformation objectives or the lack of critical skills required within the occupation as is explained by the Department of Higher Education and Training (DHET, 2011) and as found on the National Scarce Skills List of the Department of Labour (NSSL), (DoL, 2008).

For the purpose of this research, I was required to choose two to three scarce skills to investigate in the study. As mentioned above in section 2.1, this choice was guided by the GreenMatter Priority Scarce Skills list (SANBI/Lewis Foundation, 2012). The chosen scarce skills were:

- 1) wildlife veterinarian, a relative scarcity, which means that the qualified individuals are present within the sector, yet are unable to fulfil the demand, as a result of factors such as transformative objectives, geographical placing.

- 2) freshwater ecologist (with a wetland ecology focus), identified as an absolute scarcity, which means that there is a definite lack of individuals within the sector, as a result of the relative newness or emergence of the skill or occupation, or the absence of skilled professionals within the industry.

However, the skills debate is not just confined to definitions of relative and absolute scarcity, as the concept of *critical skills* is also used. This often creates confusion as to how ‘scarcity’ is viewed within the biodiversity sector. All professionals, including those in the biodiversity sector, need to possess certain competencies prior to entering the workforce, such as: knowledge of the sector, ability to work in complex situations and a passion for the environment (Breier & Erasmus, 2009). This is also often apparent in the requirements section of a job advertisement, and a lack of these competencies can also lead to difficulty in finding work (Kraak, 2009). In relation to this, Wanless (2013) states: “When biodiversity graduates first enter the workplace they often lack skills such as, problem solving, planning, tackling group projects and the application of theory from their studies into a real world context”. The skills mentioned in the quotation refer to *critical skills*, which Kraak (2009) identifies as specific skills which are required within an occupation and its relevant workforce. Critical skills can be further delineated into two forms of critical skills: generic and particular operational (as also introduced briefly in Chapter One, section 1.2.1) (Department of Higher Education and Training, DHET, 2014; Health and Welfare Sector, HWSETA, 2012; Kraak, 2009). Particular operational skills can be understood as critical skills relevant to a specific trade or operation, for example a wildlife veterinary critical skill could be that of blood sampling. A generic critical skill could be telephone etiquette, minute taking, HIV/ AIDS knowledge and conflict resolution. (HWSETA, 2012 ; South Africa. Department of Environmental Affairs, 2010).

Defining what a scarce skill is in relative or absolute terms, or identifying what critical skills are absent (generic or occupation specific) is an element of the bigger issue of skills scarcity and shortages. What is more important to investigate once it has been determined that skills are scarce, is to develop a more in-depth understanding as to why these skills are scarce, and what is shaping the scarcity. This requires research into supply and demand issues.

**Supply side factors** are focussed on how the skills are supplied into a sector and this involves looking at the education and training system and skills system provisioning.

Examples of factors that need to be considered from a supply side perspective are quality and access to schooling, subject choices in schooling, career guidance, experiential learning, university entry opportunities, curriculum content in universities. Kraak (2009) for example suggests that factors such as geographical placing of jobs, limited choices in employing low level skilled workers can lead to skills gaps.

**Demand side factors** on the other hand relate to the employment context and labour market factors such as whether there are adequate economic resources to employ people in the sector, whether employers are seeking out graduates, and what the scope and range of employment opportunities are in a sector. Kraak (2009), in his chapter on the South African electrical energy sector, for example suggests that the rate of economic growth, will also play a large role in determining the demand for skills, this will also clarify the consistency or inconsistency of the demand for skills.

However, as briefly introduced in Chapter One, there is also the phase and processes that operate *in-between supply and demand*, which in the literature is referred to as *transitioning* (Bronfenbrenner, 1979; Ecclestone et al., 2009; Fenwick, 2013). Transitioning is a complex process and involves a shift or development from one state or setting to another, and through this process the settings, roles, activities and relationships are affected (Ecclestone, 2009), Transitioning will be discussed in more detail below (see section 2.4), as this was the ‘interface’ between supply and demand that I examined in this study. Fenwick, (2013) argues research into transitioning allows one to study *the relationship between* supply and demand. I reasoned that this would provide a strong lens through which to understand issues of skills scarcity (relative or absolute) as well as issues pertaining to critical skills (occupationally specific or generic).

### **2.3.2 Gaps in knowledge pertaining to scarce and critical skills, skills shortages and transitioning factors within the biodiversity sector**

South Africa’s turbulent political history has impacted largely on the efficacy of its growth and transition into a developing country (Borel-Saladin & Turok, 2013). The apartheid legacy as well as issues experienced within the emerging governance system in South Africa (e.g. widespread reports of corruption; ongoing violence etc.) has led to many skilled professionals leaving the country or changing original career trajectories resulting in a noticeable shortage of professional skills (Crush et al., 2000). It is not only political drivers that have led to such shortages of skills, but also issues associated with the quality of education, and the exclusion

of the majority of South African's from a high quality education (Rosenberg, Personal communication, 2013). Apart from the aforementioned issue of the biodiversity sector featuring in Government as an emerging sector (see section 2.2.1), and the associated emergence of a scarcity of biodiversity related skills, a lack of knowledge pertaining to skills in general, including those of biodiversity, has been illuminated as problematic (SA.DEA,2010; Rosenberg, Personal communication, 2013). The ESSP (SA.DEA,2010) underlined the importance of filling the knowledge gap whilst also addressing the issue of skill shortages within the Environmental and Biodiversity sectors respectively (South Africa. Department of Environmental Affairs, 2010).

Evident gaps in knowledge pertaining to scarce skills within the biodiversity sector have motivated research and development of a national strategy to address the issues (SANBI/Lewis, 2010). However, to date, research findings and strategic orientation is broad, and there is a lack of detailed empirical insights into the exact factors affecting skills supply and demand within this sector. I highlight two such examples of gaps in research requiring additional investigation, namely: skills migration and tacit knowledge. Skills migration is a big threat to the development and strengthening of the biodiversity sector, whilst, an area such as tacit knowledge serves as a building block for the development of young professionals as they enter the workforce. Further research into both of these elements would have an impact on the success of the biodiversity sector (SANBI/ Lewis Foundation, 2012).The final chapter of the thesis (Chapter Six) provides further insight into some of the more complex issues influencing skills supply and demand and why there is a skills scarcity for the two occupations under investigation. The two factors that are already known to influence skills supply and demand in the biodiversity sector, and more broadly in the South African context, are outlined and explained below and give more distinct reasons for the existence of these scarce skills.

### **2.3.2.1 Migratory skills and skills migration**

Migratory skills are identified as skills for which there is a high global demand. Often specifically skilled workers cannot find a suitable match for their specific talents, leading to these individuals leaving their country of origin to seek work on foreign shores (Blankley et al., 2004)Another contributing factor is a country's lack of infrastructure with which to offer to specialised candidates viable job opportunities. Additionally, the skill/s could be considered too diverse or too specialised for a particular context's demands (Bailey, 2003;



Campbell, 2002). Periodically, as is the case in South Africa, the actual economic and political stance of a country serves to drive skilled individuals to migrate for their own benefit (Campbell, 2002; Kraak & Press, 2008). Crush et al. (2000) describes a South African / African phenomenon dubbed as the “brain drain”, and states that since pre democratic South Africa to date, many skilled and talented individuals have left the country to seek opportunities elsewhere. The phenomenon of a ‘brain drain’ also characterises many African countries, as salaries are often higher in countries outside of Africa. However, prior to the democratic changes there was also an influx of skilled professionals as many in exiles returned home. There has also been a longer term influx of workers from surrounding African countries into South Africa, the majority of which were classified as lower skill level as their labour was sought in the mining industry especially (Campbell, 2002). According to Breier and Erasmus (2009), it is especially in the fields of medicine, engineering and information communication technology, that the outflow of highly skilled individuals vacating the country for other countries is noticeable. Reasons for their departures included, but were not limited to, the opportunities of greater remuneration and skills recognition, bettering the offers available within the local context (ibid).

In this study’s set up phase (during contextual profiling) I found that both scarce skills of freshwater ecologist and the wildlife veterinary vocations are identified as highly migratory vocations, according to reports from both Onderstepoort (Burroughs, Personal communication, 2013) and Stellenbosch University (Esler, Personal communication, 2014). Furthermore, the few pre grad individuals that I interacted with when setting up this study, stated that they would prefer to work overseas. However, I was not able to trace the exact numbers of professionals in these two categories that have migrated.

Since its re-emergence into the economic field after years of apartheid-based sanctions, South Africa has had to work extensively to contend with economically more powerful countries. Additionally, South Africa is recognised as a developing country within a state of growth and therefore certain sectors are not currently able to offer jobs or permanent posts to specifically or scarce-skilled individuals. The rapid changes and more flexible and mobile patterns of employment that are emerging under neo-liberal globalisation, together with the potential for specific skills not being adequately recognised or accommodated in the South African workforce, is a contributing factor aiding in the migration of many talented individuals (Bailey, 2003; Campbell, 2002; Crush, 2000). Furthermore, opportunities for young

graduates to be able to shadow and gain valuable insight and experience in their specific workplace, often a prerequisite to obtaining employment, are not always available and as a result opportunity is sought elsewhere, including foreign markets.

Lastly in the South African context, job opportunities are advertised for, and are directly and specifically aimed at affirmative action and transformation policies in companies and within government. This affects especially those who are not the focus of affirmative action and/or transformation policies (especially white males) who often choose to migrate as they fail to be considered for jobs. Additionally the affects of an escalating crime rate and other forms of violence in South Africa have been cited as reasons for potential candidates to seek opportunities abroad (Bailey, 2003).

#### **2.3.2.2 Tacit knowledge**

A second factor influencing scarcity of skills is tacit knowledge. Eraut (2000) describes tacit knowledge as the knowledge one acquires over time and through experience, it is further divided into three types, namely; the understanding of situations and people, routine actions and finally, tacit rules underpinning decision making. These actions become evident when four processes are followed; reading the situation, weighing up options, explicit activity coupled with three modes of cognition, intuitive, analytic and deliberate, also referred to as metacognition (ibid). Tacit knowledge forms the basis of the experience required by employers for their employees and often these individuals lack these skills, especially if they are 'fresh' out of college / university and have had little or no work experience.

Working individuals gain tacit knowledge through experiences, workplace learning and mentorship and guidance in the workplace. It is not necessarily provided or instructed at university level, but gained through years of working experience. It is perhaps ironic or paradoxical, that for young people to gain access to the workplace they require work experience yet young people are not able to access the jobs which will give them work experience. This requires other instruments to provide for transitioning from university to workplace so that professionals can gain experience, for example via internships, job shadowing programmes (SA.DEA, 2010).

The short discussion on these two issues noted above, provide some insight into how different factors shape supply and demand, and furthermore that supply and demand issues should not just be understood in technical terms via a quantification of scarce and critical

skills. There is also a need for the contextualisation of understanding of scarce and critical skills, and in this study this is done via in-depth qualitative research into two scarce skill occupations, which are introduced next.

### **2.3.3 Veterinary and wildlife veterinarians in South Africa**

The field of veterinary science and practice is a highly specialised, yet exceptionally diverse and cross cutting field, which is influenced and shaped by global trends such as: disease outbreak, food production, biotechnology and ecotourism, and therefore must be able to serve political, agricultural and economic demands (Kriek & Swan, 2009; South African Veterinary Association, 2014). Globally there is a need for experienced, qualified veterinarians, possessing sound education and postgraduate training to contribute to the veterinary related research that is required within this wider socio-ecological / socio-economic context. It is particularly the need for biodiversity conservation and protection of animal biodiversity, mega fauna and fisheries, as well as the burgeoning ecotourism business and wildlife farming (hunting) that influences this scarce skill. Furthermore, this scarce skill is influenced by the international agreements to protect wildlife and animals that originate from the international Biodiversity Convention. One of the seven conventions of particular importance to this study is the Convention on International Trade in Endangered Species of Wild Fauna and Flora, CITES legislation, and this directly impacts the trade, management and handling of wildlife internationally (Convention for Biological Diversity, 2014). The aforementioned issues contributed to South Africa's decision to commit to the Convention on International Trade in Endangered Species of Wild Fauna and Flora, CITES, in 1975, in order to protect local species from over exploitation and extinction (DEA, 2014). The international trade of wildlife species is recognised as being a several billion dollar industry into which the South African wildlife and game ranching industry fits (WRSA, 2012).

Veterinary services are vital elements contributing to not only animal welfare and husbandry, but the international agricultural economy, food production, the sustained health and well being of both animals and humans globally. The value and importance of veterinarians involved with wildlife health and disease, as well as public health, transboundary diseases and zoonosis, are of paramount significance to the environmental sector as elaborated below.

South Africa's biodiversity is species rich, a large component of which is comprised of unique and invaluable faunal species,

- micro fauna, such as indigenous rodents, avifauna, reptiles
- macro fauna, including primates and some species of antelope, and some of the big five species
- mega fauna, also including some species of the big five, large antelope as well as cetaceans.

Furthermore, this faunal component and many of the associated species are recognised as intrinsically and economically valuable across many of the sectors, such as: agriculture, environment, cultural and historical, trade and tourism, including ecotourism and hunting.

Within the past two decades, the South African wildlife and game ranching industry has grown exponentially into an industry with the R8 Billion per annum value and has attracted local and international interest and investment (WRSA, 2012). This is why its management requires specific, highly trained individuals

Conversely, wildlife has and continues to, serve as “reservoirs” for pathogens resulting in disease in both domestic animals and humans, also referred to as transboundary diseases. Causes for the spread of transboundary diseases can be attributed to intrusions into wild animal natural habitats, as well as the viral trade in bush meat, agricultural sprawl, and the exotic pet market. Additionally, transboundary diseases have been recognised as one of the eight classes of diseases which will become rife within the next two and a half decades, as conditions allow for the their promotion (Kriek & Swan, 2009).

As a result of these current and historical threats which wildlife pose to the agricultural sector, including problem animal issues, pests and transboundary diseases, the management of wildlife has gained an unfortunate reputation within the agricultural context. Effective mitigation and management of transboundary diseases, and promotion of general veterinary practice and disease control, is reliant upon adequate, functional veterinary institutions and facilities, in conjunction with governmental support and a constantly revised curriculum in line with global veterinary standards.

To date, there are 46 veterinary training institutes within Africa, 21 of which are located in Sub-Saharan Africa (Burroughs, Personal communication, 2014; Kriek & Swan, 2009). For the purpose of this study I have focussed on the only South African based institute, located in Pretoria, namely: Onderstepoort. The aforementioned institutes were primarily established as

a defence against disease epidemics within the agricultural sectors, as a result of wildlife and domestic animal interactions (Kriek & Swan, 2009).

The history of the veterinarian sciences and practice in South Africa has its foundations rooted in the early agricultural and disease prevention landscape. The founding veterinary and disinfection station was set up by a Swiss national, Dr Arnold Theiler, shortly after the station closed its doors in 1905. Dr Theiler then set up Onderstepoort in 1908, and subsequently began training the first official South African Veterinarians in 1920. The initiation of the veterinary institute was as a result of previous epidemics such as the Rinderpest, Catarrhal fever, Blood Water and Anthrax and at the time it was seen as imperative that a council of trained professionals be available to attend to such outbreaks as these diseases had far reaching consequences for the newly developing South African agricultural sector, which often suffered financially and loss of stock, due to outbreaks (Onderstepoort website, 2013; South African Veterinary Association, 2014).

The Onderstepoort Veterinary School of Medicine has since its modest beginning, grown and diversified to offer a variety of different services such as; veterinary nursing, veterinary technology, anaesthesiology, and wildlife veterinary care. The undergraduate curriculum is tailored to the global demands as specified for veterinary education including the outcomes of the New Partnership for African Development, referred to as NEPAD and the African Union (Burroughs, Personal communication, 2014) and regulations pertaining to the international trade in species such as CITES and the South African Biodiversity Act No 10 of 2004. The latter provides for the management and conservation of South Africa's biodiversity, within the framework of the National Environmental Management Act (1998), and ensures the protection of species and ecosystems that warrant national protection and sustainable usage of natural resources.

As with many of its African counterparts the focus of the undergraduate curriculum at Onderstepoort is threefold, in that focus is placed upon producing veterinarians who are able to firstly, recognise, diagnose, and implement treatment for disease control; secondly, apply treatment to animals; and thirdly safeguard the wellbeing of human health and augment animal wellbeing (Kriek & Swan, 2009). The dynamic nature of the undergraduate veterinary curricula allows for the response to global pressures (ibid), and subjects such as wildlife and ecotourism, health and food production are increasingly being incorporated. From 2015 the

adapted curriculum incorporating the One Health principles which emphasis veterinary issues not only at a local level, but globally (Burroughs, Personal communication, 2014; Kock, Personal communication, 2014). The current 6<sup>th</sup> year students were the last intake to be instructed via the main course offered for veterinary specialisation in the curriculum of 2009. This course, known as the '*Wildlife, Ostriches and Crocodiles 610*' course, was undertaken by students in their final year prior to clinical work. Further insight into this course is provided in Chapter Four (section 4.4).

Wildlife veterinary practice is a specialism which the students have been able to take in their penultimate year of undergraduate study<sup>1</sup>. Further to this, veterinary students who possess the basic veterinary degree can conduct a postgraduate degree, in the form of a Master's in wildlife veterinary topics, in order to specialise as a qualified wildlife veterinarian. Two options for postgraduate degrees currently exist; the first is a MSc. veterinary degree, equivalent to a master's course at another higher education institute. The second option is the M.Med.Vet. Course offered as a Master's level veterinarian specialism. This is a popular course and is based on a three year long supervision period of the student by a qualified and approved supervisor. The student then works under the guidance of the supervisor and upon completion, writes an exam which renders the qualified individual a practicing specialised veterinarian. This course however, is constrained by a number of factors especially the presence and availability of the only four qualified and able supervisors. Three of whom are based in Onderstepoort and one is based at South African National Parks- Kruger National Park. This allows students to enrol for the course on the condition that they are able to take up a post, supervised at either Onderstepoort or the Kruger National Park or in a vicinity close by. Should any of the supervisors be unable to continue with the student, there are financial and other implications for the university, and the student will be unable to complete the degree.

Of the 120 to 150 students who enrol for the undergraduate veterinary course annually, less than 20 % will move into the wildlife veterinary field upon graduation [WV/Int.07]. This is why this skill is considered migratory and in highly demand as the numbers of students

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<sup>1</sup> The curriculum has changed over the past 10 years, and in this time, the complete length of the degree has varied, from 5 years, to 6 years to seven years and to date the graduating class of (2015/2016) will have undergone a 6 year degree. Furthermore, the 2015 curriculum will include One Health principles and thus incorporate the wildlife veterinary focus from the 1<sup>st</sup> year.

progressing to the South African workforce are understood to be fewer than required (Kock, Personal communication, 2014). Another factor influencing the presence and scarcity of wildlife veterinarians, is that between the 1960's and 1980's students had to serve in governmental posts after qualifying. These posts were mostly in the equine and large animal fields or in far afield game and nature reserves. Consequently a great many veterinarians chose the domestic large animals or state veterinarians positions, as they were not keen to move to remote conservation locations, where often supplies and day to day tasks were hampered by vast distances, and also personal and family responsibilities prohibited these individuals from pursuing this career. (Bracher, Personal communication, 2014). Currently, the interest in state posts amongst recent graduates is less than what was experienced during the past four decades. This is due to young veterinarians electing to pursue private sector opportunities and perceiving state veterinarian jobs to be deskbound and administrative and less challenging.

This relates to a new and seemingly significant trend which is emerging from the recent changes in drugs and medicines legislation Medicines and Related Substances Control Act: 101/ 65, coupled with the boom in the game industry. This trend involves recent (often young) graduates being approached by game capture companies to serve as assistants or on-site veterinarians as the game capture companies require a qualified veterinarian to be present to dispense the drugs needed for game capture, as outlined below:

The Medicines and Related Substances Control Act, 1965 (Act 101 of 1965), administered by the National Department of Health (namely veterinary medicines) states the following:

- *“Controls use, sale, manufacture and advertising”*
- *“Meets international conventions”*
- *“Restricted for use by a veterinarian, in accordance with professional scope of practice [22A(16(c))”*

Medicines controlled by schedules: “In terms of Act 101/65, medicines are grouped into various schedules (unscheduled – Schedule 9) based on their safety, use and habit-forming potential. Unscheduled medicines are identified as over-the-counter products and are thus legally available to the public from specified retail outlets. Pharmacists may supply any medicine up to Schedule 2 directly to clients for use in animals without a veterinary prescription; however a veterinary prescription is required for all

other scheduled substances 18. Medicines are highly controlled because they are deemed as unsafe. Classes of medicines used primarily in game capture and wildlife ranching or farming are: sedatives and tranquilisers and general anaesthetics”. (SAVC, 2014)

- Tranquilizers, sedatives and anaesthetics are Schedule 5 drugs
- Opioids, general anaesthetic drugs, highly concentrated and dangerous are Schedule 6 Drugs

The aforementioned type of operation, working with potentially unethical game capture companies, is warned against, due to questionable ethical practices and potential underutilisation of the veterinarian (Burroughs, Personal communication, 2014; Kock, Personal communication, 2014). This is one amongst other challenges that young veterinary graduates have to confront. Other challenges and obstacles in their transitioning to becoming experienced and valued wildlife vets are discussed in Chapter Four and Chapter Six, based on data generated for this study.

#### **2.3.4 Freshwater (Wetland) ecologists in South Africa**

Water is an essential support for all life on earth. The preservation and management of water and its many intricate systems (including wetlands) has become a global effort, as is evident within the UNEP Millennium Development Goals document (UNEP, 2012) and the newly revised Sustainable Development Goals, goal six “ Ensure availability and sustainable management of water and sanitation for all” (UN, 2015). In South Africa, which is a water scarce country, the Department of Water Affairs has the key responsibility for managing South Africa’s water resources. However, other departments such as the Department of Environmental Affairs share responsibilities that relate to water resources management in South Africa. The key legislation governing water resources management is the National Water Act (No. 36 of 1998) which states that water is recognised as a scarce and unevenly distributed natural resource, which forms part of an inter-dependant cycle. Furthermore there exists a need for integrated, sustainable management of this commodity and its resources and systems, which is inclusive and beneficial to all users. The National Water Resources Strategy (2013), shares this sentiment as its vision is sustainable, equitable and secure water for a better life and environment for all. However in order to achieve these goals, adequately trained professionals are required.



Within recent years hydrology, and associated studies, have gained increasing importance, as the preservation of water and catchment areas are identified as major contributors to not only the agricultural sector, but to the basic functioning of South Africa as a whole (Ellery, Personal communication, 2014). Resulting from encroachment, system interference, mismanagement and inadequate preservation, the freshwater aquatic systems face a myriad of ongoing challenges. It is for these pressing economic and ecologically linked challenges and issues, that the handling and monitoring of this precious commodity needs to be conducted by specialists who understand the interlinking systems and overall dynamics. Systems such as; floodplains, fluvial and riparian zones and wetlands, are key elements to the functioning of the intricate and fragile aquatic system. In this study, I, as the researcher chose to investigate individuals who are focussing on wetlands and the broader freshwater ecology system since they have been identified as a scarce skill as reported on in section 2.3.1.

To understand the work of wetland ecologists it is necessary to understand the dynamics and importance of South Africa's wetlands. Wetlands serve several important functions, namely, ecological, agricultural and economic.

The ecological functions include the purification and filtration of water from riparian systems, as the flora present within a wetland system contains specific plant life which is able to cleanse and rid water of excessive nutrients and toxins. The breeding grounds and nursery areas of many of South Africa's aquatic micro fauna, avifauna and fish and additionally, wetlands and the biodiversity they harbour are recognised as bio-indicators, whereby the health of a riparian system can be monitored through the health of a wetland system (Barnes, 2013). Often local communities rely on wetlands and riparian systems for agricultural and subsistence farming, drawing water for crops and livestock purposes.

Lastly, as wetland and riparian systems contribute to the economy of the country through both ecological and agricultural means mentioned above, the careful monitoring and integrated management of these systems is imperative (Ellery, Personal communication, 2014; Kotze, Personal communication, 2014).

South Africa is a signatory to the RAMSAR convention which is a key international agreement to further the aims of wetland management. The RAMSAR convention of 1975 established an international framework for managing wetlands of international importance and also drew attention to the need for wetland management to preserve waterfowl habitat.

South Africa signed the convention in 1975 and in doing so became the fifth contracting party to the convention. Through this convention an international treaty for the sustainable utilisation of wetlands, whilst recognising their fundamental ecological functions, including economic and cultural value was put into effect. As a result of this convention, all wetlands are to be listed, classified through key criteria and managed to ensure their wise use, adequate monitoring and management (Cowan & Van Riet, 1998).

Furthermore, freshwater ecosystems and wetlands around the globe are strictly protected by copious legislative literature and laws governing their preservation and adequate management by capable and competent professionals (Ellery, Personal communication, 2014; Kiburz, Personal communication 2014; Lindley, personal communication, 2014). The jobs related to the protection of wetlands are imperative and often are interlinked with companies wanting to conduct Environmental Impact Assessments in the effort to scoping potential for new structural developments in wetland areas.

A wetland ecologist is one of the professions associated with the broad vocation of freshwater ecology. Although still a relatively recent profession, it is considered exceptionally important for water and catchment management. The profession is constantly being updated and displays dynamic properties in relation to the demands of the sector (Barnes, Personal communication, 2013). A deep understanding of wetlands and freshwater systems at a foundational level, focussing on their evolution, the effects of natural erosion and degradation and impact of anthropogenic influences on the slope, area and erosion, is vital for any credible wetland or freshwater ecologist (Ellery, 2014).

The lack of suitably qualified freshwater and wetland ecologists has led to this profession being classified as an absolute scarce skill. It is seen to be a high migratory skill (see section 2.3.2.1 above), and often graduates move into the private sector and general environmental impact arenas, more specially environmental management consultancies<sup>2</sup>, resulting in vacant positions at Governmental level. Additionally, the trend exists of appointing less qualified people than the required skill levels in order to fill transformation quotas, or the qualified scientists are being promoted to management positions (Rosenberg, Personal communication, 2013; South Africa. Department of Environmental Affairs, 2010. The DEA's (2010) study

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<sup>2</sup>I experienced this upon identifying individuals to incorporate into my study and for this reason, I had to broaden my focus to include freshwater ecologists, and not only wetland ecologists as initially intended.

on skills in the environment sector, and the HSRC (2009) study on the biodiversity sector, showed that there was more than one factor shaping scarcity, hence the need for more in-depth understanding of the occupations, and the classification of a scarce skill area, as argued in section 2.3.2 above.

Individuals initially train as ecologists and in their postgraduate years they can make the decision to specialise in freshwater ecology. However they frequently do not use these skills in practice due to the labour market context as noted above (SA.DEA,2010), the detail of which is explained in Chapter Five in the case studies of freshwater ecology graduates.

## **2.4 THEORETICAL FRAMEWORKS FOR RESEARCHING SUPPLY AND DEMAND OF SCARCE SKILLS**

In this section the theoretical frameworks employed in the study are introduced and explained. The area of supply and demand of scarce skills is quite complex as there are multiple factors that affect supply and demand. As noted above in section 2.3.1, simply quantifying supply (i.e. how many wildlife veterinarians qualify) and demand (i.e. and how many wildlife veterinarians obtain work placements) only presents a very narrow unsophisticated view of supply and demand. Issues of transition from study to work are also important, and these potentially provide insight into issues of supply and demand. In this study, which is a qualitative analysis of factors influencing supply and demand, I concentrate on the concept of transitioning to develop a more detailed and in-depth understanding of the problem.

However, transition theory is described as a ‘middle range’ theory which is specific for analysing changes within settings for example, of study to work, or from school to study. It does not necessarily provide an in-depth understanding of how such movements are influenced. Hence, in this study I have also worked with the Bronfenbrenner’s human ecological systems theory (Bronfenbrenner, 1979) and a critical realist underlabouring (especially the concept of emergence) (Archer et al., 1998) to provide a more powerful language of description for the transitions, and for explaining the factors influencing supply and demand.

Critical realism is employed to a lesser degree in the data analysis. However, critical realism is used as an explanatory tool as it provides answers to the question ‘what must reality be like to make X possible?’ recognising reality to be emergent in open systems (Danermark,

Ekstrom, Jakobsen & Karlsson, 2002), hence an introduction to critical realism is given in section 2.5 and as methodological tool and the practical application is explained in section 3.3 (the methodology chapter).

Firstly I explain the rationale for the utilisation of the transition theory from a macro perspective, secondly, the intellectual background to transition theory is provided with emphasis placed on the principles of the human ecological system. Thirdly, the scope of transitions is described and fourthly the utilisation of transition theory as a lens to understanding the scarce skills within the context of the South African biodiversity sector is detailed. Lastly the limitations of transition theory are discussed.

#### **2.4.1 Transition theory rationale**

At a global level, South Africa's recent emergence from a previously brown economy, and steady transition into a green economy (see section 2.2.2, above), has been spurred on by several key factors; firstly, the response to the long-wave theory typical of global economies reacting to critical economic milestones, and secondly the recognition and ownership of the plethora of factors from an unstable past, which have contributed to direly unsustainable practices and exploitation of natural resources (see section 2.2.2; Swilling, 2013). This has led to the need for an incorporation of new ideas and creative action necessary for countering the historical conditions (e.g. environmental policy making; introduction of sustainability practices into workplaces; landscape and environmental management practices etc.), with the aim of benefitting future generations and the sustainability of the country as a whole. Like any transitional period this comes with a unique set of turbulent factors adding to the shaping and development of the new green economy and those involved in it. The process of this transition is not a smooth pathway from one point to another, but is, instead a gradual process which involves encounters and unfamiliar territory both for the economy; and as described later in this section, for individuals that are actors within this social-ecological and social-economic context.

The trends and flux of the global economy, the current local labour market, and governmental decisions greatly affect and influence the demand for and ultimately supply of graduates to the workforce (Maia & Giordano, 2011). This transition to a green economy entails matching the needs of this new green economy with fulfilling the requirement of specially trained

individuals who are required to occupy newly developed positions and/or change their practices to be more sustainability oriented (Borel-Saladin & Turok, 2013).

These local and global trends can affect the availability and stability of jobs as well as the focus of the curricula that train individuals to match the demands of these jobs (Fenwick, 2013; Lampila & Stenstrom, 2012; Sawchuk & Taylor, 2010). This adds to the scarcity of certain skills and skilled individuals and ultimately affects the supply of and demand for these individuals in the workforce (ibid).

Current employees and new entrants into the post modernist workforce face a plethora of challenges and demands on a daily basis. These include the constantly increasing spectrum of technological advancements and communications, and requirements from employers that new employees enter the workforce equipped with relevant skill sets, capable of sustaining an optimum working rate (Ingram et al., 2009). This adds stress to an already tense period in a young professional's career trajectory. Apart from the pressures listed above, are new and emerging pressures, mainly the influential chronosystemic event of the global recession (Ecclestone, 2009). This is coupled with particularly difficult financial periods which affect job availability, contributing to external pressures a recent graduate will encounter. For example, in Europe in mid 2012 the unemployment statistic rose to more than 25 million, approximately 10 % of the European population (Bonneau, Jurado, McConville, Rayment, & Tucker, 2012). South Africa, as a developing country, two decades into its democracy, continues to be one of the countries with the highest unemployment rate of 25.2% (Borel-Saladin & Turok, 2013). The high unemployment rate in South Africa is attributable to the previous government's policies of apartheid, the current education system which still delivers poor quality education for the majority of children, and a lack of focus on the transition between school, higher education institutes, and workplaces (Kraak, 2009).

This period in South Africa is identified as a transition period, both from a political-social perspective, as well as a social-ecological perspective (Swilling, 2013). Although transitions are commonplace throughout life, much of the available literature purports these phenomena as particularly stressful and risk filled eras (Ecclestone et al., 2009; Fenwick, 2013; Hannan, Raffe, & Smyth, 2008; Raffe, 2008).

Added to this are the transitions that individuals need to make between home and school, school and higher education, higher education and workplace or directly from school to work.

There is an emerging body of literature that explains and describes such transitions. In this study the focus is positioned on the transition between higher education and work in the case of two scarce skills in the biodiversity sector. However, literature covers a wide range of transitions, although gaps appear in this literature too. In this study as the researcher, I have found literature based specifically on transitions in a professional's life interesting, as this literature seeks to describe how to predict these transitions, and how to prepare one to enter these so called stress filled regions (Ecclestone et al., 2009; Fenwick, 2013). The definition of transition is provided in section 2.4.2 below.

#### **2.4.2 Introduction to transition theory**

A transition is understood not to be a movement, but an alteration from one context to another, also understood to be "... any form of event or non event that leads to changes in routine, assumption, roles or relationship" (Meyer, 2013). Transition indicates shifts in the agency and identity of an individual as they progress through an education system or learning process. Lam and Pollard (cited in Ecclestone et al., 2009, p. 11), add to this understanding by stating that a transition involves: "A personal transition between two states of being, the before and after of specified learning experiences". This perspective on transitions proposes that people are faced with and embark upon cultural and societal transitions on an individual level as well as within a collective, in response to broader contexts of structural change and or opportunities in the work place or in work structures (Ecclestone et al., 2009; Fenwick, 2013). The literature shows evidence that transitions are areas in which turning points or milestones or life events are combined through complex processes, whereupon an individual "becomes somebody" in a personal, educational or professional capacity.

In this research such transitions have been investigated, namely: the transition of a specific scarce skilled individual from a higher education institute to a place of work, with emphasis placed on identifying the constraining and enabling factors, which ultimately attributes causality to the success or failure of the transition. Transitions are understood to be identified via events which can be anticipated (i.e. an event which is expected to occur such as graduating from a degree programme) or unanticipated (i.e. an event which is often unexpected and can result in transition e.g. getting 'landed' a job) and / or via non events (Fenwick, 2013). Such events are described in more detail:

- **Personal-** an event or occurrence which is expected to have happened yet does not.

- **Resultant**- an event which then leads to a non event i.e.: an individual gets accepted to a university, but as a result of finances is unable to finish their course and therefore does not go into the field of work they were being educated for.
- **Delayed**- an event which still may or may not happen.
- **Ripple**- unfulfilled events occur to an individual which then directly affects another person, such as a person's parents losing their job which then directly affects the individual's choice of tertiary education institution. (Lampila & Stenstrom, 2012)

Furthermore, Raffae, (2008) suggests a framework which posits transitions into typologies, of which there are four types namely; 1) micro transitions, 2) macro transitions, 3) national transition patterns, as well as 4) institutional and structural dimensions of transition systems. Micro transitions focus on an individualistic level, where the specific transition and the factors affecting and influencing an individual are investigated. However, this cannot be separated from macro transitions (as mentioned in section 2.4.1). At macro system - level two level of transition- according to Raffae (2008), national views on transition and to a degree, level three transitions, institutional and structural dimensions of transition systems are investigations of transitions from a wider perspective (Raffae, 2008). In this research transitions are approached from a micro perspective, in that the research was conducted mainly on an individualistic level. This is achieved through two of the data generation methods, namely: semi structured interviews and field observations (details of which are reported on in Chapters Four and Five). However, this research will contribute knowledge to the macro systemic perspective, providing detail pertaining to reoccurring factors prevalent throughout the participants transitions, which in turn may be considered relevant to additional individuals in the two scarce skills areas, and potentially also within the greater biodiversity sector (reported on in Chapter Six). However, to make the link between the micro and the macro, there is need for a systemic theory that can facilitate such an analysis.

### **2.4.3 Intellectual background of transition theory**

The primary principles of transition theory are rooted in aspects of lifelong learning and Bronfenbrenner's (1979) ecological (model) principles. Bronfenbrenner's ecological model is not unlike the stratified ontology of the basic critical realism framework of Bhaskar, in that Bronfenbrenner explains that an individual's experiences are influenced by five environmental layers within an inter-related system. Bhaskar (1998) proposes a 'stratified ontology' within an open system in which emergence occurs (see section 2.5.2.5 below); with

Bhaskar's work giving greater attention to the existence of a reality outside of our knowing it than Bronfenbrenner's model does.

In the Bronfenbrenner (1979) model the roles of individuals and settings within each system are particular to, and change according to the involvement of the individual within the specific system being investigated. This model is useful for transitions research as it identifies five inter-related ecosystems as:

#### Lower order systems:

The lower order systems of micro, meso and exo, tend to possess similarities across studied groups, characterising ethnic groups, social classes and religious groups. As a result these systems may be distinctly different between different social groups. Through the comparison of the lower order systems, it then becomes possible to describe systematically the ecological properties of these larger social contexts as suitable environments for human development and transition.

**Microsystem**, the family, religion, institutions and neighbourhood, all affecting the individual, their role and the setting in which they are active. A setting is defined as a place, in this study examples of a setting could be, home, university, workplace. The setting is comprised of three key elements; **role**, that which an individual undertakes and in a specific setting, often dictates or determines how an individual is expected to behave or act, and the **activities** they conduct affects their **relationship** with those within their microsystem. The elements of role, activity and relationship are subject to change in the incident of an ecological transition.

The **Mesosystem**, which relates to the interconnections between the microsystems and settings of an individual.

The **Exosystem**, the links between a social setting in which the individual does not have a direct role, but is nonetheless affected by the macrosystem.

#### Higher order systems

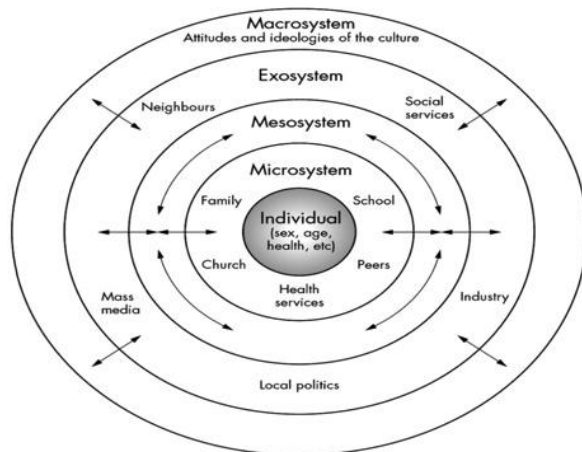
The **Macrosystem**, the overarching complex nested interconnected systems including ideologies of the particular cultural or ethnocentric group to which the individual belongs, this is moulded and developed over time as each successive generation may alter the



Macrosystem. Within a specific society or social group, the structure and make-up of the group defines their specific macrosystem.

The **Chronosystem**- the patterning and fashioning of environmental events and transitions over a period of the life course, which further includes the socio-historical circumstances such as feminine rights and racial inclusion. The diagram 1, below depicts the human ecological system proposed by Bronfenbrenner (1979).

Diagram 1. Bronfenbrenner's Ecological Systems Model (Adapted from Bronfenbrenner 1979, pp. 6-7)



Bronfenbrenner explains an ecological transition as a process occurring across the aforementioned systems and whenever an individual's position in the ecological environment is altered, it will invariably involve a change in setting or role or both. He goes on to state that roles possess, "emergent" properties, which have the power to alter the treatment and how they think, feel and act.

An example of an ecological transition, would be the progression of a freshwater ecologist, from the role of a young graduate of a specific higher education institution, who applies for a job as a junior freshwater ecologist at a local environmental consulting firm. Upon taking up the job he/she experiences changes in role, now as a junior employee, relationship, he is now understood as a junior member and thus the activities he conducts will be suited to his experience and education.

Transition theory emphasises events and experiences and at times explains structures and mechanisms shaping experiences and events. Transition theory is identified as a relatively contemporary theory (Lampila & Stenstrom, 2012, citing Teichler, 2002). It has been in existence since the latter part of the 20<sup>th</sup> century and is gaining ground in the early 21<sup>st</sup>

century, due mainly to the expansion of interest in lifelong learning (ibid). Furthermore, interest in transitions can be identified from across a wide variety of fields (Ecclestone et al., 2009; Fenwick, 2013; Kilminster & Birbeck, 2012).

Theoretical traditions ranging from social capital, to developmental psychology have been utilised to study transitions, each allowing for differing perspectives and constructs, but all positioning transition in a specific manner that can give rise to assumptions about the nature of practice, knowing and change. According to Ecclestone et al. (2009) and Fenwick (2013), research on transitions is based on three specific fields of research namely: Psychology, Life Course studies and Career studies.

**Psychology:** Emphasises individuals responses to changes in their lives (Ecclestone et al., 2009 ; Ingram, Field et al, 2009).

**Life Course Studies:** Emphasises the manner in which individuals encounter and progress through transitions, with particular reference to socio-cultural context and diversity (Pallas, 1993).

**Career Studies:** Transitions accompanying significant progressions from one career stage to the next, especially from school to work and also from practitioner to leader. A vast majority of these studies concentrate on the individual moving from one institution or sphere of activities to the next, often largely assuming that these passages or movements are risk filled and stressful (Ecclestone et al., 2009; Fenwick, 2013).

#### **2.4.4 The roles of Agency, Identity and Structure in transitions**

Furthermore, transitions have also become the focus of political, academic and practical interests, however this being said, these are underpinned by both explicit and implicit perspectives on the emphasis of agency, identity and the effect of structure. For example: strands of life course studies convey an institutional or context specific view of transitions and how these ought to be predicted, managed, eased or even lessened. The political role campaigns about and emphasises transitions in education, especially in the European context, and has been extensively researched Ecclestone et al, (2009).

**Agency:** Agency is broadly defined as the interactions an individual has with material conditions and other individuals, which can help shape their destinies, individually or as a

collective, and is reliant on self-efficacy, self determination and the platforms upon which to act autonomously. Life course research proposes agency to be the way in which individuals progress through transitions, through the choices they make and actions they take, bearing in mind the opportunities and constraints at a historical and social level which ultimately also contribute to the construction of the individual's life course. Thus, in order to understand agency fully within various differing contexts of transitioning, it is necessary to consider the dynamic interplay between structural influences from the past on an individual's agency or ability to act and make choices along a pathway. Ecclestone et al. (2009, cites Tedder & Biesta, 2007), saying that:

The temporally constructed engagement of actors of different structural environments- the temporal relational contexts of action, through which, the interplay of imagination, habit and judgement, produces and transforms those structures in interactive responses to the problems caused by changing historical situations .(p.16)

**Identity:** Identity can be understood as the ways in which the individual self is represented and understood, in different, multifaceted and developing ways, the ways in which the personal, social and cultural meet (Ecclestone et al., 2009)

**Structure:** Structural factors, such as gender, race, economic and occupational conditions, education institutions, are determining factors, which influence the identity and agency of individuals. According to (Ecclestone et al., 2009), researchers involved in transitional research state that it is exceptionally difficult to divorce agency and identity factors from that of structure when trying to gain a deeper understanding of how these have been affected, shaped and determined by structural aspects. And although all these elements are inextricably linked, researchers study transitions in different ways with various resulting emphases.

Working with the Bronfenbrenner model (1979), and with Bhaskar's stratified ontological perspective and his theory of emergence, will allow me to consider how structural factors shape agentive actions and identity formation in the context of the two scarce skills that are the focus of this study (see Chapters Four, Five and Six).

The theoretical focus developed within this study is important to respond to the problem in transitions research raised by Ecclestone (2009). She suggests that a reason for the limited literature and in-depth understanding pertaining to transitions, could be attributed to the excessive emphasis being placed on identity and agency over structures in transitions research, which would potentially shift the discourse away from relying too heavily on the

individual agent to manage the whole transition process ‘alone’, to placing more focus on easing the process of transitions via structural interventions and mechanisms.

Allais & Nathan, (2012) concur with Ecclestone, by stating that in the South African context a large amount of transitions literature reporting on transition outcomes, is largely centred on the broad individualistic choices with the focus and less on the structural, socio- economic factors that influence and shape individual decisions. Allais and Nathan (2012) continue to say that the latter issues should be incorporated into the structuring of transition frameworks, to better understand why and how transitions fail.

#### **2.4.5 Transition theory as a lens to understand the development of scarce skills in the South African biodiversity sector**

A number of career based studies have challenged the depiction of transition as being a change brought on by a navigation of institutional norms and structures, and rather focus on the being and becoming of the individual (Allais & Nathan, 2012; Ecclestone, 2009). These same studies highlight the manner in which people embark upon and make social and cultural transitions as individuals and as a collective, in response to the broader context of structural change, for example: opportunities within the labour market or even changes within the work structures or specific organisations. Cleary and Gallacher (2007), define a transition as a personal transition between two states of being, the before and after of specified learning experiences.

According to Allais and Nathan (2012) although transitions (Higher Education Institute to workplace) in the South African context, have been widely researched, much literature is situated around the decisions that an individual makes and not enough emphasis is placed on the socio-economic issues and structural constraints affecting transitions. These, they state, are downplayed and are not explicitly defined in the overall understanding of the success or failure of the said transitions. This presents as an important caveat for working with transition theory in South Africa, and has shaped the theoretical tools and frameworks used for analysis and interpretation in this study (see Chapter Six). As the researcher, I have therefore sought to consider some of the wider structural issues shape the scarce skills landscape in the biodiversity sector, such as policy and legislation, trends in the economy (e.g. unemployment), loss of biodiversity, changes in curricula (see sections 2.2.4 above, and also Chapter Four, Five and Six). However, as Bhaskar (1998) argues, people do have agency, and this is exercised in the pre-existing context of structural influences, however people do

possess abilities to change structural conditions. This normally takes place over time. Thus it is also important to consider individual agency and identity in transitions research.

In this specific research, the emergence of scarce skills in the biodiversity sector, as explained in section 2.3 above, are and have largely been a result of both individual and structural factors such as individual choices to pursue the specific career paths, the recent emphasis on the green economy from a governmental perspective, and lastly the biodiversity sector's need for these specific specialists. More insights on these interacting factors are offered in Chapter Four, Five and Six respectively. However the actual structures and mechanisms which allow for a skilled graduated to pursue their career trajectory, such as opportunities to gain workplace experience, networking platforms and internships, tend to be overlooked and some universities are unable to keep track record of the specific fields in which their graduates enter, due to capacity and logistical reasons (Barnes, Personal communication, 2013; Burroughs, Personal communication, 2014; Esler, Personal communication, 2014; Lindley, Personal communication, 2014). As a result little to no information is freely available to track the entrance of graduates into these scarce skill fields, and it is therefore not easy to capture the structure-agency factors shaping transitioning into these occupations.

#### **2.4.6 Limitations or critiques of transition theory**

As with any theory, criticisms and critiques add valuable contributions and insights into deepening the understanding, refinement and application of the theory. This also helps the researcher adopt a less biased approach to applying and utilising the theory. For the purpose of this section, various authors were drawn upon to obtain a well rounded perspective on the criticisms levelled at transition theory. As is alluded to in section 2.4.2, the three major approaches to research on transitions were kept in mind when gathering information.

I start out by considering the first of the common themes pertaining to transitions, namely the stress and risk associated with transitions. Much of the literature pertaining to transitions frames this as being a negative, risk and stress filled period in any individual's life; rather than a natural anthropogenic process, occurring periodically throughout an individual's life, in which lifelong lessons can be learnt, (Candy & Crebert, 1991). This is a result of placing the emphasis on agency and identity over structure. In addition, limited knowledge is understood about the structures and mechanisms in place which enable transitions to occur.

Fenwick (2013) highlights two additional areas in which transitions research is limited. Firstly the educational perspective on transitions focuses too heavily on the success of the transition and methods in which to ease and pacify these “natural anthropogenic occurrences” (p. 2). Secondly, this then leads to the deconstruction of the complexity and the compression of the challenges associated with and brought on by transitions. Sawchuck and Taylor (2010, as cited by Fenwick, 2013), state that the depiction of the majority of adult transitions research reflects a reduction of social facts to economic dimensions and offers only a linear approach for interpretation, from juvenile to adult.

Leading on from this point, Fenwick states that transitions are often posited as linear progressions, in which an individual continues through life along a specific pathway or trajectory, thus excluding the effects of social forces on these transitions as they pertain to bringing forth the actual transition. Transitions then become milestones, turning points or even rites of passage in an individual’s journey.

In keeping with the view of transitions as linear trajectories, many studies conducted on school to work transitions are quantitative and are comprised of longitudinal, comparative analyses constructed via survey data. This research has generally been administered over a lengthy period in specific individual’s lives (Allias & Nathan, 2012; Ecclestone, 2009; Raffe, 2008). An example of this type of research is the Comparative Analysis of Transitions from Education to Work in Europe (CATEWE). The CATEWE Project involved the gathering of data on the aforementioned transition, from various European cities via survey data. Analysis involved identifying common trends, patterns and characteristics that were evident and which contributed to the shaping of transitions throughout the transition period.

Ecclestone et al. (2009, citing Baruch, 2004), state that contemporary models have emerged which deal with addressing the unpredictability and diversity of the developing work life, taking into account the external and internal changes influencing the individual. Much of the literature positioning transitions as a linear trajectory, highlights the ideas of “getting somewhere”, or becoming someone”, or even “moving through”, which highlights the fact that individuals are travelling through static spaces with the aim of becoming someone new on a specific journey. The problem arising from the “journey perspective” of transitions is that emphasis is placed upon temporary transactional relations between individuals and various organisations, and not on multiple pathways.

Another perspective focuses on the success of a transition, which allows one to prepare to make this “leap” and in doing so, compresses and squashes the elements of the transition and pathologises the view of transitions, leading individuals into a sense of having to prepare for a daunting change (Ecclestone et al., 2009; Fenwick, 2013). Raffe (2008) states that although much of the literature on transitions can lay claim to the inclusion of theoretical, empirical, policy-laden achievements, the limitations to this research have been caused by data limitations and theoretical diversity or eclecticism. He suggests that the research should change to include transition frameworks in order to better understand and grasp the changes experienced by *transitions systems* and move away from viewing transitions as singular units of analysis.

By highlighting the limitations and criticisms of transitions research I sought to shed light on the various aspects of transition research in order to address some of its weaknesses. This is further reported in Chapter Six where the research is reflexively reviewed, and how, as the researcher, I worked with transitions theory in this research, informed by the Bronfenbrenner model, and Bhaskar’s critical realism, which is discussed in more detail below.

## **2.5. BASIC CRITICAL REALISM AS AN UNDERLABOURER TO THIS STUDY**

Critical realism is a philosophy which acts as a theoretical underlabourer, in that it supports complementary theories, and allows one to answer the following questions: “what is truth, what is reality and knowledge”(Elder-Vass, 2007, p. 229).

In this study basic critical realism supports the theory of transition in addition to the human ecological systems theory employed to address the research questions within the study’s analysis phase. In using critical realism as underlabourer for this study, I sought to identify casual mechanisms, structures and emergent properties, to counter the over-emphasis on the individual narrative and identity (as this is noted above as being a weakness of transitions research).

### **2.5.1 The core tenets of basic critical realism**

Danermark et al. (2002) suggest that critical realism can be understood as a means of investigation and identification of relationships and non-relationships, respectively, between what we experience, what actually happens, and the underlying mechanisms producing events in the world. Critical realism is applicable to, and supports both natural and social

sciences research, clearing a philosophical path and in doing so, allowing for the analysis of stratified and depth ontology.

In the 1970's Roy Bhaskar, the founder of critical realism, expressed concern about the ways in which positivist scientists confirmed that all they saw or experienced within their experiments was all the reality there actually was. In doing so, they had been collapsing actual events into the real, their positions became actualist. An example of this problem would be if one were to interpret the appointment of a wildlife vet to a new game farm as 'the real', when in fact there are other causal mechanisms at play which are also 'real', such as the revised drug laws governing the usage and handling of medicines related to the darting and capture of wild animals. Influencing this law and its management, is the tendency to buy and sell wildlife which has its roots in capitalist economic frameworks in which wildlife has been turned into a commodity. Thus explaining the wildlife vet's appointment requires a depth ontological explanation if one were to avoid actualism.

Bhaskar countered the tendency towards the 'fallacy of actualism' through stating that the world, and therefore reality, consists of generative mechanisms that lead to events and actual experiences (Bhaskar, 1975; Danermark et al., 2002), as shown in the example above (i.e. it is the commodification of wildlife that is partially causal in the event of the vet's job). Bhaskar, 1975, (as cited by (Harvey, 2002)), stated that the scientific world is comprised of a plurality of entities that are ontologically stratified and have non-linear relations and are themselves irreducible to one another.

Critical realists make three specific commitments when looking at reality, namely: ontological realism, judgmental rationality and epistemic relativism. Ontological realism states that, the world exists independent of humans and thus human knowledge of the world does not equate to the world, we cannot reduce reality to knowledge alone about reality. Judgmental rationality maintains that humans are able to make judgements of part of reality and can make judgements about which specific understanding is dominant, however not all perspectives are equal. And lastly, epistemic relativism suggests that human judgements have been moulded by socio-historical and socio-cultural influences, and it is possible to construct knowledge *of* reality, but this does not mean that reality is socially constructed. Critical realism has a wide and complex array of theoretical tools that can be worked with in social



science research; in this study, however, I focus on the concepts of stratified ontology, emergence and open systems, not the other concepts. This is because they provide a better means of explanation for the emergence of, and structuring of transitions as experienced by individuals in the two scarce skill occupations under study.

### **2.5.2 Basic Critical Realism employed in this study**

Basic critical realism is based on three ontological arguments: stratified depth ontology, emergence, open and closed systems, as described below.

#### **2.5.2.1 Stratified Ontology:**

Danermark et al. (2002) cite Bhaskar (1978), stating that stratified ontology, serves as an ontological map providing a detailed approach to understanding the various layers of reality. Bhaskar (1978, cited in Danermark et al., 2002) suggests that reality is divided into three layers, or domains; also referred to as strata. The three layers are defined as: the real, the actual and the empirical. Danermark et al. (2002) stress the importance of understanding the difference between the domains, as it allows one to argue that events may take place whether they are observed or not. The domain of the real is described by Sayer (2010) as one of the three layers of reality, of stratified ontology, which is comprised of structures and generative mechanisms and possess the potential to produce observable events that occur in the world (e.g. as in the case above, the tendency to commodify everything (including wildlife) produces the observable event of the vet getting a job on a game farm).

By way of another example; this study has been guided by the priority scarce skills list, the formulation of which was directed by research and input events from a variety of institutions as stated in Chapters One and Two. What should be understood, however, from a critical realist perspective, is that the possibility of these skills being identified as scarce skills, exists within the domain of the real, and is related to generative causal mechanisms that are pertinent to the needs for conservation and management of the social-ecological system. As such, the scarce skills focussed on in this study have evolved through various needs and situations all of which are emergent from generative mechanisms and structures that can potentially be identified in the domain of the real through retroductive analysis (Danermark et al., 2002). (See Chapter Six).

Additionally, these mechanisms exist irrespective of whether they produce an event or not. For example, the tendency towards commodification *need not* produce wildlife farming or the events of major game auctions; however, the mechanism of commodification still exists (activated or unactivated). Furthermore, should an event occur, this event will be understood to have been actualised and therefore occur within the domain of the actual, the second layer of reality. For example, the event of a wildlife auction would be a typical event found in the domain of the actual. And the witnessing or experience of this event by individuals is understood to exist within the domain of the empirical; here one could think of the wildlife vets present at the auction and how they experience it, or the wildlife farmers and how they experience the event. Table 2.1 provides an illustrated perspective of stratified ontology.

Table 2.1 – Bhaskar’s three domains: populating entities. Source: (Bhaskar, 1978, p. 13)

	Domain of the Real	Domain of the Actual	Domain of the Empirical
Mechanism	X		
Events	X	X	
Experiences	X	X	X

Possessing this understanding of stratified ontology has assisted me to understand the transitions and supply and demand issues pertaining to the two scarce skills under study. As a result, I have been able to apply this outlook to each of the cases, thus permitting a deeper understanding of emergence, which I found to be a critical aspect of the research, as it effectively describes the relations between a whole and its parts (see Chapter Six). Emergence is described in detail in section 2.5.2.5

### **2.5.2.2 Level abstracted thinking and retroduction:**

Elder-Vass (2007) refers to a ‘level-abstracted view’ in stratification (of ontology). A level-abstracted view is understood to be looking at a single part of a whole, that it, one dissects a single layer of reality to better understand it. In practice, this means that one analytically abstracts a level or stratum of the whole at one time to explore it and understand it. This links directly to Bhaskar’s point that when a stratum of reality (i.e. the experiences of the wildlife veterinarian) has been adequately described, it allows for the investigation of the mechanisms present at that level, and then to consider how these are causally shaped within an open system (Danermark et al., 2002).

Retroductive analysis is one of the four inference processes influencing the means by which an individual obtains knowledge through analysis of data. The retroductive analysis process begins to track, in reverse, from the domains of the empirical and the actual, to uncover the often intransitive, progressions and generative mechanisms at work, into the domain of the real. This enables a better understanding of the domain of the real and its influence on the domains of the actual and empirical. Retroductive thinking and the level abstracted view were employed when analysing questions about the experiences and factors shaping the transition of the two selected scarce skill occupations (see Chapter Six).

### **2.5.2.3 Intransitivity and transitivity**

Benton and Craib (2001) states that critical realism allows researchers to ask the question, “What must case A be like, in order for a particular outcome to occur?” Danermark et al. (2002, cite Bhaskar, 1978) and state that generative mechanisms are intransitive to humans. Meaning that the presence of humans is not necessary in order for the said mechanisms to occur or become actualised. The intransitive dimension is comprised of real things or entities and structures possessing their own powers and tendencies, and are as such, causally effective. In this research an example of intransitivity could be the social-economic mechanisms present within the macro system (e.g. the ‘economic downturn’), allowing for or disallowing the transition of the biodiversity graduates into a workplace.

### **2.5.2.4 Open and closed systems**

Bhaskar (1978, cited in Danermark et al, 2002), states that reality is differentiated between the presence of open and closed systems. A closed system is indicative of causes and effects observed in carefully controlled environments and can be likened to a sterile and controlled environment, such as an experiment within a laboratory. Open systems are identified as a series of mechanisms operating collectively outside of a controlled environment, which give rise to a series of events and can lead to diverse outcomes. Such an example in the study could be the advent of the green economy, which has been created by a need to mitigate environmental issues and meet poverty alleviation, thus leading to the construction of new and emerging green focussed jobs, as well as a need for these jobs to be fulfilled.

#### **2.5.2.5 Emergence and emergent properties**

Another critical realist concept pertinent to this study is emergence. From the prior explanation on stratified ontology, one can begin to understand the basic principles of emergence. The most basic element of emergent ontology, emergence, pertains to entities. An entity is an object, comprised of many parts, which together may possess causal powers, the ability to have a causal effect on the world (Elder-Vass, 2007).

Casual powers are tantamount to emergent properties. Emergent properties can be explained by causal mechanisms, which are processes dependent of interactions between the many parts of an entity, when organised in a particular, significant manner can able to react, resulting in the process of emergence. However, the parts are unable to act independently and alone will not result in the process of emergence. Elder-Vass, (2005) states that a whole, together with its collective parts, in a synchronous relationship, possesses emergent properties and therefore results in the process of emergence and can henceforth create an observable change. Although, in order to actualise this, the parts need to be in relation to one another, an example of which is, a young graduate studying and obtaining a number of qualifications with arbitrary skills, which essentially could do little to allow for the progression of the individual from university to workplace, or into a specific field. However, when an individual applies to study a specific course, with strategic outcomes, coupled with self determination to pursue experience in the specific field, this could allow for the student to gain valuable insight and feel confident to apply for positions and opportunities which might result in the student gaining access to the workplace. Conversely, the opposite could occur, the student having studied an unrelated course and possessing a number or arbitrary qualifications and experience in another field, although of significance to the individual would be understood to be identified as a “heap”, parts in a whole, which do not work in sync and thus have properties of their own and do not result in emergence.

Furthermore, within stratified ontology, one can observe the domain of the real, via retroduction from the domain of the empirical and actual. Through this, it is possible to identify what has emerged as a result of particular causal mechanisms and structures becoming actualised, where transivity is apparent (Sayer, 2010). Such explanations are also fallible, as humans exist in open systems (Sayer, 2010) and this calls for researcher reflexivity.

### **2.5.3 Transition theory and critical realism in the study**

Bhaskar's (1975) basic critical realism, its stratified ontology, is not dissimilar to the ecological model of Bronfenbrenner (1979), in that structures and mechanisms are present within the domains of reality. Furthermore within the ecological systems model of Bronfenbrenner, these affect and shape an individual's development and their overall transition as a result of the presence of internal and external sources particular to a setting, a role or a relationship. Furthermore, an individual's development has and can be affected through the dynamic interplay of external and internal settings, roles and relationships existent within the domain of the real, where causal mechanisms and structures reside, until actualised, resulting in the encounters and reality that the said individuals experience and recall.

From the perspective of Bronfenbrenner's (1979) ecological systems model, for example, individual's career decisions are influenced by their foundational microsystemic elements: family, schooling, peers, which helped to guide and support the individual throughout their lifetime and the mesosystemic relationships existing between the various microsystems as shown in Diagram 1, as above. Any present exosystemic factors, in which the individual is not immediately involved, may however directly affect the individual, as do external macrosystemic elements such as the attitudes and culture of a society, all of which has occurred throughout time or within a specific event present in the particular chronosystem.

## **2.6 CONCLUSION**

The purpose of this chapter has been to provide an overview of the literature and theoretical frameworks that are pertinent to the study. This has included the review of pivotal documentation relevant to the South African environmental and biodiversity sectors, highlighting key areas of concern including the need to address biodiversity issues in line with the development of the South African green economy, and the shortcomings of research pertaining to knowledge of green skills at a national level. Additionally the chapter provided some insight into the two scarce skills being investigated in the study, namely the scarce skills of wildlife veterinarian and freshwater ecologist.

Lastly, the chapter provided insight into the theoretical perspectives used for the research, namely transition theory, which was traced to the historical aspects and the key theorists informing this theory, namely Bronfenbrenner's (1979) human ecological systems model.

The chapter also reviewed some of the limitations of transition theory research, and indicated that there is need to take a more robust account of structural factors shaping transitions. A critical realist underlabouring perspective has helped to provide tools to address this need (see also Chapter Six).

In conclusion, this chapter has provided insight into the context in which the study is situated, as well as the theoretical framework, which has guided this study. In the next chapter I discuss the methods and methodology of the study.

## **Chapter 3: Methodology and Methods**

### **3.1 INTRODUCTION AND CHAPTER OVERVIEW**

This chapter provides a description of the research process and the methods utilised to investigate the two research questions and five sub-questions:

1. How do enabling or constraining factors influence the transition of scarce skill biodiversity professionals from a higher education institute to the workplace?
2. How does this affect the supply and demand dynamics associated with the scarce skills within the biodiversity sector?

#### Sub-questions

1. What demand-side practices influence the scarcity (relative or absolute) of wildlife veterinarians and freshwater ecologists?
2. To what extent do the higher education institutions' curricula for the specified scarce skill occupations reflect and respond to demand-side critical skills?
3. How are the scarce-skilled graduates' individual transitions between the higher education institutes and workplace affected by enabling and constraining factors?
4. What factors enable the supply of wildlife veterinarian and freshwater ecologist scarce skills in the biodiversity sector?
5. What factors constrain the supply of wildlife veterinarian and freshwater ecologist scarce skills in the biodiversity sector?

The chapter begins with an overview of qualitative research, after which the case study methodology employed in the study is explained and justified, with reference to the research questions set out above. This is followed by an account of critical realism from a methodological perspective. Details of the two case studies are provided, before I describe the data generation methods used and the processes of data analysis. The chapter includes a discussion on validity and ethics, and the methodological limitations experienced in the course of the study.

## **3.2 RESEARCH DESIGN AND METHODOLOGY**

### **3.2.1 Qualitative study**

This is a study in the field of the social sciences, a range of disciplines known for producing both qualitative, descriptive studies, and quantitative, statistical studies. This study utilises a qualitative research methodology with a critical realist emphasis in order to unlock a new understanding and interpretation of the complex interactions between social structures. Because these complex processes are approached from the perspective of the individuals involved and their understanding of their experiences, a qualitative case study methodology is employed (Janse van Rensburg, 2001). The following section discusses case study methodology in more detail and provides further justification for its use in this study.

### **3.2.2 Case study approach and its employment in the study**

One of the key types of naturalistic inquiry is the case study, which allows a researcher to focus upon a specific phenomenon or entity, an individual, a group of individuals, a relationship or an organisation, in order to gain a better understanding of these phenomena (Flyvbjerg, 2006; , Yin, 1994). The benefit of a case study lies in its ability to investigate phenomena as they occur. The method requires diligence and reflexivity on the part of the researcher, because it is vulnerable to his or her bias and subjectivity. This is discussed in Section 3.9.1, along with other issues and limitations pertaining to case study methodology as experienced in this research.

Case studies allow for the illumination of events specific to a case or cases being investigated (Cohen, Manion, & Morrison, 2007), whilst providing for thick description of the studied event or phenomena. A thick description involves sharing the cultural framework of case study participants through richness and detail in the account. Thick descriptions are created from the accounts of individual participants, using their own language or words. This form of research enables the researcher to “deconstruct and then subsequently reconstruct” the area, issue or phenomenon being studied (Cohen et al., 2007).

This research employed nested case studies, a method that lent itself to thick data descriptions. Nested case studies are understood to be the investigation of cases within a wider case. The method allowed for the examination of a range of cases within the two main occupational cases researched, namely, wildlife veterinarians and freshwater ecologists. This form of case study was identified through and adopted from the example of Lotz-Sisitka and



Raven (2004), who used nested case studies in the Goldfields participatory course, to approach the complexities and contradictions of real-life relations and patterns in context, thereby emphasising context-dependant knowledge.

Baxter and Jack (2008) refer to three different types of case study: exploratory, explanatory and descriptive. Exploratory case study allows one to explore and investigate an unknown phenomenon, whilst explanatory case study affords one the opportunity to explain in depth a specific idea, phenomenon or practice. Lastly, descriptive case study research allows one to describe the phenomenon studied (Flyvbjerg, 2006; Hyett et al., 2014).

The case studies in this research are explanatory as they aim to investigate and account for the development of selected scarce skills in the context of the biodiversity sector. This approach complements the theoretical frameworks informing transitioning research, namely human ecological systems and the underlying postulates of basic critical realism. As reported in Section 2.5, the study is underpinned by critical realism and seeks to understand the causal mechanisms and structures which give rise to factors constraining or enabling the skills being recognised as scarce, thus providing “explanatory critique” (Sayer, 2010). Lotz-Sisitka and Raven (2004) cite Sturman (1994) in arguing that case study research should be an in-depth exploration of the parts of a whole and the patterns which emerge, which resonates with the critical realist process of emergence. As this study investigates the factors which constrain and enable young biodiversity professionals, the concept of emergence is utilised to shed light on these factors.

Data generation methods appropriate to the case study were used, including interviewing, document analysis and observation. In conceptualising the factors affecting the transition of young scarce-skilled biodiversity professionals, explicit attention to contextual detail was imperative. This included the context affecting which specific subjects were taught, which skills are gained through university study, and which factors are pushing these individuals into or away from the biodiversity workforce.

Yin (1994, as cited in Baxter and Jack, 2008) indicates that case studies are set in real life, and are particularly useful for the investigation of a phenomenon and its context when the boundaries between them are neither apparent or defined. The phenomenon or entity studied must be bounded in some way to prevent an excessive broadening or explosion of too much

information (Baxter & Jack, 2008). These boundaries can be determined by time and place, time and activity or definition and context.

In the present instance, the boundaries consist of context and definition. To be more specific, the study was bound by the scope of two defining factors: recently qualified individuals and relevant academic staff and students from the following institutions: Stellenbosch University, Rhodes University, and the University of Pretoria, also referred to as Onderstepoort.

In conclusion, the application of any method, namely in this instance case study, needs to be applicable to the situation, the problem faced and the particular set of circumstances.

### **3.3 RESEARCH ORIENTATION: AN ITERATIVE, THEORETICALLY INFORMED DATA GENERATION APPROACH**

In this study, basic critical realism provides the philosophical substructure for the theory of transition used to address the research questions. The theoretical framework enables the identification of causal mechanisms, structures and emergent properties; it also generates new knowledge pertaining to the scarcity of the two skills, as well as about the supply of and demand for them in the biodiversity workforce.

Critical realism suggests that the world exists independent of human consciousness and stratifies reality into three, interwoven strata: the real, the actual and the empirical. Each layer has its own distinctive characteristics, as described in Section 2.5.2.1. An example of stratified ontology within the study is to be found in the case study of Wildlife Veterinarians. To illustrate:

- *At the level of the real:* the presence of wildlife and the many unknown threats they can impose on upon the agricultural sector leading to or contributing to the emergence of:
- *Events at the level of the actual:* the establishment of the sector, and the development of a veterinary training institution in 1906, where preventative measures, such as disease control, diagnosis and treatment, could be developed and implemented. All of this has led to the subsequent development and focus of the veterinary curriculum to suit South African needs, and address other aspects of health; in turn leading to or contributing to the emergence of:

- *Experiences at the level of the empirical:* Here we find the experience of the veterinary students, the graduates, their lecturers, game farmers, conservation veterinarians as expressed in their storied realities.

Having an understanding of stratified ontology enabled me, as the researcher, to apply this outlook to each of the cases. This in turn allowed for the probing of the cases historically and socially, and the generation of data on the institutional contexts and events surrounding the experiences of the respondents. Furthermore, the principles of stratified ontology and emergence were applied within the analysis phase of the research, to uncover and identify the events and mechanisms which led to the experiences and overall shaping and development of the participants' transitions, as reported on in Chapter Six.

The usage of both retroductive thinking and emergence are detailed below and in more detail in Sections 2.5.2.2 and 2.5.2.5. Critical realism requires retroductive thinking, that is, the process of tracing mechanisms 'in reverse' from the domain of the empirical, through the domain of the actual, illuminating the often intransitive progressions and generative mechanisms at work, into the domain of the real. Bhaskar (1978) notes that all three levels are real, but the stratified ontology avoids conflation of the levels of the real into one. He suggests that such a differentiated approach to ontology allows for a greater understanding of the structures and mechanisms existent within domain of the real and their influence on the domains of the actual and empirical. It also allows for a differentiated epistemology (i.e. ways of knowing), which is most often expressed in the domain of the empirical. What people say about reality may not in fact be the full explanation of that reality. Bhaskar (1978) also points out that underlying mechanisms exist as tendencies that can be actualised in a particular empirical context or not.

Through the process of emergence, causal generative mechanisms and structures act as parts of a whole, affecting the transition of the young biodiversity professional. For example, as shown in the example used in Chapter Two, a tendency in human societies towards the commodification of life is influencing the transition of young biodiversity professionals (see Chapters Five and Six).

To illustrate the concept of emergence, an example from the study's subject matter is used. Emergence can be found in the threat of unknown transmission diseases that wildlife poses to the agricultural sector, which exists within the domain of the real. Yet these threats, identified as parts of a whole, cannot become emergent or actualised, unless there are specific conditions present which allow them to do so. Under these specific conditions the possibility of these diseases existing becomes actualised and experienced, and the diseases emerge. In response, the veterinarian profession has emerged in South Africa, and a curriculum module focussing on wildlife diseases has also emerged at Onderstepoort. Knowledge of these diseases would not be possessed by trained veterinarians, should the diseases not be offset by a specific set of conditions: that is, the knowledge and presence of the specified veterinarians is determined by interaction between the external factors that result in the diseases being experienced. See Chapter Six for further discussion on emergence as found in this study, pertaining as it does to the transitions of young biodiversity professionals.

In conclusion, the purpose of the usage of critical realism in this study was twofold, firstly to reveal the structures and mechanisms which resulted in emergent constraining and enabling factors; and secondly to provide insight into the reasons behind the scarcity of the skills as well as their supply and demand in the biodiversity workforce (see Chapter Six).

### **3.4 SELECTION OF CASE STUDIES**

As noted above, this research is framed as a qualitative, critical realist study in which a case study approach, focussing on a small group of individuals particular to the biodiversity sector, was utilised. As described in Section 3.2.2, case study research is defined and accentuated according to boundaries which narrow the scope of research and contain specific ideas or concepts, in order to retain focus on the phenomena being studied. In this instance the boundaries of the case study were as follows: research participants needed to be employed as specific scarce-skilled biodiversity professionals (wildlife veterinarians and freshwater ecologists), moreover recently qualified and/or new entrants to their specialisms in the biodiversity sector. This was in accordance with the Green Matter Priority Skills List (SANBI/Lewis Foundation, 2012), in which scarce and critical skills specific to the biodiversity sector are listed, and the Human Capital Development Strategy for the Biodiversity Sector (SANBI/Lewis) (see Section 2.2.4.1).

### **3.4.1 Selection of participants**

The selection of participants was based on a set of criteria aligned with the boundaries of the cases, in accordance with case study method literature (Bassey, 1999; Hsieh, 2006). The criteria for the selection of participants were clearly defined as:

- *For individuals in the workforce:* recent graduates from 0 years to 6 years since graduation. This boundary was in line with the curriculum refinements and changes, which according to personal communication with (Burroughs, 2014; Ellery, 2014; Esler, 2014; Kriek & Swan, 2009) are refined and or altered in four- to five-year cyclical periods in relation to new requirements as determined by the industry experts, policy and legislation.
- *For the curriculum advisors and/or lecturers approached:* a knowledge of and experience in the fields of scarce-skill, wildlife veterinary medicine and/or freshwater ecology; and finally,
- *For the students:* a knowledge of or interest in wildlife veterinary medicine or freshwater ecology.

To locate these individuals, the following strategies were used: approaches were made to selected universities that were known to offer degree and postgraduate programmes relevant to the two occupations (see below), and relevant forums (e.g. the wetland forums) both online and physical were accessed, as well as social media, especially LinkedIn. These strategies assisted in locating individuals who would match the criteria for respondent selection outlined above. The role, usage and inclusion of social media in the research, is illuminated in Section 3.5.2.2. As the researcher, I maintained ethical protocols by drafting and sending access letters to each of the universities in order to gain access to the university-situated participants. The established professionals were contacted directly and a letter of permission was sent, along with the ethical clearance letter. See appendices A, B and C respectively.

### **3.4.2 Universities particular to participants**

The initial search for respondents led me to the following four universities, where respondents relevant to the two occupational categories were identified. It was necessary to work with university lecturers and students because supply issues relating to the transition from university to work comprised a key focus area of the study.

### The University of Kwa-Zulu Natal:

The University of Kwa-Zulu Natal (UKZN) is one of the oldest universities in South Africa, with a history of graduates in the aquatic, in particular wetland, ecology fields, stemming from research programmes in its Geography and Ecology departments. UKZN has been recognised as a leader in the area of freshwater ecology and several young professionals (and hence potential participants in this study) had graduated there. However, with the recent merging of the two campuses, a number of the leading lecturers in the freshwater ecology field had left to take up posts at other higher education institutes. Nevertheless, several well-respected and established freshwater ecologists hailed from or were currently affiliated to UKZN. For these reasons, UKZN was the first higher education institution contacted when I embarked on the study, although research was not conducted at this specific university.

### The University of Stellenbosch:

Situated in the Western Cape, and hence within the Cape Floristic Region, Stellenbosch University is home to a variety of renowned environmental and biodiversity-related departments, one of which is the Department of Conservation Ecology and Entomology. This Department has produced some of the most influential South African ecologists to date, and allows students to specialise in various fields of ecology: terrestrial and aquatic, freshwater, wetland and riparian.

### Rhodes University:

Rhodes University is located in the Eastern Cape, within the ecotone of the Cape Floristic Region and is also well-known for environmental- and biodiversity-focussed faculties and departments. Owing to this and the presence of many well-established academics, the quality of environmental graduates is high and is recognised as such in the biodiversity sector. One of the prominent national wetland ecology lecturers previously at UKZN had relocated to Rhodes University, and he, with the collaboration of highly sought-after academics in the Departments of Environmental Sciences and Geography, supports specialist studies in ecological systems, or aquatic ecology. At postgraduate level scholars can specialise in freshwater ecology and wetland ecological systems and their management.

### University of Pretoria, Onderstepoort Veterinary Section:

The University of Pretoria is the only South African institution offering veterinary training. It is one of 46 African-based universities offering this training, 21 of which are situated in Sub-Saharan Africa. Furthermore, its veterinary institute, known as Onderstepoort, is globally recognised as a leading institution in a variety of veterinary specialisms, including that of wildlife veterinary medicine (Kriek & Swan, 2009).

Table 3.1, below, features a list of all of the key participants whose valued input was included in the study, along with their associated higher education institution and the unique index code assigned to each. In Chapters Four and Five, the individuals are referred to by their surname and title, whilst in Chapter Six they are referred to by their unique index code; this is because the analysis and discussion of the data covered both cases and this made identification easier for the reader. In total 21 interview respondents contributed to this study. I found it difficult to locate suitable individuals for the study, especially since I was looking for individuals in workplaces in the two occupations who had recently graduated. I was also looking for individuals were linked to the higher education institutions where I was generating data on the academic programmes. This was complex, due for example to the issue of university mergers noted above (e.g. I was able to find graduates from the UKZN in wetland ecology, but the university no longer offered the programmes due to the movement of academic staff). Not all universities kept records of their graduates' movements, and it was therefore not a simple matter to locate specific alumni. There is also movement amongst graduates. In the end a combination of strategies helped me to find enough suitable respondents for this study.

Table 3.1. List of Participants

<b>Index Code</b>	<b>Interviewee</b>	<b>Name</b>	<b>Site/ University</b>
FE/Int.13	Individual	Dr Simaika	Stellenbosch University
FE/Int.05	PhD / Individual Unemployed	Mrs Rebello	Stellenbosch University
FE/Int.12	Individual	Dr Reinecke	Southern Waters (Stellenbosch University)

FE/Int.04	Individual, PhD, No longer in pure wetland ecology	Dr Magoba	City of Cape Town(Stellenbosch University)
FE/Int.08	MSC	Mr Barrows	Stellenbosch University
FE/Int.10	Curriculum/ Lecturer	Prof Esler	Stellenbosch University
FE/Int.09	PhD Scholar	Ms Luvuno	Stellenbosch University
FE/Int.01	Individual 1	Ms Nhleko	Online (Rhodes University)
FE/Int.02	PhD	Mrs Joubert	SKYPE (Rhodes University)
FE/Int.03	MSC	Ms Dubazane	Howick (Rhodes University)
FE/Int.07a and 07b	Undergrad	Ms Schlegal and Ms Mgaba	Interview Schedule (Rhodes University)
FE/Int.11	Curriculum/ Lecturer	Prof Ellery	(Rhodes University)
WV/Int.1	Individual 1	Dr J Simmonds	Onderstepoort
WV/ Int2	Individual 2	Dr. D Pretorius	Motsumi wild (Onderstepoort)
WV/ Int3	Individual 3	Dr. J Roxborough	Onderstepoort
WV/ Int.4	Individual 4	Dr. D Breed	Cape Town Onderstepoort
	M. Med. Vet. /Postgraduate	Dr. J O Dell	Onderstepoort
WV/ Int.5	Undergrad	Focus Group	Onderstepoort
WV/ Int.6	Curriculum/ Lecturer	Prof	Onderstepoort
WV/ Int.7	Curriculum/ Lecturer	Prof M Kock (Wildlife Expert)	Onderstepoort
WV/ Int.8	Curriculum/ Lecturer	Dr Salt	Onderstepoort



The data generation process is described in more detail below.

### **3.5 METHODS OF DATA GENERATION**

#### **3.5.1 Overview of the data generation process**

Fieldwork was structured to begin at the universities from which the individuals had graduated, or at which they were currently studying. The first observation and interview was with WV/Int.01, Dr Simmonds, during April in Cape Town, after which interviews with staff and students at the University of Pretoria and the University of Stellenbosch were arranged.

As is the norm in case study research, multiple methods for data generation were used. During the entire research process, a total of 21 key interviews and four participant observations of wildlife veterinarians were conducted. Although observations of the freshwater ecologists were planned, difficulties were encountered in trying to achieve this, as is elaborated in 3.9.2. I also used focus group methods and social media research interactions as strategies in this research. I classified the following as primary methods of data generation: document analysis, interviews (semi-structured and focus group), and participant observations. Secondary methods included the employment of social media and an initial contextual profiling survey aimed at biodiversity professionals, which helped me to locate respondents.

#### **3.5.2 Primary methods of data generation**

##### **3.5.2.1 Document analysis**

Documents sought and obtained for this study ranged from course prospectuses to scarce skill advertisements, outlines of basic undergraduate curricula, and syllabuses for short courses aimed at continuous professional development.

Each document obtained was systematically logged for analysis within the relevant case study.

In the case of the wildlife veterinarians, of particular importance to the study was the prospectus of an elective course named ‘Wildlife, Ostriches and Crocodiles’ or the WOC610 course, appendix D [DWV/1]. This is the main wildlife veterinary course offered at Onderstepoort. Up to the present, it has in fact been the only taught wildlife segment within

the undergraduate curriculum. The course outline gave insight into the various components of the course, but did not offer much detail (see discussion on limitations in Section 3.9.3.1). Document D2, was an outline of the courses offered by the Centre for Wildlife Studies. Another three documents which provided insight into macrosystemic issues affecting wildlife veterinarians and the utilisation of dangerous drugs, as well as the congruent issue of the sudden growth in the game trading industry, are the following:

Document E: [ DWV 3]Newspaper Article: Breeders Sink Teeth into Profits: Sunday Times (15 June 2014)

[DWV 5] Online Article: Game farmers prevented from using tranquilising drugs: Wildlife Ranching South Africa (12 December 2012)

[DWV6] Annual Newsletter of the South African Veterinary Council (September 2013)

The documents feature in the document log, appendix F.

Similarities were sought between these documents and data obtained through the interviews and participant observations, which assisted in supporting, validating and triangulating the data.

Appendix G includes a document log of documents consulted in the freshwater ecologist case study, which shows the use of a range of different documents. For the freshwater ecologist case, adverts were sourced which were relevant to seeking individuals possessing this skill set understood to be scarce, and the resultant data compared with data gained from the interviews. The adverts collected were used to identify the particular skills required for the advertised post, so that these could be compared to what the recent graduates obtained from their qualifications (see appendix H). To understand the qualifications of graduates I collected prospectuses and outlines of the undergraduate and Honours courses pertaining to freshwater management (appendix I and appendix J), and from these the emphasis on skills and exposure to the field were identified, and further illuminated by the interviews. The limitations to this data collection method are detailed in Section 3.9.3.1.

### **3.5.2.2 Semi-structured interviews**

For this study semi-structured interviews were designed and conducted. These comprised a selection of predetermined questions, fashioned into an interview schedule. Semi-structured

interviewing is often used in case study research. Sayer (2010) and Shen (2009) say that this form of interviewing is not inflexible and rigid, but guides, prompts and allows participants not only to respond to the question but to elaborate as they wish upon specific issues. A possible limitation to this method is that the onus remains on the interviewer to probe into the answers at times, in order to obtain further depth, should the question not have been adequately answered. This type of questioning allowed me to develop deeper insights into the perceptions of interviewees and to better understand how they depict or describe particular phenomena. Such an example was how the freshwater ecologists perceived the field of general environmental consulting, as distinct from conservation-centred consulting and work.

The reason for choosing the method of semi-structured interviewing was its suitability to a qualitative case study (Cohen et al., 2007). The sequence of the setting up and asking of the questions was determined in accordance with the framework of research questions and supporting sub-questions (Cohen et al., 2007). This method of data collection complemented the critical realist framework, as it provided rich description and allowed for utilisation of the principles of stratified ontology and emergence. The result was a better understanding of the structural mechanisms responsible for the events that occurred and the experiences of the participants.

The interviews ranged from 35 to 45 minutes in length and consisted of an interview schedule tailored to suit the differing audiences (examples of which can be found in appendices K, L and M). For each interview, an audio recording device was set up, prior to which the participants were informed of my intention to record the interview, for the purposes of data capturing, transcription and validity. Additionally, a notebook was kept close by, in which I made notes as the interview progressed. These were referred to and incorporated during the transcription and analysis phases.

As can be seen from Table 3.1, the participant list comprised academic staff, lecturers and/or curriculum advisors, and specific individuals working in the field. The last mentioned provided useful detail regarding the skills obtained from university and those they had taught themselves. I also sought to probe these individuals about the various factors they had encountered which had affected their transition or career trajectory.

### **3.5.2.3 Focus group interviews**

Bickman and Rog (1998) and Cohen et al. (2007) state that focus group interviews are well suited to concentrating on small groups of individuals from similar backgrounds who can therefore participate in a discussion around a common or particular theme. Focus group interviews can also result in participants prompting one another and sharing common insights.

Initially three focus group interviews within the nested case studies were planned, with undergraduate students from Rhodes, Stellenbosch and the University of Pretoria who were in the beginning stage of their transition phase. It was decided that one focus group interview would be with a group of 6<sup>th</sup> year students at Onderstepoort, whilst the other two interviews would be with ecology and geography students from Rhodes and Stellenbosch universities respectively. The focus group interviews at Rhodes and Stellenbosch did not materialise, but I was able to contact specific postgraduate and undergraduate students who were willing to speak on behalf of their fellow students about course content, etcetera. The focus group discussion with the Onderstepoort veterinary students was successful in terms of providing insight into wildlife veterinarian supply, demand and transitioning concerns. An excerpt from the transcription of the focus group is evident in the Appendices O.

The limitations of the semi-structured interview method, and of the focus group

### **3.5.2.4 Participant observation**

Through participant observation, I was able gain insight into the phenomenon currently or previously experienced by the participant. The method of participant observation can allow one to witness experiences, situations and perspectives to which one would not ordinarily have access. Bickman & Rog (1998) and Cohen et al. (2007) agree that this method, in conjunction with interviewing and document analysis, can afford the researcher a greater understanding of the phenomenon being studied. I was able to gain a better sense of the degree of congruence between what individuals say and what they actually do or experience, through witnessing this in practice.

The observation process began with my drawing up guidelines on how to go about conducting an adequate observation, informed and structured according to my governing theoretical postulates. This was followed by a pilot observation, which was evaluated and adjusted to suit my purposes.

Through this method of data generation, the enabling factors which further assisted, delayed or affected the participants in carrying out their jobs and day-to-day tasks, were experienced first-hand. An important result of this method was the opportunity it afforded me to witness and gain an understanding of participants' skills, both imparted by the university and subsequently acquired, in action. As the researcher, I was able to note the obvious constraints and enablers present within the individual's work and how they incorporated and/or worked around these factors. This was especially valuable, as I was able fully to appreciate how these individuals conducted their day-to-day duties, using skills either self taught or obtained through references and sought networks, to address issues or factors inhibiting progress in the workplace. While this was useful, observations were not found to be essential for addressing the research question. As with the transcription of interviews, the observation notes from the each observation schedule were documented on the same evening or during that same week (see appendices N). The limitations of this method are detailed in Section 3.9.3.3. I was not able to set up similar observations for the freshwater ecology cases, but as the method was not found to be essential for addressing the research question, I was able to progress without this set of observations.

In total I conducted the following observations:

- **Wildlife Veterinarian 1:** Dr Simmonds: April 2014
- **Wildlife Veterinarians 2 and 4:** Dr Pretorius and Dr Roxburgh: May 2014
- **Wildlife Veterinarian 3:** Dr Breed: June and July 2014

### **3.5.3 Supplementary/secondary methods of data generation**

The direction of this study was also influenced by data generated through secondary data generation methods. In the section below, I describe how a short survey conducted during the earliest contextual profiling stage of this study guided the formulation of the research question and methodology. I also describe the contribution of social media to my developing understanding of the field and identification of research participants. I also reflect on the contribution of my research diary as a secondary data generation method.

### **3.5.3.1 The influences of social media data in this study**

The use of technology in research is becoming increasingly evident. This includes reliance on social media and related social networks to obtain information and peer reviewed insights into various topics (Cohen et al., 2007). I too made use of the medium of online research, for two purposes: first, to source individuals who had graduated from the aforementioned universities, and secondly, as a method of data collection, in the form of documents pertinent to the case studies and the exchanges of online groups.

Having been in the professional workforce prior to conducting this research, my previous job had required me to possess an established online social media presence, in the forms of LinkedIn and Twitter. Through these, I was able to utilize simple key word searches, for example, “wetland or freshwater ecologist<sup>3</sup> and Stellenbosch University” or “ wildlife veterinarian and Onderstepoort”, and in this way identify and then contact individuals who could contribute to the study.

Additionally, I located and joined a number of job websites and specified searches for “Wetland specialist”, “Freshwater ecologist”, “Wildlife veterinarian” in the search categories, but found that joining selected Google groups, the South African Veterinary Association and the Wetlands Forum, provided superior inroads into locating job advertisements.

I was also able, through Facebook, Google Groups and Yahoo groups, to join various networks to ask about young graduates within the biodiversity field. This method of group posting is, however, limited in that it relies heavily on the presence of an administrator who will monitor and support postings (Esler, 2014, Personal communication), as was my experience.

### **3.5.3.2 Initial survey aimed at biodiversity professionals**

Prior to embarking on this research in the contextual profiling stage, I drew up a loosely structured survey aimed at biodiversity professionals at varying stages in their careers, and with varying levels of experience. Twenty individuals from the biodiversity sector were approached via previous working networks: since my background is the biodiversity sector,

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<sup>3</sup> Initially I had been researching wetland ecologists, however, after careful consideration, I changed this to freshwater ecologists.

previous colleagues were identified and I circulated a short survey via email to them, with a request for them to complete a questionnaire. The questions focused on their experiences and perceptions of their transition into careers in the biodiversity sector. Through this survey I began to map the landscape for research and the importance of the topic to biodiversity graduates and professionals from a broader perspective.

The presence of secondary data allowed for further research into the pertinent scarce skills, as well as access to networks, groups and insights from established professionals and graduates within the wider biodiversity sector. Subsequently, this data proved useful in the triangulation of the primary data during the analysis phase.

### **3.6 DATA MANAGEMENT**

Accurate data management is an imperative in all research, as this affects the quality, rigour and the validity of the contribution of the data to the overall research (Bassey, 1999; Cohen et al., 2007). In this section, descriptions are provided of the various considerations taken and measures implemented to ensure the adequate management and safe keeping of the data.

Prior to embarking on this research, I purchased two external hard drives, which – in combination with cloud software, namely Google Drive and Drop Box – allowed me to store the data in digital format. Regarding hard copies of data, I obtained safe storage spaces for my two nested case studies, where I would place interview data, documents and any other literature pertaining to the case being investigated. Each interview was recorded and transcribed, and after each transcription was completed, I added it to the original interview schedule, digitally. I then printed and placed these in individually marked plastic sleeves, which had the relevant index coding details and other relevant markings clearly visible. This was at the prompting of Flyvbjerg (2006) and Janse van Rensburg (2001), who recommend that researchers organise their data in a manner allowing easy access to data for future recall.

Since I had employed three specific methods of data collection, namely semi-structured interviews, (participant) observation and document analysis, I made copies of the recordings and documents given to me after each session. This was backed up digitally; enabling access to the information should I not be close to my own laptop. This diligence evidences respect for the importance of the data and its safe keeping (Janse van Rensburg, 2001). I also noted that rigour and validity could be compromised if such measures were not implemented (ibid.). As I read through the data repeatedly (observations, recordings and/or interview

transcripts), previously unnoticed insights emerged. I ensured that I noted these down in the appropriate files, for later recall.

For semi-structured and focus group interviews, I would always bring along two devices with which to capture the audio, namely, my cell phone and my laptop. However, through trial and error, the preferred method became cell phone recording, as the clarity and distinctness were much higher than that of the laptop recording. However, I was always certain to make two copies of each interview, in the event of the failure of one of the devices. After each interview I ensured that the recordings were saved to both the laptop and Google Drive. I would then begin my transcription of the interview, on the same evening. See appendix O for an example of an interview transcript.

Participant observation was a technique utilised with the actual working professionals, as noted above in Section 3.5.2.4. In some instances I was not able to document what was happening minute-by-minute, as I would be out in the field with the participant; in such cases the pertinent points were noted in shorthand, and later written up in full. As in the case of the transcription of interviews, I attempted to start typing up the observation notes from each observation schedule on the same evening or during that same week.

The third and final methodological technique employed, as recommended by (Bickman & Rog, 1998; Cohen et al., 2007), was document analysis, an integral part of data collection (see Section 3.5.2.1, above. When documents were received, they would be scanned and saved to the Google drive. Hard copies that could not be scanned – documents such as prospectuses, data sheets etc. – were stored carefully in the drawer allocated to that particular nested case study. Each of the documents was entered digitally into a document log (see Appendix F and G). All of this data, including pictures, was added to the NVIVO qualitative data analysis programme.

I constructed a table that reflects the various data generation methods, the case study they are particular to, and the index code allocated to the data source (see Table 3.2). This assisted me in organising my data and making it easily accessible to myself, the reader and potential future researchers. According to Flyvbjerg (2006) and Hyett et al. (2014) this is an essential attribute of good case study research.



Table 3.2 Summary of data generated

<u>Primary Data Collection</u>	<u>Nested Case Study</u>	<u>Index code</u>
<b><u>Interviews( Semi Structured)</u></b>	Wildlife Vets	WV/Int1-16
	Freshwater Ecologists	FE/Int 1-13
<b><u>Interviews (Focus Group)</u></b>	Wildlife Vet	WV/Int FG1
<b><u>Digitally obtained interview schedules</u></b>	Freshwater Ecologists	FE/Int.07 and FE/Int.01
	Wildlife vets	WV/Int.04
<b><u>Document Analysis</u></b>	Freshwater Ecologists	DFE 1-10
	Wildlife Vets	DWV 1-10
<b><u>Observation</u></b>	Wildlife Vets	WV/Obs 1-3
<b>Secondary Data Collection</b>		
Interviews with professionals	Freshwater Ecologists	FE/Int.14-17

### 3.6.1 Data Analysis

The process of qualitative data analysis consists of organising, taking ownership of and describing in detail the data accumulated through the data generation techniques utilised. This allows the reader to gain new knowledge about previously foreign phenomena. Data analysis relies on interpretation and the crafting of raw data into refined, workable, meaning-filled data, which is both accessible and suited to the reader and different audiences (Cohen et al., 2007).

What should be understood about the analysis of qualitative data is that the data is multi-layered and thus open to a variety of interpretations. For this reason, prior to embarking upon analysis, the researcher needs be aware of the following:

- **The view or scope of data:** the crucial initial step in data analysis is a short description of what a researcher seeks to do through the lens of the data, broadening or magnifying focus, as required (Guest, MacQueen, & Namey, 2012).

- **The data quality:** Also of crucial importance is the quality of the data that is needed to fulfil the analysis objective.
- **Adequate resources and time** need to be allocated to such a task in order for the researcher to conduct a sound and weighted analysis. The element of time allows a researcher to either embark upon grounded analysis, a lengthy, time consuming process, suitable for a longer study, for instance a PhD or, thematic analysis, a method which takes in account the factors of time, quality and rigour of data, whilst permitting the researcher to shelve or catalogue data, to be called up at a later stage, or for other potential researchers (Cohen et al., 2007; Raffe, 2008).

Initially, like other novice researchers, I was struck by the idea of grounded analysis. However, in keeping with the methodology of case study as well as because of time constraints coupled with the volume of data that I needed to analyse, I decided upon applied thematic analysis (see Chapters Four and Five).

Three modes of inference – inductive, abductive and retroductive – were drawn upon in the analysis process. Most research methodology texts refer only to inductive and deductive modes of analysis (Cohen et al., 2007). However, in critical realist research, it is recommended that researchers work with inductive, abductive and retroductive modes of inference (Danermark et al., 2002). These modes of inference were critical in assisting me in analysing the data (see Table 3.3 and further explanation of these modes of inference, below). I understood that, although I was working within a critical realist theoretical framework, I also used the theoretical perspectives of Bronfenbrenner's human ecology model. I used lenses derived from these theoretical perspectives to guide the analysis, but – especially initially – I was not too rigidly tied to these perspectives, which allowed for the inductive emergence of themes from within the data. These modes of data analysis have been identified as stages within the overall analysis and have been incorporated accordingly. They are described in more detail in Section 3.6.2, below.

Table 3.3. Modes of Inference (adapted from Danermark et al., 2002, pp. 80 & 81)

	Induction	Abduction	Retroduction
Fundamental Structure / thought operations	Draw universally valid conclusions from a number of instances. See similarities in a number of observations (identifications of patterns in data)	Interpret and recontextualise individual phenomena within a conceptual framework (theory) or set of ideas. Understand something in a new conceptual framework.	From a description and analysis of concrete phenomena, reconstruct the basis conditions for these phenomena to be what they are. By way of thought operations and counterfactual thinking.
Central issue	What is the element common for a number of observed entities?	What meaning is given to something interpreted within a particular conceptual framework?	What qualities must exist for something to be possible?
Strength	Provides guidance in connection with empirical generalisations.	Provides guidance for interpretative processes by which to ascribe meaning to events in relation to a larger context.	Provides knowledge of transfactual conditions, structures and mechanisms that cannot always be observed in the domain of the empirical.
Limitation	Inductive inference can never be either analytically or empirically certain (internal limitations of induction)	There are no fixed criteria from which it is possible to assess in a definite way the validity of an abductive conclusion.	There are no fixed criteria from which it would be possible to assess in a definite way the validity of a retroductive conclusion
Use in this study	To develop initial thematic areas for understanding enabling and constraining factors influencing supply, demand and transition in the two occupations. (Used to inform initial data analysis which fed into the descriptive analytical case studies reported in Chapter Four and Five).	Use of transition theory to interpret issues related to supply and demand of biodiversity skills, including Bronfenbrenner's ecological model (see Chapters Four and Five).	Use of retroduction to examine generative mechanisms and structures that influenced scarcity and transitions of the two biodiversity occupations defined as 'scarce skills' (see Chapter Six).

### **3.6.2 Phases and stages of data organisation and analysis**

The phases of analysis are sequenced according to the chronological stage and analysis technique employed.

#### **3.6.2.1 Phase 1: Primary coding of data**

##### **Stage 1: Transcribing and coding the semi-structured interviews and field observations**

For this stage, the recordings of the semi-structured interviews were transcribed, ensuring that the interview data was captured as carefully as possible. This same process was administered for the three field observations conducted, and for the documents used. After the data obtained through interviews, documents and observations was entered into the data analysis programme NVivo, I began to inductively code this data for emerging categories. The codes are listed below. This is an instance of inductive inference, whereby the researcher is able to discover themes emerging from the data, as explained in Table 3.4, above. An example of this kind of analysis is when the specific structural and agentic factors affecting the biodiversity professionals became apparent during inspection of the data whilst bearing the research questions in mind. The themed categories were devised as follows:

##### **Enabling Factors:**

- Mentoring or mentor (including family and friends)
- Experience (workplace)
- Passion, motivation, interest, desire
- Degree and curriculum
- Networks and exposure
- Skills development and skills acquired
- Structural enablers
- Bursary
- Previous courses
- Need or demand for skill

##### **Constraining Factors**

- Lack of focus on skill in curriculum
- Lack of experience in skill set
- Lack of mentor or supervisor
- No or limited knowledge of skill
- Lack of time and/or assumed responsibilities
- Setting specific issues

- Stress, lack of confidence
- Structural issues – distance, finance.
- Supply of skill
- Compulsory previous degree
- Restricted advertising or inaccessibility to advertising platform
- Inflated expectation

### Stage 2: Reading and coding the scarce skill-related documents obtained

All of the documents obtained from the participants and in relation to the two scarce skills were logged, as explained above in 3.5. I analysed these document from the following perspectives:

- Curriculum content
- Critical skills relevant to the workplace included in the curriculum
- Skills required by the workplace
- Experience required.

#### **3.6.2.2 Phase 2: Drafting of analytic memos**

From the codes or categories which had been assigned through the application of the Nvivo programme, and via the initial inductive categories outlined above, a set of analytical memos was drafted, which essentially placed the raw data into easily accessible categories. In this study, the following analytical memos were developed:

#### **Enabling:**

- Passion or motivation
- Networking
- Family influences
- Experience
- Mentors (presence)
- Structural enablements: Finances, bursary, internship programmes.
- Need or demand for the skills
- Degree or curriculum

#### **Constraining:**

- Setting specific issues
- Lack of supply of scarce skills
- No or limited support from family or friends

- No or limited subject knowledge
- Lack of confidence, stress, demotivation
- Structural constraints: responsibilities, time, financial issues, travel
- Lack of focus on skill in the undergraduate curriculum
- Lack of a mentor or supervisor.

(See Appendix P for an example of an analytic memo.)

The use of analytical memos is a data reduction strategy that helps researchers to make sense of the data and begin to synthesise it. It allowed me to prepare the data for further analysis using abductive and retroductive approaches.

### **3.6.3.3 Phase 3: Secondary Analysis**

The secondary phase of analysis mainly used abductive inference, to analyse the data obtained from the semi-structured interviews, field observations and documents obtained using transition theory (Bronfenbrenner's ecological systems model, explained in Section 2.4.3). Factors investigated were those occurring within the participants' individual ecosystemic systems and their development from their beginning to current date. Initially I drew upon Bronfenbrenner's ecological systems to identify agentic and structural factors particular to the participants. A timeline was drawn up for each participant and from this the structure of the ecosystem and the particular ecosystemic factors began to emerge.

Firstly I focussed on the microsystemic factors influencing an individual's transition, namely exposure and experience within the biodiversity field, as a result of any microsystemic relationships they held with family members or friends. Secondly, I analysed macrosystemic factors, within both interviews and document analysis. Thirdly and lastly I analysed and sought to identify the exosystemic and chronosystemic factors which indicated external, often structural factors which influenced an individual's development and greater transition. Examples of these different factors as analysed in the data are evident in the descriptions of the cases provided in Chapters Four and Five.

### **3.6.2.4 Phase 4: Drafting Analytic statements**

Bassey (1999) suggests that one way of managing and making sense of the data is to reduce it to purposeful statements, also referred to as analytical statements. These statements are the product of raw data, which has been coded into specific categories. They provide synthetic

perspectives on the data and help the researcher to make claims from the study that can ultimately be traced back to the original data. A set of analytical statements was drawn up, which assisted in answering the main and subsidiary research questions. The analytical statements are presented in Chapter Six.

#### **3.6.2.5 Phase 5: Making claims, data discussion and interpretation**

In the final stage of analysis, the main findings of the study need to be discussed to determine what they mean in the context of a field, and in relation to the questions that were posed for the research (Bassey, 1999; Cohen et al., 2007). In this study I discuss each of the analytical statements by reflecting on the meaning of the findings of the study in relation to the research questions, and also in relation to the wider context in which the study was located. I was also able to discuss the data more critically using the retroductive analytical approach that characterises critical realism. This enabled me to deepen the analysis of the data through reflecting on the generative mechanisms and emergence processes. As indicated here, this phase of analysis used mainly retroductive analysis (see Table 3.3, above), which in congruence with the nested case study approach was employed to allow for the deconstruction and reconstruction of various phenomena (Baxter and Jack, 2008). In retroductively analysing the data, the emerging structures and mechanisms were traced, which contributed to a greater understanding of the empirical experiences of the various participants. This analysis is presented in Chapter 6, along with recommendations per analytical statement.

### **3.7 VALIDITY AND TRUSTWORTHINESS**

Validity and trustworthiness is pivotal to designing, implementing and delivering research. Cohen et al. (2007) inform us that should any form of research be invalid, it is worthless. But Janse van Rensburg (2001) suggests that validity may not be an appropriate concept for qualitative research as it is associated more with positivist research designs, and that trustworthiness is perhaps a more appropriate concept to use in and for case study research. I have made a concerted effort to ensure that this study meets and delivers principles of trustworthiness, whilst contributing to the body of knowledge pertaining to skills supply and demand within the biodiversity sector.

The principles of ensuring trustworthiness in this study are outlined here. As noted above, I was guided by critical realist underlabouring and a case study research design. This assisted

in managing choices of methods for data collection and analysis, as outlined above. Trustworthiness is not, however, limited to the process of data generation, but is also ensured through the careful way in which data is managed and processed, as well as through the thorough way in which meaning is made in the analytical process, via the forms of inference that I used. I realised that as the researcher I was responsible for making meaning and sense of my own data and the methods that I employed. In order to do so I needed to ensure complete honesty and rigour, and I had to present a trustworthy account of how I conducted the research, with data trails (i.e. the original data should be evident).

Honesty is one of the core principles in ensuring validity and trustworthiness, and in order to comply with this throughout my research process, I repeatedly went through the findings, questions and the analytic process.

A second principle of validity and trustworthiness relates to scope and depth of analysis of the data. I often questioned and reflected upon the methods of data collection and analysis, to ensure that I had provided enough depth accurately to reflect answers to the research questions. I also used thick description to provide an accurate account of the data, and included appendices to show the manner in which I captured, analysed and approached the data.

Additional means of ensuring internal validity and trustworthiness were employed via the strategy of data triangulation, also referred to as methodological triangulation, meaning that three data collection methods were used and the data generated by each was compared and checked for regularities and irregularities. As this study is nested case study research, the process of triangulation, according to Cohen et al. (2007), Janse van Rensburg (2001), and Sayer (2010), is complementary, as it allows the researcher to investigate at a deeper level a previously unknown or complex phenomenon. I also sought to ensure internal coherence through the manner in which I undertook the analysis in relation to the theoretical framework of the study. I sought to ensure that I was conducting a critical realist study, and not just an empirical case study. This required that I use abductive and retroductive modes of inference, as shown above in Table 3.3, and as demonstrated in Chapters Four, Five and Six.

These strategies all add detail to the data description, ensuring the ‘thick description’ (Cohen et al. 2007) which typically serves to ensure trustworthiness in case study research. And finally, trustworthiness was established through the method of member checking (ibid.),



which is when a researcher seeks to enhance accuracy by checking or submitting facts and questions to individuals who are within the field of study, or to those who were respondents in the study. This was achieved through sharing interview transcripts with interviewees to obtain feedback from them, as well as through secondary interviews with established professionals within the field of study.

### **3.8 ETHICAL CONSIDERATIONS**

A pivotal concern in any form of research is that of research ethics. In Latin, *Primum non nocere*, translated as “First do no harm”, refers to the crucial step of caution and compassion necessary within any research, placing the welfare and wellbeing of others before one’s own research interest. I tried to ensure ethical practice throughout the entire research process and hence applied this principle to the research in a variety of ways, as outlined below.

Prior to conducting interviews with participants, I applied for ethics clearance from the university where I was registered and obtained an official letter of approval. This letter was sent to the various institutions I planned to approach in order to request permission to do research. The letter detailed the research intent and the individuals with whom I planned to approach; it furthermore stated that the individuals were under no obligation to participate in the study and that, should they choose to leave or discontinue, I would accept this (Cohen et al., 2007; Janse van Rensburg, 2001).

My previous working and research experience assisted me in understanding that in order to gain access, I needed to take into account organisational hierarchy, and therefore I took great care in seeking out the correct individuals to approach. Once access had been granted, a letter of invitation to participate in the research was drafted and sent to the various potential participants, who were asked to consent to participating in the research. The letter is a form of informed consent, whereby a participant is given the opportunity to choose to become involved in a study, or not, after being informed of the facts and details of a specific study. It was guided by four essential elements: competence, voluntarism, full information and comprehension (Cohen et al., 2007).

These terms were re-explained at the outset of each interview with each participant, and each participant was given the opportunity to withdraw from participating in the event should they have so wished. Additionally, I explained to each participant that they could remain anonymous. Three participants chose to remain anonymous, and for reasons of

standardisation and ethical duty, I have changed all reference to them via the use of pseudonyms, identifying the other participants by their titles and surnames only.

### 3.9 METHODOLOGICAL CHALLENGES AND LIMITATIONS TO THIS STUDY

In this section, limitations recognised and challenges encountered within the course of this study are explained: first, challenges experienced as a result of using the case study methodology, and secondly, issues experienced within the data generation phase.

#### 3.9.1 Limitations of case study research

The limitations associated with case study methodology should be considered due to their potential impact on academic rigour, analysis and the validity or trustworthiness of the study (Janse van Rensburg, 2001). In the process of conducting the research, I realised the importance of understanding the criticisms of case studies particular to the “cases”. This was achieved through drawing on Flyvbjerg (2006), who presents five main criticisms of case studies. Considering my research against these five points helped me to identify and define the limitations I experienced. Of particular interest to this study was misunderstanding four, as elaborated on below. In this definition, the contradictions and mindset associated with case studies were illuminated, and through drawing on the literature I was able to substantiate the limitations experienced within this research and the mitigating measures. Flyvbjerg (2006) describes five often encountered misunderstandings that relate to the case study research:

Table 3.4: The five limitations to case study. Source: (Flyvbjerg, 2006).

<p><b><u>Misunderstanding 1:</u></b> General, theoretical (context-independent) knowledge is more valuable than concrete, practical (context-dependent) knowledge.</p> <p><b><u>*Misunderstanding 2:</u></b> One cannot generalize on the basis of an individual case; therefore, the case study cannot contribute to scientific development.</p> <p><b><u>Misunderstanding 3:</u></b> The case study is most useful for generating hypotheses; that is, in the first stage of a total research process, whereas other methods are more suitable for hypotheses testing and theory building.</p> <p><b><u>*Misunderstanding 4:</u></b> The case study contains a bias toward verification, that is, a tendency to confirm the researcher’s preconceived notions.</p> <p><b><u>Misunderstanding 5:</u></b> It is often difficult to summarize and develop general propositions and theories on the basis of specific case studies.</p>
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In his paper, Flyvbjerg suggests that the above points above are ‘misunderstandings’ that relate to case study research. He suggests for example that context-dependent knowledge – in the case of this study, the experiences of people in the two occupations – *is valuable* as it provides a rich, nuanced perspective on the topic under study (misunderstanding 1). With regard to generalisation, he suggests that it is possible to generalise from case study, from the perspective of applied generalisation and uptake of insights into alternative contexts. Bassey (1999) suggests it is possible to use fuzzy generalisations in case study research, as should be the case in all social research, as social prediction is always subject to response from people. Critical realists suggest that it is possible to generalise at the level of the real, i.e. via explanations of the generative mechanisms that shape experiences (e.g. the commodification of wildlife is likely to affect many more wildlife veterinarians than those who were interviewed in this study) (Danermark et al. 2002; misunderstanding 2). Flyvbjerg (2006) suggests too that case studies can be useful for hypothesis development (misunderstanding 3), and via abductive and retroductive research as in this study, it is possible to develop more general propositions or theory development (misunderstanding 5; see Chapter Six). However, Flyvbjerg (2006) reports that other social scientists suggest that bias is greater within case studies than with other qualitative methods (misunderstanding 4). He suggests that this relates to subjectivity in research, which generally characterises all qualitative studies. This requires the researcher to exercise self-reflexivity and employ this throughout the stages of initial planning, implementation of the method and execution of the study. I endeavoured to be reflexive throughout the research process, as indicated above in my methodological descriptions, and by taking into account the limitations of the study, as outlined below.

### **3.9.2 Limitations in the data generation phase**

Initially several universities offering courses in freshwater ecology were to be approached: the University of Stellenbosch, the University of Kwa Zulu Natal, and the University of Cape Town (the latter two known for graduating a number of freshwater ecologists employed in the Biodiversity Sector). As explained earlier, at UKZN I was unable to make much headway because a number of the experts in freshwater ecology had moved on to other universities and/or resigned (Barnes, personal communication 2013; Kotze, personal communication, 2014; Lindley, personal communication, 2014). A similar situation was experienced when trying to approach the University of Cape Town, UCT. Here the department in question had closed down and the remaining members had been incorporated into the climate change

departments within UCT. I therefore had to review my original strategy, and made a decision to focus rather on Stellenbosch University and Rhodes University, contacting several potential participants.

Once the freshwater individuals had been contacted and had agreed to participate in the study, the interviews with and field observations of the currently working professionals were organised; however, I was unable to observe any of the participants in the field. This was for two reasons: first, they were not practising in the field at the time of the scheduled interview and field observation, or secondly, they had chosen to return to the academy and were therefore not conducting fieldwork during this time. This situation was compounded by time constraints associated with the study.

### **3.9.3 Limitations of data generation methods**

#### **3.9.3.1 Document analysis**

Limitations to document analysis stemmed from a lack of depth in some of the selected documents, which called for further questioning from the relevant participants, or online research. For example, one of the shortcomings encountered pertained to the depth of detail of the WOC610 curriculum. Two documents were provided by the lecturers, namely the brief course outline and a leaflet indicating the courses offered by the Centre for Wildlife Studies, but this did not contain a great amount of detail, thus necessitating further questioning of the lecturers involved.

#### **3.9.3.2 Semi structured interviews and focus group interviews**

Although the method of semi-structured interviewing was fruitful, limitations were encountered. For instance, periodically I would have to rephrase or reword the questions as a result of the interviews being semi-structured and therefore open to flexibility. Furthermore, I found that to request interviewees to elaborate upon a valuable answer was not a simple task, and required me to be attentive and to allow participants to respond in unexpected ways.

Although three focus group interviews were initially planned, only my initial interview with the focus group of undergraduate students from Onderstepoort was actualised. Although numerous notifications were put out requesting participants to attend the focus group interviews, no feedback was received from undergraduates at Rhodes University or Stellenbosch University. To compensate for this I tried to make the interviews that I could obtain as detailed and rich as possible.

### **3.9.3.3 Participant observations**

In some instances minute-by-minute documentation was not possible, as I would be out in the field with the participant. This was remedied in part by my recording the pertinent points in shorthand; later, at a more convenient time, I would return to the notes and elaborate on them.

## **3.10 CONCLUSION**

In this chapter the research process has been explained and discussed in terms of design, implementation, research methods and theoretical framing. Moreover, a description of the data generation methods, which were guided by the research interest and question and the focus on transitions, has been provided. In conjunction with this, I have explained the analytical process, and how I developed analytical memos and analytical statements to synthesise and process the data. I also discussed the limitations to the study that I experienced.

What follows in Chapter Four and Chapter Five is a presentation and discussion of the data gathered. Due to the wealth of information, this has been spread across two chapters, with Chapter Four discussing wildlife veterinarians and Chapter Five, freshwater ecologists.

## **Chapter 4: Transitions of wildlife veterinarians from university to workplace**

### **Overview on Chapters Four and Chapter Five**

The structure of the following two chapters, chapter four and chapter five respectively are detailed below.

Contextually, this research is situated within the South African biodiversity sector as explained in sections 2.1 and 1.1. Participants were carefully selected for inclusion in this study according to the parameters of case study research (section 3.2.2). Both chapters begin with an overview and history on these scarce skills, which then leads into the interviews held with the particular participants per case study.

I report on the findings from the interviews with graduates and current students, describing their version of their own transition(s) by drawing on the principles of Bronfenbrenner's ecological systems theory. The data regarding their transitions is structured as follows: (1) direct microsystemic factors and relations, such as their gender and familial relationships, as well as their education from secondary schooling to tertiary education, (2) their motivation for pursuing a career within the environmental field, (3) mesosystemic factors such as mentoring opportunities, (4) macrosystemic factors, such as the expectations of potential employers in the workplace and (5) chronosystemic factors, such as those related to the use and availability of technology, as well as any pivotal events occurring within their life time, such as apartheid or its ramifications.

The data presented in this chapter is particular to wildlife veterinarians, and it aims to highlight the factors which the participants encountered or perceived to encounter in their transitions from university to workplace.

Chapter five is particular to freshwater ecologists and is presented in the same fashion and aims to highlight the factors which the participants encountered or perceive to encounter in their respective transitions from university to workplace.

## **4.1 INTRODUCTION TO CASE STUDY A : WILDLIFE VETERINARIANS**

I start by sketching the history and background to wildlife veterinary science in South Africa, as communicated in interviews by a number of the participants. Further information was obtained by reviewing documents and websites as well as referral to by these individuals. Thereafter the findings from the interviews with the individual wildlife veterinarians and insights gained from field observations are reported on, guided by the principles of Bronfenbrenner's ecological systems theory (see section 2.4.3). This has allowed for an analysis of the enabling or constraining factors influencing participants' transitions. Here, I use the terms mesosystem, macrosystem, exosystem and the chronosystem as described in the theory.

I also present the data generated from the interview held with a veterinary professional, who is currently studying toward a postgraduate M.Med Vet degree, specialising in wildlife health. Although he has not yet entered the workforce as a veterinarian, he provided me with an outline of his transition and of any influencing factors.

The next section deals with data from the focus group interview held with the last class of veterinary students taking the Wildlife, Crocodile and Ostrich 6<sup>th</sup> Year 10<sup>th</sup> Semester (WOC 610) elective. The data focuses on their perception of the course, and their idea of their future transitions and the factors that could affect them. The concluding interviews are those with the lecturers who are involved both with the course, and with mentoring and supervising students wishing to pursue wildlife veterinary medicine.

In this chapter the participants will be referred to by their surnames and not by their index codes. However, index codes are used to indicate the source of direct quotations.

## **4.2 HISTORICAL CONTEXT OF VETERINARY TRAINING IN SOUTH AFRICA**

The establishment of Onderstepoort in the early twentieth century was largely due to increasing domestic livestock population and the threats posed by wildlife to a developing agricultural economy (as briefly introduced in section 2.3.3). These threats included the outbreak of various diseases which were transmitted from wildlife to domestic livestock leading to loss of domestic stock. [WV/Int.08]. A basic veterinary course was therefore

tailored to suit the South African agricultural economy and to factor in the influence of wildlife on this emerging market.

The focus of the veterinary curriculum in South Africa has been: (1) to address the needs of the agricultural sector, (2) to train veterinarians to accurately diagnose conditions in a generalist setting and implement mitigating measures and (3) to train individuals to fill state veterinary positions. A description of the current or outgoing BVSc programme is provided at the end of this section, as well as the new curriculum which has recently been implemented. The participants interviewed for this study, all completed the earlier curriculum.

Veterinary training has not altered much from its original generalist perspective and wildlife health has constituted a small part of the curriculum. This has prompted young graduates to seek opportunities to move into this field through alternative pathways, such as residencies at foreign universities, or applying for junior or part time posts at a local zoo or veterinary practice [WV/Int.08], [WV/Int.01], [WV/Int.04].

Wildlife veterinary medicine is a relatively modern vocation in South Africa (Kriek & Swan, 2009). Some of the first South African specialist wildlife veterinarians of the early nineteen eighties conducted their undergraduate degree at Onderstepoort and continued with their education at overseas universities, in the United States and the United Kingdom in order to pursue their interests. At the universities they were enrolled into specialist programmes and residencies, and were exposed to wildlife at a specialist and not a generalist level. Up until the late 1990s, there were few wildlife veterinarians, especially within the conservation sector, but there has been an increase in the number of wildlife veterinarians in the country recently. This can be attributed to the exponential growth within the game ranching and game farming trades (see the text Box 1 below from the website of a wildlife ranching business which also offers training. The discourse on the website page provides some insight into the growth of this industry).



**TEXT BOX 1:** Wildlife ranching (from [www.careforwild.co.za](http://www.careforwild.co.za))

Wildlife ranching is an increasingly important, growth industry in South Africa. Whilst the number of commercial farmers has dropped to some 37,000 farmers as a result of sub-economic farming and land utilization issues, the game industry has transformed some 20 million hectares of marginal agricultural land into thriving productive game ranches. Typically a commercial wildlife ranch generates around R220/ha of economic output versus an average of R80/ha for conventional livestock farming. Historically, up until the middle of the 1950/60's wildlife had no economic value in Southern Africa and game animals were considered as competitors for livestock grazing land. The result was the extensive hunting of all wildlife and the subsequent heavy reduction in stock levels.

At that stage there were only 19 bontebok, 2000 blesbok and 30 white rhino left in South Africa. Since then there has been a further erosion of game animals and predator populations due to habitat encroachment by humans, habitat destruction and alteration, the introduction of diseases such as bovine TB - an introduced disease - and gene pool depletion. This has seen animal populations such as for Sable Antelope decline from around 15,000-20,000 in the 1950's to approximately 2,200 in 1986 and a present day level of 100-200. Roan Antelope population numbers have similarly declined by the thousands over the past 50-60 years. Fortunately, over the past 20 years or so there has been an increased recognition of the value of our wildlife and today more animals are bred on game farms than in the National Parks. Wildlife ranching is big business and increasingly the focus is on

- Disease free animals - particularly TB in Buffalo;
- Genetic improvement;
- Recessive genetic variants;
- The breeding of recessive colour variants of certain animal species; examples are "Black Faced Impala" and "Golden Wildebeest".

There is no doubt that the breeding of good quality game animals, and specifically rare game species, has become a growing and very important factor in the game industry. Care for Wild offers a comprehensive set of courses which deal with all aspects of wildlife management and ranching. Covered are topics such as:

- genetic profiling,
- habitat restoration,
- disease management,
- animal husbandry, and
- animal capture and relocation

With highly prized animals (often valued at over several million Rands) being acquired for these ventures, it is not surprising that many individuals from across the broader economy have become integrated into this new market. [WV/Int.05] (See Appendix E Value of game-newspaper article). However the representation of wildlife veterinarians within the pure conservation field or within charity-based organisations has not grown at the same rate, despite the distinct need for conservation medicine related veterinarians, as was stated by Dr

O'Dell , Professor Burroughs and Professor Kock. According to Professor Burroughs, the number of veterinarians entering the wildlife industry remains unknown, and a need for a study on these individuals exists, but there is no funding from the governing authorities.

The wildlife veterinary profession is also governed through legislation and regulations which have had an impact on the veterinary profession in recent years: “As a vet, you need to be registered for the Threatened and Protected Species legislation (TOPS) which forms part of the National Environmental Management Act regulation, Biodiversity action of the Biodiversity Act ... So there's all kinds of impacts from another governmental regulation that impact on wildlife and how vets work on wildlife” [sic] [WV/Int.07.120]. He gave an example of having to be registered in different provinces if one was relocating a rhinoceros, due to TOPS and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) agreement.

There has been a development enabling the exposure of young veterinarians to the wildlife spectrum with the creation of an international symposium on wildlife in South Africa, which was established in 1986 (Symco, homepage, 2014). This biannual event aims to address the needs of wildlife veterinarians at a global level. The symposium is comprised of both theoretical and practical components. It also serves as a forum where international and local speakers can address young veterinarian students wishing to pursue a career in wildlife veterinary science.

#### **4.2.1 Outline of the South African undergraduate veterinary curriculum and incoming curriculum**

The current BVSc degree is a 4-year advanced Bachelor's degree offered by the Faculty of Veterinary Science at the Onderstepoort Campus of the University of Pretoria. It required the completion of the specifically-designed 3-year BSc (Veterinary Biology) degree offered by the Faculty of Natural and Agricultural Sciences and the Faculty of Veterinary Science. As a result of alterations to the degree structure, the BSc (Veterinary Biology) degree was phased out. The commencement of this change occurred in 2010 resulting in no first year intake into this programme. It was mandatory for students registered for BSc (Veterinary Biology) I in 2009 and for BSc (Veterinary Biology) II in 2009 and 2010, to complete the existing double degree programme followed by the selection during 2009 and 2010 for admission to BSc

(Veterinary Biology) III in 2010 and 2011 after which selected individuals were required to complete the existing four year BVSc degree programme in order to qualify for 2014/2015.

#### New programme

A core-elective 6 year single-degree structure was developed as a replacement for the previous double degree programme. Implementation of the new programme began in 2010 with no new admittances to BSc (Veterinary Biology). The first intake of these students was in 2011. The programme is internationally recognised and sees candidates completing a new core curriculum for the duration of 4.5 years (9 semesters). Following which, the students complete a chosen elective over 4 months, allowing for the development of competencies in order to allow for the entrance into chosen career trajectories. This degree would then be completed with 14 months experiential training within the chosen elective.

Further insight into how the curriculum is *experienced* as a vital part of transitioning into wildlife veterinary practice is provided below in the transitioning stories and via the interview data which is presented next.

### **4.3 THE PRACTISING VETERINARIANS' STORIES:**

In this section I share the stories of four practicing veterinarians. They work in different contexts, and all have different histories, and unique transitioning stories.

#### **4.3.1 Case Study 1: Dr Simmonds [WV/Int.01]**

Dr Simmonds is a white female, who identifies herself as a vet who focuses on wildlife, exotics and collection animal species. She currently works for a well known marine institute based in Cape Town. She was born and raised in a rural region of England, where she spent most of her childhood involved in equine and farm activities.

“I grew up in the country-side, rural England; I was always surrounded by animals, domestic and farm animals” [WV/Int.01.13]. Additionally, Dr Simmonds has always had a passion for wild animals and wanted to work with large wildlife. At a macrosystemic perspective, Dr Simmonds was born into an upper to middle class British family with a solid support system. She obtained a private school education and she had regular interaction with agriculture, equestrian and domestic animals, which helped to prepare her to enter into the veterinary

field. From a young age, Dr Simmonds planned to become a veterinarian and therefore the majority of her schooling was focused on attaining the marks necessary for acceptance into a veterinary programme.

She emphasised the pivotal role that her mother played in the development of her love for animals and in inspiring her to become a veterinarian. “My mum was an inspiration to me. She also shared a passion for animals and encouraged me to become a vet” [Wv/Int.01.15]. The microsystemic role her mother held was instrumental in Dr Simmonds’ transition from secondary education to becoming a veterinarian. Her mother not only motivated her to follow this career path, but also assisted her in obtaining a variety of experiential and work shadowing opportunities, prior to admission to the Royal Veterinary College. “Prior to application to Vet School in the UK you do not stand a chance, unless you have done a minimum of eight weeks prior experience, prior to attending... At that stage you are 17, so you have to organise all of that yourself. And my Mum actually helped me organise that. You have to go to a farm or a riding stable and have a variety or range and expected” [WV/Int.01.23].

After gaining the required experience, Dr Simmonds was accepted by the Royal Veterinary College where she obtained her undergraduate degree (BVSC). She recalled how the curriculum was mainly based upon domestic animals, including livestock, with little emphasis on wildlife. “You are doing an undergraduate degree; you are learning the core skills to be able to operate in the workplace as a vet. The flip side of the coin is that your basic veterinary degree (or mine) totally underprepared one to deal with wildlife... So I went into equine practice, as I felt that this was what I was best prepared for ... As a new graduate you are somewhat lacking in confidence and you sometimes have a tendency to head towards the career to which you feel best equipped”[WV/Int.01.49]. Thus, she entered the workforce as an equestrian veterinarian, remaining in this position for three years before moving into the wildlife veterinary field.

“I’d always wanted to do wildlife, but had no idea how to make the leap ... So after three years in the equine practice I decided to leave the field, as no one in the UK is going to employ you as a wildlife vet; you need to get some experience somehow ...”[Wv/Int.01.49].

Dr Simmonds explained that there is a tendency for British veterinarians to employ specialised wildlife veterinarians to attend to wildlife issues, rather than generalist domestic

animal veterinarians. A specialist postgraduate degree is required to become a wildlife veterinarian.

She investigated opportunities to complete a full-time degree in wildlife veterinary health in the United Kingdom but this option allowed limited time to gain working experience. She was subsequently offered a three month internship at the Johannesburg Zoo, which she accepted.

As Dr Simmonds is not a South African citizen, she had to acquire a working permit or visa and write a board examination in order to practice veterinary medicine in South Africa. Fortuitously she was informed of an opportunity to study toward a Master's degree through her mentor at the Johannesburg Zoo and as a result was able to obtain her working and studying permit allowing her to enrol at Onderstepoort and begin her part-time Master's degree. On completion of the three month internship, she obtained a job as a junior or assistant veterinarian at the Zoo, where she remained for over a year.

In a similar microsystemic relationship to that of her mother's supportive relationship, although in the alternative role and setting of Onderstepoort, Dr Simmonds' master's supervisor informed her of a job opening at her current job based at the Marine Institute. She then applied for the job and upon getting the position, moved to Cape Town. She functions as the only veterinarian at the institute, and does not have any veterinary nurse assistance. This is mainly due to financial constraints. Dr Simmonds informed me that this has affected her growth as a veterinarian and has, to a degree, hampered her ability to conduct research.

### **The issues facing the need for and supply of biodiversity professionals**

As a qualified veterinarian, Dr Simmonds listed the following factors as having impacted her own transition and which could potentially influence the transition of new graduates.

She described the influences of her Onderstepoort mentor who assisted her with both her Master's project and finding work, noting the importance of a supportive mentor or supervisor and how these individuals could have a positive influence on the transition of a young graduate.

As Dr Simmonds grew up during the Information Technology era, she was exposed to a variety of technologies, as was evident within her daily working routine. She integrates

technology into her work: she has access to specific veterinary equipment, such as ultra sound machines and blood sampling equipment. However she did state that with the increasing costs associated with the technology and tools used within a veterinary practice, the set-up and running of a veterinary practice is often out of the financial limits of a recent graduate. Within her current job she receives a budget to source and purchase relevant veterinary equipment.

Dr Simmonds and her colleagues have access to laptops and the internet; where she is part of various social media groups, online peer interactions and journals. This access to online platforms is part of her student privileges as a current Onderstepoort student [WV/01.Obs].

She further commented on the usefulness of social media platforms for networking which she identified as an enabling factor for students and graduates. She had overseen a number of work shadowing groups in the past, and had encouraged them to utilise online resources. Dr Simmonds indicated that she relied extensively on a network she had created with a group of veterinarians based in South Africa at similar marine institutions.

A difficulty she faced upon leaving university was the lack of working experience; she attributed her eventual success in finding work to determination, tenacity and actively seeking opportunities. She strongly advised graduates to adopt a similar proactive approach. As she is often working with new and foreign species and does not have any fellow veterinarians working at the same institution, she has had to rely on self teaching and her research skills, acquired during her degrees, to collect new information. However, she was not always able to publish her findings and insights, partially as a result of her workload.

In conclusion, Dr Simmonds felt that there was a demand for graduates with wildlife veterinary skills and experience, and based her answer on the current growth rate of the wildlife industry. She noted that this lack had been highlighted at many conferences she had attended. She did however inform me that the number of job posts did not represent the demand for these individuals and gave an example of her initial struggle to find work and the fact that she holds her current position as a result of her supervisor at Onderstepoort telling her about the post.

#### **4.3.2 Case Study 2: Dr Pretorius [WV/Int.02]**

Dr Pretorius is a white, Afrikaans male born into a family of three boys. His father is a veterinarian and his mother, although not a veterinarian herself assists in the family-run veterinary business. Dr Pretorius owns and is the chief veterinarian for Motsumi Wild and Game Capture. Dr Pretorius attributes the development of his passion for animal health care and veterinary work to the microsystemic influences of his father and family. He assisted in the family business from an early age. Macrosystemically, Dr Pretorius is from an Afrikaans background and is considered to be historically advantaged. Although he did not receive a bursary or a loan to complete his studies, his parents were financially able to provide him with an opportunity to attend a former Model C school. His father was a veterinarian in the Britz area, Pretoria. However, as a result of an exosystemic factor of career advancement, while Dr Pretorius was still young, the family moved to Namibia. He and his brothers continued their respective schooling careers there, whilst their father took up a post as State Veterinarian. As the State Veterinarian, his father was also extensively involved in agriculture and livestock veterinary medicine and, occasionally, wildlife. It was through his father's work that Dr Pretorius was exposed to wildlife, as well as through various hunting and game farming activities. As a result of the strenuous and time consuming aspects of the agricultural veterinary aspect of his job, his father opted to move back to Britz and continue his practice focussing on small domestic animals [WV/Int.02.10].

Upon his return to Britz, Dr Pretorius was further integrated into the family veterinary business, where he was exposed to various aspects of veterinary practice, including client relations, various animal species, veterinary and medical equipment and practice protocol.

After the completion of his schooling, he pursued his initial BSc degree, which allowed him to enter into Onderstepoort to pursue a BVSc degree. From a chronosystemic perspective, Dr Pretorius grew up in the age of information technology (IT) which resulted in him developing a keen interest in IT and he began his tertiary education within this field. However, he subsequently decided that his love and passion for the veterinary field, coupled with an interest in wildlife, would determine his career path. He retained his technological skills through designing and establishing an IT network at the Onderstepoort residences and by later creating an online shop for his father's veterinary practice. He has been able to integrate this skill set successfully into his own practice, as I witnessed, and wishes to pursue this further [WV/Obs.02].

Upon completion of his degree, he worked for an established veterinarian, however lost his job soon afterwards, he was informed of an alternative opportunity with another wildlife veterinarian who owned a game capture business and obtained a job within this specific business. After gaining sufficient experience from this veterinarian, He then began his own business, which centred on game capture and wildlife veterinary science relying heavily on his past experience to initiate and maintain his own veterinary practice and game capture company.

### **The issues facing the need and supply of biodiversity professionals**

As an established veterinarian and the business owner of Motsumi Wild, Dr Pretorius summarised the following factors, as having affected his transition and which could potentially impact the transition of fellow young veterinarians. He explained that he had not felt concerned about his own transition, as he had gained invaluable experience in both domestic and wildlife veterinary practice through the exposure he had gained in his father's practice. However, he felt that not every graduate was as fortunate to gain such experience and critical skill development. Furthermore, he mentioned the lack of strong mentors and supervisors available to the students during his undergraduate degree, this gap was again filled by his father in his own development as a wildlife veterinarian. He expressed concern at the lack of darting experience and lack of practise in prescribing and utilising drugs in the undergraduate curriculum at Onderstepoort, a view shared not only by him, but, Dr Simmonds, Dr Breed and Dr Roxburgh. "A lot of guys do not trust young vets, they tend to lose a lot more animals working with extremely dangerous drugs and they do not know how to deal with that." [WV/Int.02.64]

Dr Pretorius highlighted time and responsibilities as critical factors affecting his transition. In his first year post graduation he got married and at this point did not have a steady job: "I was going to do small animals; I'd always had an interest in wildlife, then I lost my job ... My previous boss was able to organise me an interview with Dr D Grobelaar and Dr Grobelaar then organised me with my first wildlife job and I worked for a game capture company for a year ... Then I started developing my own clients and my second year was more rushed, as my wife was pregnant, so it was a bit more urgent to make money and support a family" [WV/Int.02.18]. The need to make ends meet to support his new family was a critical turning point in his transition. He further commented that financial factors were a concern for new



graduates wanting to set up their own practices or needing to gain relevant experience. Furthermore, once a practice has been established, the guidelines of the veterinary council prohibit the advertisement of veterinary services which has hindered his ability to attract clients. He felt that this was hugely disadvantageous.

However, he did comment that through his networks he was introduced to wildlife farmers and other wildlife veterinarians. He showed me the online Google Group of which he is a member, but explained that access to this network was via recommendation by an already connected member or established professional; he had experienced difficulties when trying to invite his junior veterinarian to join this platform [WV/Obs.02].

Additionally, the stress of extensive business travelling and lengthy periods away from home, prompted him to begin his own business and work with a client base within close proximity to his home in Britz. He qualified this by saying, “The other constraint is having a family; you cannot just go out and do this or that, so I try to find work in my area, but in the long-term everyone will be faced with that ... So it is easy for young vets to travel and then later on they try to settle, which is what I am trying to do” [WV/Int.02.86].

In conclusion, he stated that he believed there was a demand for experienced, educated professionals, and there was also a willingness from young graduates to enter into this field as a result of the boom within the game industry. He qualified this by stating, “Coming from a place that he has no or little exposure, or trying to make the jump from normal practice to wildlife can be very hard. There is a demand, but the demand is for vets who are able to do wildlife ... experienced vets, not just the guy who has recently finished” [WV/Int.02.64]. He informed me that with the game industry boom and the high value placed on many of the species, the owners did not want inexperienced individuals working with their highly prized animals.

#### **4.3.3 Case Study 3: Dr Breed [WV/Int.03]**

WV/03 is a white, Afrikaans female, and is one of two children. She was raised on a farm in the northern region of South Africa. Both of her parents were very involved with the running of the farm. Although her mother was a practising advocate, she shared a passion for and interest in animals and would have pursued a veterinary career had she been given the opportunity. Dr Breed’s father is a farmer and he always tried to include his daughter in the day to day work and animal husbandry on the farm. Macrosystemically, Dr Breed, like

WV/Int.02 and WV/Int.04, form part of the generation born into the late apartheid era and are therefore recognised as previously advantaged. She too was able to attend a former model C school, however she had the ability and support system to allow her to leave and pursue home schooling in grade 11 in order to focus on her becoming a veterinarian. Furthermore, she was exposed to a variety of technological advancements, such as computers, the internet, social media and a diversity of veterinary equipment, all of which she has been able to regularly utilise within her professional capacity as a veterinarian [WV/Obs.03]. Once she obtained her Matriculation, Dr Breed studied two years of Animal Sciences through the University of Pretoria, before being accepted to Onderstepoort to conduct her BVSc degree.

Dr Breed wanted to pursue a state veterinary position, however, ramifications from the apartheid era have prevented her from doing so. She informed me that recruitment for state veterinarian posts are predominantly aimed at non white candidates. She stated that she was interested in disease control, which is a pivotal performance area for a state veterinarian and also falls under the umbrella of the wildlife veterinary field. As she was unable to obtain a state veterinary position, she worked full time under an established veterinarian who included elements of wildlife health in the practice. During this time she was presented with the opportunity of pursuing a master's degree on feline AIDS in the Hwange National Park through the University of Edinburgh which came about due to a microsystemic relationship with a previous supervisor from Onderstepoort.

It was during this Master's degree that she developed a specific interest in wildlife health and where she was exposed to the One Health veterinary concept. Once the veterinarian she had been working for sold his practice, she set out to find alternative work and into private practice in the United Kingdom to gain further experience. After returning from the UK, she was offered a contract position as the wildlife veterinarian for CapeNature and through this was exposed to Human Wildlife Solutions, a company whose main aim is the mitigation of human and wildlife conflict within the urban sector of Cape Town.

### **The issues facing the need and supply of biodiversity professionals**

As a practicing veterinarian, Dr Breed has encountered a number of factors which affected her and could potentially affect other young veterinarians. She felt that the exosystemic pressures of the current dangerous drugs legislation in response to the game industry exponential growth, the demands on a wildlife veterinarian pertaining to time and

responsibilities, as well as the limited size of the wildlife veterinary community made entering and remaining in this field particularly difficult [WV/Int.03.100].

She explained that there was an ongoing court case between the South African Council for Veterinary Professionals and the group named Wildlife Ranching South Africa, pertaining to the handling and use of dangerous drugs for game capture purposes. She informed me that, in the past, anyone who was involved in game capture or wildlife management was able to gain access to these drugs; however due to legislation being passed regarding the control of these drugs, a court case had ensued. As a result of the court case, access to these drugs has been strictly controlled and limited to veterinarians only, which has led to illegal operations occurring and this has had an impact on the young graduates entering the workforce. She informed me that graduates with limited experience could be hired by unscrupulous game capture companies in order to fulfil the prescribed need for a veterinarian on site and in order to access the necessary dangerous drugs. The inexperienced veterinarian would not actually be efficiently utilised within this role and the game capture operators would continue darting, as occurred previously. This would have ramifications for the development of the darting skills of the young graduate [WV/Int.03.35]. Another implication of the aforementioned court case, was the non-availability of various dangerous drugs and as a result, veterinarians needed to rely on alternative drugs for game capture and darting purposes. This had even greater repercussions for the safety of the individuals handling the drugs as well as potentially the animals on which the drugs were being used.

She was particularly concerned that the graduates and students were not entirely aware of these practices and might be implicated in potentially precarious situations, as they possibly had not gained this insight at University. She explained that although her degree had provided her with a certain depth of veterinary related knowledge and practical skills, she felt that the only way to develop critical skills, both generic and in particular operational skills (see section 2.3), was to practice and find a suitable mentor in an established veterinarian or supervisor [WV/Int.03.91]. Whilst stressing the importance of having a good mentor, she again made reference to her supervisor who had helped her to organise the master's project, as well as the first veterinarian she had worked for. She qualified this statement by saying: "... You see, there is a vast amount of knowledge that you do not know when you enter the working world. I mean you can learn it yourself, you know, trial and error, which is not the best way, whereas an older vet can just cut a few steps out for you ... You know, practical

things ... You know the person does the work this way or that or that works, and it is things that the university can never teach you ...” [WV/Int.03.91]. She made reference to the manner in which she was taught these skills at university and how, as a wildlife veterinarian, one needed to learn to adapt these skills for a particular setting, such as being on the back of an open truck or in the field and having to perform surgeries without the sterile environment of an operating theatre. She also alluded to the contacts and networking ability that an established veterinarian was able to access and stated that she had been fortunate enough to have worked with a veterinarian who had assisted her with this..

However, she did inform me that young graduates or veterinary students should not just rely on a mentor or supervisor, but should seek out opportunities through different platforms, and cited the South African Veterinary Association and their monthly publication, as well as the Google Wildlife Vet Nett and Onderstepoort itself, as places where a graduate could find possible opportunities.

Ending off the interview, she reflected that there was a need for wildlife veterinarians, especially with the rise in the game trading industry: “There are a lot of small animal jobs, wild animals a lot less ... But there is not enough demand for the conservation related veterinarians but more for the commercial or game related wildlife veterinarians” [WV/Int.03.103].

#### **4.3.4 Case Study 4: Dr Roxburgh [ WV/Int.04]**

Dr Roxburgh is a white, English male who was born into a small family, with no family influences within the agricultural or veterinary professions. Dr Roxburgh like Dr Pretorius and Dr Breed, was born and brought up in the late apartheid era, and he too had access to university to pursue his veterinary degrees. He is currently working as the assistant veterinarian at Motsumi Wild Dr Pretorius’ wildlife veterinary and game capture business. He was always passionate about animals and he states that his lifelong dream was to become involved with wildlife. Dr Roxburgh pursued a degree within conservation and biodiversity management and entered into the field of conservation. However, due to feeling unfulfilled in this field, he left the position and enrolled at Onderstepoort, with the idea of becoming involved with wildlife. Whilst studying through Onderstepoort he met and became friends with [WV/Int.02], his senior by a year. He remained in contact and upon graduation reconnected with Dr Pretorius, who then offered him a position as an assistant veterinarian.

Through this position Dr Roxburgh has gained both experience and further skills development. Although Dr Roxburgh is older than WV/Int.02, and has less work experience, he is essentially more highly qualified, as he has a master's degree as well as the basic veterinary degree obtained from Onderstepoort.

### **The issues facing the need and supply of biodiversity professionals**

Dr Roxburgh informed me that as a white male in a profession which as a result of apartheid, is facing transformation and Broad Based Black Economic Empowerment, he struggled to find a job within this sector. Another turn of events, he informed me, was the sudden growth in game ranching and the value of the game which are being bought and sold. This has had an effect on the veterinarians entering into wildlife medicine, as the openings for jobs within game capture companies far outweighs the availability of pure conservation medicine posts [WV/Int.08].

During his lifetime, he has been able to access various technological advancements, including information technology and relevant veterinary technology, which he draws upon substantially in his day to day routine.

## **4.4 RESPONSES FROM WOC 610 COURSE UNDERGRADUATE STUDENTS AND AN M. M.Ed VET POSTGRADUATE SCHOLAR**

### **4.4.1 BVSc Veterinary undergraduate degree and Wildlife Crocodiles Ostrich 610 Elective, WOC610 [WV/Int.06]**

Wildlife medicine has been allocated a three month elective in the final (6<sup>th</sup>) year of the previous undergraduate veterinary curriculum. The course is the Wildlife, Ostrich and Crocodile 6<sup>th</sup> Year 10<sup>th</sup> Semester (WOC 610). The class of 2014 consisted of 60 students, 15 of whom were able to participate in the interview. The balance were either writing tests or unable to attend. The other elective, Caged Birds and Exotics, consisted of 80 individuals and the difference in numbers was explained by nearly 70% of the present focus group participants: they stated that the Cage Birds and Exotics elective was the “easier” or “simpler” of the two electives.

The students representing the WOC610 class at the interview indicated that factors such as having an interest and or passion for wildlife from an early age, including exposure to game farms, nature reserves and parks, served as an integral part of their desire to pursue wildlife veterinary medicine . Additionally, the influence of microsystemic relationships, such as

those with family, friends and educators were motivating factors for them to become involved in wildlife veterinary medicine. However, none of the representative students had family members who were veterinarians themselves and therefore defined themselves as groundbreakers.

All of the individuals present, except for one, had completed a degree prior to acceptance to Onderstepoort. These degrees ranged from Veterinary Biology, Nature Conservation and Biodiversity Management to Agriculture and even Viticulture. The group commented that this was fairly standard practice and this was also reflected in the interviews I conducted with the practising professionals. When asked why this was so, the group informed me that it was due to a variety of reasons which included: failure to attain the required entrance marks, change of focus from one field of interest to another, namely in veterinary medicine, a lifelong passion recognised after prior work or life experience. They also informed me that these prior degrees had prepared them to enter into the veterinary undergraduate programme, which is understood to be a demanding course.

The students explained that since the degree's inception to now, the veterinary undergraduate curriculum had a strong emphasis on diagnosis, treatment and disease control, especially pertaining to domestic and or agricultural species and their handling and management. Although the institute Onderstepoort, as stated in section 2, was established in order to assist with the external influences and threats from wildlife to the newly emerging agricultural sector, little focus on wildlife diseases and wildlife veterinary medicine is evident, nor has this been developed significantly, as per [WV/Int.06].

The group recommended that the veterinary curriculum should be improved to respond to the demands of current veterinary health related issues in keeping with a broader global perspective. The students felt that the skills gained through their undergraduate course and certain techniques which were demonstrated in experiential opportunities, were outdated or to a degree limited. They stated that this was evident upon entering work-shadow or experiential opportunities. Additionally, a concern voiced by the group was the inability of the young veterinarians to obtain sufficient experience handling darts and the actual darting practice.

Exosystemically, a factor which affected the students was the limited time between the tests, lectures and practicals, often resulting in the students having to choose what session they felt they would benefit from most, at the cost of attending another potentially useful session.

They claimed to have approached their supervisors about the matter, however time constraints within the curriculum seemed unavoidable and their lecturers encouraged them to attend sessions they felt were most beneficial to their career trajectory.

Microsystemically, the presence of two supervisors, Professor Burroughs and Professor Kock, were unanimously identified as playing influential and supportive roles in connecting the students with opportunities with established veterinarians and wildlife centres, enabling the development of skills and growth as an aspirant wildlife veterinarian. This same sentiment was echoed by Dr Roxburgh in his interview, see section 4.3.4.

Both Professor Burroughs and Professor Kock have been extensively involved in the wildlife industry for over 30 years, and dedicate time to seeking out opportunities for the students to obtain both skills and experience. They have witnessed the growth and development of the sector and are equipped with the knowledge and networking capabilities, in order to assist with the transition of the young veterinarians. As reported by the students, this has been very advantageous, as they have been exposed to and regularly informed of the developments within the wildlife veterinary field.

The students referred to the exosystemic influences of the sudden boom in the game industry and the ongoing court cases between Wildlife Ranching South Africa and the Veterinary Medicines Council, and as stated by [FG/01] and [WV/L1] and [WV/02], this has implications for the inclusion of young wildlife veterinarians into the game industry, often by unscrupulous game capture companies. The students understood that this situation could lead to the employment of young inexperienced veterinarians, purely for legal purposes and the obtainment and handling of dangerous drugs.

As has been mentioned in sections 4.3.1-4.3.4, the sudden exponential growth of the game industry is seen as both a constraining and enabling factor. “If you went to a wildlife auction three years ago, you’d know everyone ... All the wildlife farmers would be there that you know and all the vets ... but it was like a handful of them (vets) ... and everyone knew everyone. Go to an auction now and you’re introduced to someone via someone else ... and you have never heard about them before” [WV/Int.06.201].

Approaching the transition can be especially difficult for the students to do on their own, as often they are not taken seriously or claim not to have sufficient time with which to organise

external practice to further their experience [WV/Int.06]. A number of the focus group students were worried about the geographical location of jobs which does not always coincide with needs of the students who are considering relationships, family responsibilities and access to veterinary resources. This was identified by the Priority Skills List for Biodiversity (SANBI & GreenMatter/Lewis Foundation, 2012) as one of the factors contributing to the scarcity of the skill.

The student group reported that they had been informed by recently qualified veterinarians that upon entering the workplace, younger graduates often find employment in a practice alongside more established veterinarians. Often clients prefer to have the more established veterinarian assist with their animals, rather than the newly qualified individual. “If you were to start with Manie (wildlife veterinarian) over the weekend and a client phones in, and he can’t get to the farm and you arrive at the farm ... and they are like ... ‘Where’s Manie?’ ... They want that experience and they want that vet, not you.”

In concluding the interview, the students stated that the sponsors, such as Hills, Eukanuba, and Royal Canin in association with Onderstepoort, assist young vets in attending various symposiums and conferences. The focus group reported that this provided networking opportunities for the students, allowing them to meet more established individuals: “Find sponsors, various veterinary medical suppliers, to help sponsor your travels to and from the conference and to cover costs of a congress or conference.”

#### **4.4.2 The M.Med Specialist Veterinary Degree : Dr O’Dell [WV/Int.05]**

With Dr O’Dell, I begin by touching on his transition from being an undergraduate to a veterinary specialist, incorporating his thoughts pertaining to the undergraduate curriculum at Onderstepoort. Thereafter I present his reflections on the constraining and enabling factors which may influence the students whom he assists as a lecturer.

Dr O’Dell is a white, Afrikaans speaking male, born in the early 1980s who grew up with his family in an urban environment in Johannesburg. His exposure to rural and agricultural experiences occurred as a result of microsystemic relationships with school friends, as he spent time in his youth on a friend’s game farm where he developed an interest in wildlife. He informed me that this interest in wildlife had effectively influenced his decision to pursue this field: “I wanted to go into wildlife conservation and that is what lead me to go into (Wildlife veterinary medicine) ... and it is still my goal” [WV/Int.05.146].



He began his studies by enrolling in the BSc (Veterinary Biology) programme run at the University of Pretoria, which was a prerequisite for students wishing to enrol for a BVSc degree; however this is no longer the case as this course was discontinued after the inception of the last WOC610 class, see section 4.4.1.

After spending two years in the Veterinary Biology course, he applied to Onderstepoort to conduct his undergraduate degree in Veterinary Medicine. As one of the last of the contingent of students to have been accepted to Onderstepoort by obtaining a certain academic standard as well as undergoing an interview, he reflected on the benefits of this process, especially for those wanting to enter the wildlife veterinary field: “In the past they used to interview you; it counted for 50% towards your chance of getting in and your marks counted 50% ... So you could have been an average student, but if you really had an interest in wildlife or something scarce ... then you might get in ...”[WV/Int.05.110] “ ... but obviously if they choose somebody with an interest in wildlife, they will wind up doing wildlife one day” [WV/Int.05.112].

He was accepted to Onderstepoort to begin his BVSC degree. During his undergraduate degree he was able to attend SYMCO, a biannual wildlife symposium held in Pretoria over two weeks which is offered to veterinary students who wish to gain exposure to wildlife veterinary medicine and furthermore want to pursue a career in wildlife veterinary science: “Ja, so basically ... it is about 20 odd South African students and then 60 foreign vet students from all over the world that come on this two week long symposium... lectures and then some practical work... travel all over the country and... learn more about wildlife” [WV/Int.05.32]. He stated that through this opportunity he was able to gain valuable insight into the field of wildlife veterinary science, which would be valuable toward his development as a wildlife veterinarian.

In his role as an undergraduate veterinary student, he formed a new microsystemic relationship with his current M.Med Vet supervisor, Professor Burroughs, who, after the completion of his BVSC, encouraged him to pursue a specialist degree.

Additionally, Dr O’Dell was offered a clinician post and assists with lectures in the WOC610, where he has integrated his knowledge of and exposure to wildlife into both lecturing and practical demonstrations, whilst completing his three year specialist degree.

Dr O'Dell explained that the M.Med Vet degree is a three year degree, during which the individual is supervised by one of four qualified supervisors recognised by the University. Thus, a constraint of this course is that, as has also been explained by Professor Burroughs, the availability of the supervisors. Three of these supervisors are based at Onderstepoort and one is based in the Kruger National Park and in order to register for the M.Med degree, a candidate must obtain work at either the Kruger National Park or Onderstepoort in order for the required supervision to take place.

He emphasised that most vets who qualified with an undergraduate degree through Onderstepoort were competent to deal with domestic animals upon exiting Onderstepoort; however, they were not necessarily able or willing to deal with wildlife: "I think most of the vets who walk out of here are more than competent to handle small animal cases, dogs and cats When you get to different animal species, birds, wildlife, cattle ... I think the guys are less willing to do it ... or less able to do it ... but it did not stop me, and if you have a passion for either wildlife or production animals, it is really not going to be a constraining factor" [WV/Int.05.144].

### **The issues facing the need and supply of biodiversity professionals**

Dr O'Dell, gave the following responses when questioned about factors that had influenced him and could potentially influence the students within the undergraduate program.

Like that of WV/Int.02, WV/Int.03, WV/Int.04 and the WV/Int.06, Dr O'Dell has been affected by the boom experienced in the game industry. However, although this can be a lucrative market to enter into, he positioned himself as a wildlife veterinarian focussed on conservation medicine, and not on the commercial side.

He commented on the undergraduate course held at Onderstepoort and stated that although this is understood as a positive factor, the wildlife training held at Onderstepoort is not entirely able to match the demands for these skills. The current undergraduate curriculum has been restructured every 5 years but the growth and development of the wildlife veterinary industry on a global scale occurs on an almost monthly basis. As is evident by the statements below: "I think the wildlife training at this stage is definitely lacking if you compare it to small animal medicine... so and that is probably due to the fact that the industry has grown

almost too quickly for the university to adapt, in a way. Because curriculums and things are formed every few years, whereas the industry changes almost monthly...” [WV/Int.05.98].

He explained that the WOC610 is a theoretical course, which has some practical components. He stated that although the practical elements of the course were slight, they were in fact more than some overseas universities incorporated. As per the following statement, “ ... basically it is an elective module in the 5<sup>th</sup> year (with the last group in the old curriculum, this elective occurs in the 6<sup>th</sup> year), in wildlife, ostriches and crocodiles, you don’t have to do the subject, it is your choice, but obviously if you are interested, that is the subject you take... and it is one of the very few choice subjects that Onderstepoort offers at this stage... so that is basically a theory course with a very basic practicals...” [WV/Int.05. 114].

One of the key skills that a wildlife veterinarian requires is darting, which according to Dr O’Dell, Dr Pretorius, Dr Breed and Dr Roxburgh, as well as the wildlife veterinary focus group, is introduced during WOC610. However, the students are not allowed to practice darting due to ethical constraints and stipulations from the South African Veterinary Council. “Specialist skills, obviously being important for wildlife is... darting, which we do the practical of...we discuss the emphasis on dart placement... unfortunately they never get physical experience of darting an animal...” [sic] [WV/Int.05.116]. “Other core skills are definitely ... knowing and applying knowledges of basic and important wildlife diseases” [WV/Int.05.118].

Furthermore, Dr O’Dell stated that during his undergraduate degree he was not exposed to generic critical skills such as: veterinary business life, practice management and client interactions. “All that generic stuff, you need to be able to communicate with clients... [WV/Int.05.126] in our course we did generally stuff like that, veterinary business life, practice management, but it was not really emphasised... and you think you are a vet and that you are going to work with animals, but that is totally not the case... you work with clients” [WV/Int.05.128].

Pertaining to gaining experience he stated that often the students and recent graduates approach established veterinarians, returning to their own towns and communities, seeking experiential opportunities and or work posts. And often, their first job will be with one of these vets, with whom they conducted work shadow and experiential training. “most guys if they are from a farming community they end up going to, back to the area they come from,

and they, they, not just farming communities, but also those from the cities... so...you know, normally their first job is at their local vet, that used to attend to their own farm animals. And they used to go as students to do electives there (to that practice). So that is how most guys find their first jobs” [WV/Int.05.80].

He stated that graduates did have access to advertisements and networking spaces, he informed me that at regular intervals during the year, advertisements are placed up, indicating vacancies for young veterinarians, or recent graduates. However, he stated that the regular advertisement of wildlife veterinary related posts is restricted, and there are limited positions available on the internet, this finding too, has been reflected in Dr Pretorius’ interview. Additionally, he stated that the presence of external companies, such as Vetlink, which has an affiliation with Onderstepoort, made provision for advertising and information sessions with the students at the end of the year in their final year [WV/Int.05.80]. “Networking is important and we have a valuable tool, it is an email based forum and the guys really get to know one another on there... then there is also the wildlife group of the South African Veterinary Association and this year we have started to sponsor students [WV/Int.05.50].

Dr O’Dell concluded that the field of wildlife veterinary science is exceptionally diverse, “From parks where you can do pure conservation medicine, to farming or treating individual animals in your clinic... to doing charity work for conservation organisations, the student needs to be exposed to all of that to know what to do” [WV/Int.05.153]. He stated that although advertisements were listed, there was scope for development and integration of the recent graduates within the workforce, especially with relation to the sudden growth within the game industry.

#### **4.5 THE CURRICULUM AND SKILLS EXPLAINED AND THE WAY FORWARD: CURRICULUM ADVISORS AND LECTURERS**

##### **4.5.1 Professor Burroughs [WV/Int.07]**

A white male, born in Zimbabwe, completed his initial degree in Botany and Zoology through the University of Cape Town, after which he pursued his veterinary degree, which was a 5 ½ year course. Thereafter he did his national service year, through which he was exposed to wildlife. He stated the following: “...within that national service period I worked a little bit with some wildlife, which had always been my kind of interest, but I never knew how to get into working with wildlife at that stage... you really just had the general kind of

training available to you in terms of cats and dogs and large animals, with very little scope for actually becoming involved in any kind of wildlife” [WV/Int.07.04]. Post national service year he worked at the Pretoria Zoo as the veterinarian and remained in this position for another 9 years. He gained experience with working with a variety of exotic and local species of animals, he states the following: “... there was a greater need for having some sort of veterinary input, either in terms of wildlife translocation or actually just clinical treatment of animals”. He left the Zoo and began his own business in the form of a wildlife veterinary practice, which he ran for 12 years. Professor Burroughs had to make the decision to change his job, due to family responsibilities, time and structural constraints, “A factor which affects most vets is that of family commitments” [WV/Int.07.08].

During this time he was involved in specialised game capture, consulted for breeders of specific captive animals, as well as provided management plans and consultancy services for the management of captive animals. Professor Burroughs stated how he is instrumental in the provision of continuous professional development courses to established veterinarians, some of which included: Avian anaesthesia, Ostrich management, specialised game capture. Furthermore, as stated in the microsystemic factors, he provided a service to veterinary students, both locally and international, to gain experience and shadow him. However, he emphasised the exosystemic factors of time and a lack of space within the curriculum as affecting the inclusion and participation of local students, factors he regretted.

After resigning from his position in the Department of Agriculture, he became the head lecturer on wildlife and production animals, a post he remained in until the post for the director of the Centre of Wildlife Studies at Onderstepoort became available. Professor Burroughs took up this position and currently still is in that role. He continues to provide short courses for established professionals, as he has done for a number of years. Furthermore, he contributes academically to the veterinary field by regularly publishing academic articles. He explained that he fulfils three main functions as centre director. First, he has clinical duties and second he is involved in facilitating networking and liaising with other departments at Onderstepoort as well as with external organisations. Lastly, he works to promote wildlife research and further studies through the Centre of Wildlife Studies.

The development of the centre for wildlife veterinary studies has been a factor in facilitating the exposure of students to the opportunity of working with wildlife, furthermore, the interest and numbers of students into the WOC610 elective has increased since 2009.

Regarding the current status of veterinary education, Professor Burroughs started by explaining the entrance requirements to Onderstepoort, which have changed over the past decade and with the subsequent curriculum change as of 2009. Whereas previously the candidates were accepted on the basis of an interview and high matriculation results, the current entrance requirements consist of a written examination and a minimum of 82% average result in matriculation examinations, as per section 4.2. The formal interview is no longer part of the selection procedure and Professor Burroughs mentioned that this was possibly due to the risk of bias which could cloud the interview process. The admissions process at Onderstepoort requires the students to fill in a form prior to admittance indicating the area of veterinary science they would like to specialise in, which affords them the option of pursuing wildlife veterinary science. Taken into account in this process is their background, and from these factors certain number of points are weighted for each answer. “This serves as a mitigating measure to stimulate graduates to enter into a specific field” [WV/Int.07.70]. He added that the exosystemic influence of the Department of Higher Education and Training in the form of subsidies given to the university for students can also indirectly affect the numbers of students going into the wildlife field [WV/Int.07.34, 36].

From a macrosystemic perspective, Professor Burroughs alluded to the legacy of apartheid which was evident in many universities and places of learning, including Onderstepoort until recently, where Afrikaans was the primary language of instruction. He felt that this factor contributed to the conservative and stringent approach to education within the institute. Over the last decade, English has replaced Afrikaans on the Onderstepoort campus.

Professor Burroughs reported that the undergraduate curriculum is adapted on a 5 year cyclical basis and currently does not allow sufficient time for practical experience which is an example of an exosystemic limiting factor. He noted that this could limit students’ participation in wildlife medicine activities, as was stated in interview Dr O’Dell. Undergraduate wildlife medicine exposure is limited to the wildlife elective WOC610, minimal wildlife material within the curriculum and the occasional case presenting to the veterinary hospital. Furthermore, he stated that: “There is no curriculum which defines what a

wildlife vet should know or do ...” [WV/Int.07.90]. However, he mentioned the inception of the new One Health curriculum, which is a more holistic approach to veterinary medicine, will offer extensive exposure to wildlife and wildlife training to students, and will come into effect in 2015.

The change in curriculum is a welcome one as Professor Burroughs commented on how the interest in wildlife elective, WOC610, had increased over the past half decade: “The interest in WOC610 has grown since when I started in 2009 ... from 30 students in a class to fifty and this past year’s class is 70 out of a group of 120 students” [WV/Int.07.19]. He emphasised that there were no entrance requirements for this elective and that participating in the class was purely based on individual choice. He stated that many students from agricultural backgrounds had chosen this particular elective and after graduation returned to their homes to general or large animal veterinary practice.

Professor Burroughs went on to touch on the subject of dangerous or capture drugs as part of the elective course content. This topic is introduced at the undergraduate level during the WOC610 elective, although, the students are not actually allowed use the drugs at this stage or practise darting of wild animals due to the veterinary council regulations. Professor Burroughs commented that these exosystemic factors cause a regrettable lack of experience in the use and applications of the drugs, which has implications for the valuable animals involved and the veterinarian-client relationship. As has been previously discussed, there is an ongoing court case between the Veterinary Council and Wildlife Ranching SA regarding the regulation of these drugs.

Professor Burroughs referred to the TOPs and CITES legalisations, as being influential in the functioning of a wildlife veterinarian’s day to day job, as per section 4.1.

This is briefly introduced during the undergraduate curriculum, however, the onus is on the graduates to obtain information pertaining to legislation upon graduation.

Once graduated, Professor Burroughs informed me that the young graduates not only need to accrue capital with which to either join or begin practices of their own, but they also need to consider the cost of equipment, drugs and essential continuing professional development courses. Thus, financial constraints are a limiting factor to newly graduated veterinarians. [WV/Int.07.118]. He also stated that technological advancements within the veterinary field

have given young graduates an advantage in the workplace, while social networking has afford access to information regarding work experience and job opportunities [WV/Int.07.80].

Once again, he highlighted macrosystemic boundaries which the young graduates may encounter, as the impacts of language, cultural and racial barriers, as previously stated affect the young graduate's choices and decisions of where to find work and where to work, especially young black veterinarians [WV/Int.07.114].

Additional macrosystemic factors linked to the aforementioned points of medium of curriculum instruction were those of the racial and language barriers evident within the communities that the veterinarians serve and which could affect the young non-Afrikaans speaking graduate. Professor Burroughs explained: "I think to a large extent racial issues are a big issue, particularly if young black vets graduate, they would not easily find work within fairly conservative circles ... Language is an issue too ... If you do not have a strong Afrikaans background, or you cannot make yourself understood well ... or even if you are from another country, you'd suffer on the programme<sup>4</sup>, although we run the programme in an English medium" [WV/Int.07.114]. Professor Burroughs concluded by stating that although there was a demand for wildlife veterinarians, especially within pure conservation medicine, there was little to no interest in research into this issue and that the actual discrepancy between numbers of veterinarians required in the field and the number actually practising is not known. He reported that "... there is no quantifiable study to show how many <sup>5</sup>vets we need in the country" [WV/L1/90]. He supported this statement by adding, "There isn't the funding or the interest in pursuing a study on these shortcomings" [WV/L1/94].

#### **4.5.2 Professor Kock [ WV/Int.08] Lecturer:**

"Being a wildlife vet and being a good wildlife vet is something that comes from experience" [WV/Int.08.62].

The first part of section 4.5.2 briefly covers Professor Kock's transition from veterinary graduate to his current position as wildlife specialist and lecturer at Onderstepoort. The

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<sup>4</sup> The Bachelor of Veterinary Sciences Degree at Onderstepoort.

<sup>5</sup> Vets in this instance refers to wildlife veterinarians.



second part details his views on the curriculum, his current role and the factors that he identified as affecting young graduates.

Professor Kock is a white male, born in Zimbabwe during the 1950s, and has been involved in the wildlife veterinary industry for 34 years. His brother holds a dual position of a wildlife veterinarian as well as a leading professor in wildlife health and diseases at the Royal Veterinary College. Professor Kock highlighted their shared passion for wildlife as being a motivating factor for them pursuing this career. Both brothers attended international universities: he attended the University of California Davis in the United States of America, completing a two year residency programme, while his brother attended the Royal Veterinary College in London. His decision to participate in the residency programme was twofold: first he was attracted by the invaluable wildlife experience offered by the programme and second, the macrosystemic impacts of apartheid had resulted in a desire to leave South Africa for the United States.

Professor Kock emphasised the role that this residency and its setting had played in his development as a wildlife veterinarian: “I went to the University of California Davis, the first in the world to have a residency programme in zoos and in wildlife medicine. Now, if you look around the world in Australia, United States of America and Europe, there are many more programmes” [WV/Int.08.08]. He went on to add: “my residency allowed me to follow my nose, which allowed me to pursue my passion in life, wildlife” [WV/Int.08.10]. During his two year residency, he was able to train under the guidance of one of the top wildlife veterinarians in the world and commented on how this had equipped him with both experience and the tools with which to enter into the workforce: “Once I had finished the residency that was it; I had established the groundwork and a broad base of experience” [WV/Int.08.10].

Over his career span of 34 years from graduation to date, he described a range of experiences which moulded him into an established, skilled veterinary professional. He mentioned that he has worked on three different continents and extensively throughout Africa, with particular highlights being his residency at the University of California Davis, his time spent working at the Department of Fisheries and Game in the United States and a period working in Zimbabwe on returning to Africa from the States.

As a result of his extensive experience and wealth of wildlife veterinary knowledge, he was headhunted by Onderstepoort, as a wildlife specialist, to lecture within the Production Animals Department, and on the WOC610 course. He stated that his motivation for accepting this position at Onderstepoort was to pass on his knowledge and the benefits of his training accumulated over 34 years. He accentuated the critical need in the veterinary workforce for students with a certain amount of experience. He felt that in his current role, his responsibilities included exposing students to a variety of opportunities, including field observations, as well ensuring that he instils in them a broader understanding of conservation and the involvement of veterinarians. As such, he identified himself not only as a lecturer or a wildlife specialist, but as an agent of change. He alluded to the regimented, conservative outlook which had been associated with the lecturing and curriculum at Onderstepoort for many years. He partly attributed this to the impact of apartheid which, he maintains, resulted in resistance to change or new ideas; however, he did say that the conservative system at Onderstepoort was slowly being transformed to accommodate and serve all individuals. [WV/Int.08.30]. He referenced the imminent inception of One Health into the new curriculum and the alteration of the language of instruction from Afrikaans to English.

The new curriculum in which the One Health ideology has been integrated, One Health has been shaped by input from a range of disciplines including veterinary science, conservation, disaster management, social science and medicine, will be offered from 2015, as per Burroughs, section 4.5.1. He emphasised that the inclusion of these diverse elements allows for an integrated, holistic approach to medicine and wildlife management, which he felt is advantageous for veterinarians entering the workforce. He stressed that the change in the undergraduate veterinary curriculum was vital in order to provide veterinary students with a comprehensive picture of the realities of veterinary medicine. However, he did inform me that from the first year of the undergraduate degree, the students are allowed to specialise in a particular field, which can affect the numbers of qualified veterinarians entering certain fields. This can at a later stage also hinder individuals who seek a generalist degree, and this was a view which the wildlife veterinary focus group shared. This represents a significant departure from the current curriculum where the specialty field of wildlife medicine is only introduced late in the degree.

## **Issues facing the young Veterinary students and graduates**

He stated, agreeing with Dr Burroughs that wildlife veterinary science in the current undergraduate curriculum was limited to the 6<sup>th</sup> year elective and a small proportion of the production animals lectures. He felt that this is at odds with the history of Onderstepoort which was established primarily to address wildlife issues within the agricultural sector. WV/L2 stated the following: “Onderstepoort for me has not been able to provide an enabling environment for students to learn about wildlife in a country which has such a significant wildlife industry and there will always be a significant need for veterinarians I believe” [WV/Int.08.12].

Furthermore, he stressed that the current exposure of students to wildlife in the clinical setting comprises the occasional cases being brought into the hospital and the excursions or opportunities which lecturers, such as himself, Professor Burroughs and Dr Salt can provide. However, he stated that Onderstepoort was one of the few universities which was able to provide such opportunities for students, which is often not the case for European institutions, as informed by his brother, who is a Professor at the Royal Veterinary College.

Professor Kock explained that external factors such as climate change and anthropogenic pressures have and continue to influence the veterinary field and have lead to wildlife being identified as a threat to the agricultural sector. As a result the veterinary profession has faced difficulties relating to wildlife and its management. Additional factors affecting the education and practice of veterinary medicine, include political influences and legislation, more particularly the handling and use of dangerous drugs which is controlled and monitored through the South African Veterinary Council legislation [WV/Int.07.12].

Chronosystemically, he also stressed that the wildlife veterinary industry has been significantly affected by the sudden explosion within the game farming industry, which according to him is being influenced by “ a cartel of people who are driving prices up, and you work with individuals whose animals are extremely valuable, which puts enormous pressure on you... so I feel that if you take young vets or recent graduates and stick them in a field, they begin to work with wildlife, and don’t have the training, it’s not good for the profession or for them either, and vets are not compensated for this either” [WV/Int. 08.50].

He repeated the impact that apartheid, as a dual macrosystemic and chronosystemic factor, has had on Onderstepoort. He then commented that the previously conservative system is slowly being developed to accommodate and serve all individuals; although coloured or black graduates still struggle to find work in certain conservative areas. Finally, he commented on the limited representation of non-white race groups and females at the wildlife management meetings that he attends. He did mention that this was changing and gave examples of a black state veterinarian colleague, as well as a young Zimbabwean veterinarian whom he had helped to guide and mentor, labelling them agents of change. He stated that one of most difficult stages for a young veterinarian, irrespective of colour, is that of getting “one’s foot in the door” [WV/L2/90], although, the presence of a mentor, as was stated in his own mesosystemic factors, can assist in this process. Once again he stressed his continuous effort in assisting students obtaining work experience and recent graduates in successfully entering the workforce. He did however inform me, that a certain level of dedication and effort from the students and graduates is required in certain areas, such as networking.

Also from a chronosystemic perspective, he mentioned that the continuous improvements in technology had led to increased networking opportunities for young graduates. Professor Kock added that, through the medium of social and online networking, a young veterinarian could alternatively access the following institutions to look for work: universities, laboratories, zoos and aquaria, primate facilities, pure conservation organisations, the game industry and veterinary practices.

He added that further opportunities were available to aid in preparing a young graduate for the workplace. He explained that there are establishments which offer recent graduates, as well as qualified veterinarians on sabbatical, the opportunity of gaining experience within the wildlife veterinary field; however, this experience comes at a cost. Professor Kock commented saying: “The development and presence of institutions offering experience or experiential opportunities to recently qualified veterinarians is often too costly and impractical to be positioned at South African recent graduates and instead often attracts attention from overseas and wealthy clientele” [WV/Int.08. 90]. He mentioned that there are established veterinarians who would be willing to take on students or recent graduates at little to no cost and thus act as mentors for these individuals.

In keeping with the comments of previous respondents, he commented on further financial barriers to young graduates transitioning to the workplace. These barriers included the difficulties in raising sufficient start up capital for a new practice or the funds necessary to join an established practice. The accrual of veterinary equipment and integration of up to date technology into their practice have further financial implications for young graduates. This, he stated, was unavoidable and did unfortunately impact many of the graduates entering the workforce. He suggested that graduates approach an already established professional to seek employment opportunities, or even that they locum to gain experience until finding a suitable position.

In conclusion, Professor Kock stated that the numbers of wildlife veterinarians has increased over the past three decades and commented on the impact of the field: “The influence of vets is far more significant now than it was historically”. He did feel that there were many individuals entering into the game industry sector of wildlife veterinary science and not enough entering into the pure conservation medicine and specific species operations, and felt that this should be addressed.

#### **4.5.3 Dr Paula Salt [WV/Int.09]**

The first section of the interview with Dr Salt, outlines her transition from veterinary graduate to her current position as Wildlife lecturer at Onderstepoort and postgraduate student; the second portion pertains to the curriculum and the factors she has identified as affecting young graduates.

Dr Salt is a white, female foreign national, originally from Germany. She came to South Africa in 1996 having been given an opportunity to complete her practicals and gain experience in the country. She completed her practicals at Onderstepoort, under the guidance of Professor Burroughs from 1996 to 1999, after which she decided to remain in South Africa. This, she highlighted, was partially as a result of the influence of Professor Burroughs, who was her mentor during her clinical years. However, in order to remain in South Africa she had to complete her board exam in 1999, a mandatory requirement for veterinary professionals. After completing her board exam, she realised that she needed to gain experience to further herself as a wildlife veterinarian. She then began to actively seek out onsite veterinarian posts at game capture companies which she described as being a good way to get one’s foot in the door in wildlife veterinary medicine, as well as providing

invaluable experience [WV/Int.09.59, 65]. She initially worked as a private veterinarian within various game capture teams throughout South Africa and has since initiated her own game capture business, which is still in operation, although she divides her time between other occupational and academic activities.

Dr Salt informed me that she was completing her postgraduate degree, M.MedVet in wildlife veterinary medicine through Onderstepoort; although the degree is not required for an individual to practise wildlife veterinary medicine. She commented that the programme is a demanding one and is not simple to navigate even for an individual without extra responsibilities. She mentioned that time-limiting factors such as family responsibilities affected the numbers of students deciding to embark on further postgraduate studies. Despite the rigour of her academic schedule, she was not only busy with this degree but had also taken up a lecturing position two years previously in the Production Animals department at Onderstepoort.

She explained her role as a production animal and WOC610 lecturer, and student mentor: “I take them (students) to wildlife places and production animal places and production animal cases and let them do most of it (the consulting) ... I tell them to communicate with clients and if they are not comfortable, then I do it ... So I feel at Onderstepoort that the preparation is really good compared to what you’d get in other countries ... but we are trying to intensify the wildlife training at Onderstepoort”[ WV/Int.09./38], [WV/Int.09.46].

Dr Salt then referenced the new One Health curriculum, as did Professor Burroughs and Professor Kock which now includes elements of the wildlife medicine specialty and allows students a broader choice: “... from next year will be a different system, where they, students, choose the path, but then again, if your marks are bad, you might not have a choice” [WV/Int.09.32].

With regard to the current curriculum she also commented on the limited experience students’ gain in darting animals and dealing with dangerous capture drugs which she considers as one of the most important tasks of a wildlife veterinarian. She stated that the game capturing operations can be compromised by individuals who are not familiar with rifle handling and darting and that “darting experience comes with years, it does not just come... it’s the experience you have to gain”. “However, Dr Salt did inform me that there are darting

workshops for postgraduate individuals and veterinarians who are interested in pursuing a career in wildlife veterinary medicine.

### **Issues facing the young Veterinary students and graduates**

Dr Salt identified the presence of a mentor as being a vital mesosystemic factor for the successful transition of a young graduate. As a mentor herself, she highlighted the value of a mentor in assisting their mentees in gaining knowledge and skill in various areas, such as darting, anaesthesia, handling of new species and networking. However, she did add that there were veterinarians who were reluctant to open their doors to young, ambitious veterinarians, for fear that they would utilise the skills they gain to begin their own venture and in doing so, poach clients from the established veterinarians. She added that she felt that the number of wildlife veterinarians within the game capture industry was sufficient: "... there are enough wildlife veterinarians. So you, as an established vet are reluctant to employ a young and ambitious vet ... worried that he'll open up his own shop near you ..." [WV/Int.09.80].

When asked to share examples where a young veterinarian could get a "foot in the door", she gave the following advice. Dr Salt emphasised the importance of networking and being able to sell oneself, as a critical step to entering into the wildlife veterinary field. She suggested that there are various opportunities for young veterinarians, including joining the South African Veterinary Association wildlife group, a supportive network of veterinary professionals, which often aids in assisting students and recent graduates with networking, conference support and sponsorship. The advent of both, IT and technology particular to the veterinary field has allowed for the advancement of veterinary professionals through the use of social networking and enables day to day tasks and skills development. She emphasised the social media network of the Google Group, Wildlife Vet Net, a monitored online platform which young veterinarians can join, but only with the backing and support of an established veterinary professional. However Dr Roxburgh has not yet been granted access to this group, although his employer Dr Pretorius has given his full support and recommendations. Furthermore, she stated that one of the best networking and experience gaining opportunities for young wildlife veterinarians, is to offer their services to game capture companies at a reduced rate, as she had done, as the possibility for mistakes to occur and losses to be incurred were much higher than that of an established veterinarian [WV/Int.09.59],

[WV/Int.09.65]. Dr Salt did offer the following support for this statement, stating that because of the sudden growth of the game industry, there were copious game capture companies offering work opportunities to recently qualified veterinarians. “The companies are often willing to absorb the costs or losses of you as the young vet, if you are happy to let them dart, and will include you as time goes by” [WV/Int.09.59]. This is of particular importance when it comes to the darting of valuable wildlife, as mentioned previously.

Once again a major challenge she felt would hinder wildlife veterinarians entering the field, was the lack of darting experience, which could compromise a game capture operation, leading to financial losses and potential client losses. She added the following “ The value of game is so high that you need to learn what to do... and which clients you do not need to deal with as they will take you to court, if they suffer losses...” [WV/Int.09.59]. The intensification and growth of the wildlife industry over the past two decades has led to the establishment of many game capture companies, as well as illegal operating groups.

However, Dr Salt did emphasise the role of illegal game capture operations and the current legal status<sup>6</sup> regarding the handling and possession of dangerous drugs. The illegal game capture operations are cheaper than utilising a veterinary professional. The animals captured are sold at a lower price as no veterinary fees are included in the entire operation, and the company then makes a larger profit.

She stressed two specific macrosystemic issues, firstly the boom in the game industry, which has led to extreme interest by business and high profile individuals and secondly an increase in the operation of illegal game capture companies and unscrupulous businesses. All of which effect the veterinary profession and the entrance of a young veterinarian into the workforce.

A final exosystemic factor Dr Salt highlighted was of the financial implications versus demand for wildlife veterinarians: “Wildlife Ranching South Africa says that we do not have enough vets that are skilled in wildlife ... but the problem is that they want someone to be there when they shout, but who pays or supports that someone when they are not in demand? ... I never had enough work; I would have liked more work” [WV/Int.09.36].

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<sup>6</sup> The current court case between the Wildlife Ranching South Africa and the Council of Veterinary professionals regarding the handling and possession of dangerous drugs used in game capture by non veterinary professionals.



## **4.6 CONCLUSION**

In this chapter, the aim was to present the data obtained through the three data collection methods and in doing so, illuminate the factors which have been identified as affecting the transitions from university to workplace of wildlife veterinarians, the scarce skill under study in this chapter. This data will be discussed through the application of analytical statements, in conjunction with the information collected from the freshwater ecology case study, in Chapter Six. In the next chapter I present the data pertaining to the freshwater ecologists, the second scarce skill under study in this thesis.

## **Chapter 5: Case Study 2: Transitions of Freshwater Ecologists from university to the workplace**

### **5.1 INTRODUCTION TO CASE STUDY B: FRESHWATER ECOLOGISTS**

This chapter presents data particular to case study two, namely: freshwater ecologists and aims to highlight factors encountered or anticipated by participants in their transition from university to the workplace.

The chapter begins with the history of and background to freshwater ecology in South Africa, as communicated to me by a number of established professionals and lecturers from the University of Stellenbosch and Rhodes University who participated in this study. After which, the chapter moves into the interviews held with the supervisors and lecturers which focussed on two aspects, namely the inclusion of freshwater systems, including wetlands, into the curriculum and the factors which these individuals identified as being constraints or enablements for the students' and graduates' transition to the workplace.

The findings from the interviews with graduates and current students are reported on, describing their version of their own transition(s) by drawing on the principles of Bronfenbrenner's ecological systems theory, as per description in the overview of chapter four and five. The chapter concludes with a short summary, setting up the reader to enter into the final chapter, through having presented the findings across this particular case study, thereby providing the background for further discussion in Chapter Six.

### **5.2 BACKGROUND TO FRESHWATER ECOLOGY AND INDUSTRY NEEDS IN SOUTH AFRICA**

Initially I had planned to research wetland ecologists and interviewed leading established professionals within the field. However, these individuals did not limit themselves to speaking about wetland ecology, but incorporated the broader sphere of freshwater ecology, of which wetland ecology forms a part. Their comments are reported below and address various aspects such as the history of freshwater ecology in South Africa, the tools which have been designed and shaped for South African biodiversity and the issues facing this field. Thus, the focus of this study became freshwater ecologists and not wetland ecologists as originally planned. Briefly introduced are professionals who participated in shortened interviews pertaining to freshwater ecology within South Africa.

Professor Ellery, [FE/Int.11] is the head of the Geography Department at Rhodes University.

He began his academic career at the University of Witwatersrand, where he completed his undergraduate and postgraduate degrees, as per section 5.2.

Professor Kotze, [FE/Int.14], is a well renowned established professional within terrestrial and wetland ecology, associated with the University of KwaZulu-Natal. He lectures within the terrestrial and freshwater ecology systems, and provides supervision to several post graduate students, including Ms Nhleko [FE/Int.01] during her honours year. He gave an account of the history of the sector, especially pertaining to wetland ecology.

Dr David Lindley, [FE/Int.15], is a professional who began his university career at Rhodes University with an undergraduate degree in Botany and Zoology and progressed to completing his Masters and PhD in Environmental Education through the same university. He has been instrumental in the founding and running of the Mondi Wetlands Programme, one of the programmes associated with the World Wildlife Fund, WWF, the Wildlife and Environmental Society of South Africa, WESSA and Mondi. He outlined the Mondi Wetlands Project and gave his views on the constraints facing young graduates.

Dr Heather Malan, [FE/Int.16] is a freshwater research consultant who worked for the Fresh Water research Unit of the University of Cape Town. She now consults for the same university, under the Animal Demography Unit. She provided details pertaining to the closure of the Freshwater Department, reflected in the second part of this section.

Freshwater ecology is a diverse discipline, with individuals entering this field through various trajectories. First, a number of individuals enter the field after having completed generalist natural science degrees in conservation ecology, nature conservation and biodiversity management. Second, there are those in the field who have lengthy academic careers to their credit and are specialists within fields such as entomology, botany, riparian systems, wetland systems, geomorphology and zoology. Third, a group of professionals in freshwater ecology have diverse backgrounds within other disciplines and focus on socio-ecological factors affecting the functioning of freshwater ecological systems.

The nature of the field in South Africa is governed by the geographic location of the country. Professor Ellery (see section 5.5.2) emphasised how unique the South African landscape is,

and is identified as an ancient and weathered landscape, dating back 150 million years, in relation to New Zealand or the Andes, which are recognised as youthful. This, he went on to say, coupled with limited plate tectonics occurring within the continent, presents students and ecologists with exclusive opportunities for study and was the reason behind the distinctiveness of the South African catchment and wetland systems and the need for adequate management.

The freshwater ecology field, including wetland ecology, is relatively new to South Africa. Dr Malan, stated that the field of freshwater ecology is vast and extensive, and thus covers different ecological systems. She emphasised that the focus on freshwater ecological systems has varied over the past two decades, from initial concern with river and riparian ecosystems, to mountain catchment areas and currently to wetland systems. Professor Kotze explained that the science of wetland ecology was initiated in the United States of America and introduced into South Africa by Mr George Bear during the 1980's. Mr Bear carried out a series of studies and subsequent reports of the wetlands in KwaZulu-Natal, which was funded by the then Natal Town and Regional Planning Department, with the aim of mapping out and further understanding these systems, especially where they occurred within agricultural settings. Through publishing these reports, it was established that these entities were of great importance to the management of water and gave further insight into the management and protection of wetlands. From these reports, further phases were developed, which included the detailed mapping of the wetlands, both functional and degraded within the Umfolozi catchment area. The results from these actions led to the establishment of policies outlining the adequate management of catchments and wetlands drafted and implemented at governmental level and integrated into the environmental management of these areas. This forms part of the National Environmental Management Act. This is particularly evident within the environmental impact assessment and the environmental consultancy field.

Dr Malan added to Professor Kotze's point on the integration of effective management plans for wetland and freshwater systems into environmental impact assessments; by the early 2000's, he had participated in an extensive environmental impact assessment project, run through the Department of Environmental Affairs and Tourism, where over 400 wetland and freshwater systems and their health statuses had been researched. The findings from this study indicated that with the environmental impact assessments being carried out on wetlands and freshwater systems, monitoring was inadequate and often not conducted by suitably

qualified specialists in the field. Eventually, these entities were omitted from management plans, which resulted in the degradation of these systems.

The overall achievement of the research has been identified as the requirement of further support for the strengthening of the policies regarding wetlands and catchment areas, and for these to be closely adhered to, as well as the overall demand for suitably qualified freshwater practitioners.

From this study and others like it, new and dynamic resources were drafted and made available to freshwater ecologists and professionals involved with the management and preservation of these sensitive and valuable entities. Resources in the form of management plans, the management tool series of Ecosystem services and WETHealth are products of the combination of studies and case studies conducted through the following groups: the FreshWater Consultancy group, South African National Biodiversity Institute, Rhodes University, and the University of Cape Town. All of these tools are available to freshwater ecologists and individuals involved in freshwater management, and some are introduced to the students within the geography and ecology curriculum. Dr Malan stressed the importance of legislation being a driver of adequate management of freshwater systems, as well as serving as a driver for the demand for the skills necessary to carry out the management of these entities. The legislation she indicated as important included: the National Environmental Management Act, National Water Act and tools such as those provided by the Water Research Council, WETHealth and WETEcosystem Services, with particular emphasis on the preservation of wetlands and freshwater systems. She agreed with the integration of these into the professional's day-to-day documents and supported the introduction of such pivotal documentation at undergraduate level in university courses, including wetlands and freshwater systems.

#### **5.2.1 Human Capital Development structures within the freshwater ecology field.**

Professor Kotze stated that there are environmental consulting companies who specialise in freshwater ecosystems and therefore require specifically skilled professionals in order to perform the tasks required from the jobs available. Groundtruth, a company based in KwaZulu-Natal, as well as Southern Waters, based in Cape Town, were two examples of companies focussing on freshwater ecosystem management, and the inclusion of these into environmental impact assessments. He stated that graduates possessing undergraduate

qualifications in ecology or postgraduate degrees within the specialised fields of freshwater ecology, could approach these workplaces to find work. However, with the recent closure of the two individual universities' departments offering specialised freshwater ecology programmes and projects, namely the University of Kwa-Zulu Natal and the University of Cape Town, the previous supply of freshwater ecology graduates had decreased, and has resulted in graduates with these scarce skills emerging from other universities, as explained below.

Dr Malan explained to me that the Freshwater Research Unit at the University of Cape Town was operational for two decades but was disbanded within the past 18 months, with some researchers and professors becoming amalgamated into the Animal Demography Unit. This closure, she stated, occurred for a variety of reasons, including a lack of university funding and focus of projects on wetland and freshwater systems. Although funding is available from the National Research Fund, (NRF) and the Water Research Commission (WRC) for students and researchers to conduct research on fresh water systems, this is strongly dependent upon large cohorts of students to conduct such studies. She also mentioned the loss of the University of Kwa-Zulu Natal's freshwater focus, and I was given further insight into this issue by Professor Ellery.

Professor Ellery highlighted that the merger between the two campuses at the University of Kwa-Zulu Natal resulted in lecturers seeking new posts at other universities. He too had left and taken up a position at Rhodes University.

Dr Malan and Professor Ellery both informed me that other universities such as the University of the Witwatersrand, Rhodes University, the University of Venda and the University of Stellenbosch were beginning to respond to the demand for specific freshwater ecologists and others working within the ecological sphere.

Moreover, both Professor Ellery and Professor Kotze mentioned that many of the students they had lectured previously, had left the country to seek employment elsewhere, citing not being able to find suitable jobs, lack of opportunities within the field, and demographic issues, as well as better opportunities overseas. Professor Ellery highlighted the lack of young freshwater and wetland ecologists within the field and stressed that the majority of individuals involved in these fields were older.

Additionally, Professor Ellery stated that the older generation of freshwater ecologists and wetland ecologists had actually received training in alternative forms of ecology and had entered into the field via various avenues. However, with the advent of new programmes such as the Mondi Wetlands programme, graduates are now presented with opportunities to gain experience whilst obtaining their postgraduate degrees and in this way, gain invaluable workplace experience.

Dr David Lindley [FE/Int.15] has been instrumental in the founding and running of the Mondi Wetlands Programme, which is one of the programmes associated with the WWF, the Wildlife and Environmental Society of South Africa (WESSA) and Mondi. This programme functioned as a platform for young graduates interested in entering the fields of wetland and freshwater ecology, to gain exposure, experience and knowledge of the field. Lindley and his colleagues at the Mondi Wetlands Programme approached Professor Kotze and Professor Hill at the University of KwaZulu-Natal to offer internships to promising young graduates. Four individuals accepted the chance and began their two year long internship with the company. The exposure they were given ranged from technical and critical skills applicable in the work field, and extensive social-ecological training and education, which would assist them to implement the skills they had learnt whilst at university and in the programme efficiently and adequately.

Although the programme was a success in many of the aspects it aimed to achieve, Dr Lindley noted that the individuals who had entered the programme had, upon completion of their contracts, either returned to academia or had been head-hunted by environmentally focussed companies offering lucrative packages and different experience. After the last group of interns completed their internships at the Mondi Wetlands Programme, a decision was made to cease the programme. Dr Lindley expressed his sadness at the closure of the programme, noting that the individuals had not wasted their time and had gained invaluable experience which would be applicable to the workforce.

### **5.3 THE QUALIFIED FRESHWATER ECOLOGISTS STORIES:**

Although I was able to conduct detailed interviews with practicing freshwater ecologists, I was unable to observe them practicing in the field, and furthermore had difficulty in accessing individuals who were currently practising and had not moved into a different field.

### **5.3.1 Freshwater ecologist 1 [FE/Int.01] Ms Nhleko Rhodes University**

Ms Nhleko is a young black female, currently employed as a graduate trainee at Umgeni Water. She was born in the Eastern Cape and has one sibling. Her mother is a pensioned house-keeper and her father passed away in 2006. Her aspiration was to work in a field related to conservation and the environment: “I enjoyed wildlife topics growing up, was part of an environmental group at the local museum and this further piqued my interest on wildlife management” [FE/Int.01.15].

She provides financial support to her family and stated the following: “Unfortunately not everyone’s circumstances allow them to volunteer; my mother is a pensioner and so I have to support my family, so for me, volunteering is not an option”. This is an example of both a chronosystemic constraining factor and a macrosystemic factor, in that Ms Nhleko was born post-apartheid, but her family still feels the effects of the previous regime, and at a macrosystemic level, volunteering to gain experience is a real issue facing young graduates, who cannot afford to access such opportunities.

Ms Nhleko applied for and completed her undergraduate BSc in Zoology and Botany through Rhodes University for which she was assisted financially by the National Student Financial Aid Scheme, NSFAS. “I registered for Zoology1 in my first year and I enjoyed it so much that I decided to do a postgraduate degree in it” [FE/Int.01.14].

After completing her degree she obtained part time work and studied her honours degree part time through the University of South Africa, which she paid for herself. Prior to beginning her master’s degree, she was approached by a contact within the Umgeni Water Programme<sup>7</sup> who informed her of their graduate training programme, which she then applied for and was appointed as a graduate trainee.

After completion of her honours, Ms Nhleko again enrolled at Rhodes University and began her Masters in Zoology, which was funded through the National Research Foundation, whilst she continued as an intern at the Umgeni Water Programme.

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<sup>7</sup> The Umgeni Graduate Training Programme is a programme which focuses on the upskilling and development of young graduate professionals and exposes these individuals to the workforce, whilst providing support and assistance to their development within their specific sectors.



As a working professional and part time student, Ms Nhleko summarised the following examples of mesosystemic factors that affected her transition and that of her peers. She felt that the ecology and environmental sector was a difficult one to enter as a young graduate, because there were not enough organisations to approach, nor did she feel that the current organisations did sufficient outreach and awareness in order to attract students.

Ms Nhleko, as a student of Rhodes University, felt that, although there was a careers centre which she could approach, insufficient support was available for students within the environmental and biodiversity sectors. She noted the following:

“The career centre could make an effort to invite organisations relevant to science or zoology students, which could engage students and advise them on how to tackle the job search in the industry. Only commerce students get interviews, etc. There is just no support or guidance for navigating the job search. Here at the career centre there are workshops, job fairs and interviews, but like I said, I don’t feel it caters for every faculty [FE/Int.01.13].

This is an example of the development potential of a mesosystemic setting, which could help to determine and affect her transition into the workplace.

Furthermore, another example of a mesosystemic relationship would be the presence and support of mentors. She felt that lecturers should be able to assist students outside of lectures: “Lecturers are very well-connected, they could invite their colleagues in the different disciplines within the sector to talk to the final year students about job opportunities in the sector” [FE/Int.01.13].

When asked how she could better prepare herself to enter the workforce, she had the following to say: “Interning, volunteering at organisations of interest. Getting a mentor to guide you, this is no easy feat” [FE/Int.01.16]. She stressed that for her, volunteering was not an option as she was relied upon to support her family. As highlighted, this was both macrosystematically and chronosystematically linked.

In terms of the industry she was planning to enter, Ms Nhleko identified macrosystemic factors, such as a lack of experience and inflated expectations of the graduates, as playing significant roles in the entrance of graduates into the workforce: “When jobs are advertised, they require candidates to have at least 5 years’ worth of experience, but the salary offer does not match their requirements” [FE/Int.01.21].

When asked about constraining factors contributing to the scarcity of freshwater ecologists, Ms Nhleko emphasised the skills shortage, restructuring, limited hiring and lack of jobs as factors affecting the entrance of new graduates into the workforce.

She explained that students focussed on completing their degrees and, due to time pressures and expectations of lecturers, were unable to gain sufficient experience. This added a great deal of stress and pressure on the individuals and often resulted in them seeking opportunities outside of the field in which they had obtained their training. This is an example of mesosystemic (relationships) and macrosystemic (expectations from the university) issues affecting the individual.

### **5.3.2 Case Study 2: [FE/Int.02] Mrs Joubert Rhodes University**

Mrs Joubert is a white female, who was born in Howick, KwaZulu-Natal and her parents are both ardent environmentalists. Her father previously worked for the Department of Water Affairs and for an environmental consultancy agency and is currently employed within the waste sector. Mrs Joubert states that her passion for nature and the environment came from her parents:

“I grew up in the city, Durban, but I always felt a connection to nature and always had holidays growing up in game reserves, being kind of in the wild... always felt a connection to nature, I really loved it and definitely wanted to go into some kind of career that involved conservation, or generally trying to help the environment [FE/Int.02.08].

Mrs Joubert conducted her schooling in Durban and, once she had matriculated, attended the University of KwaZulu-Natal (UKZN), where she completed her undergraduate degree. During her honours year she met her current supervisor, Professor Fred Ellery who, along with her father, she credits with being a great inspiration to her to continue her studies within the environmental field: “I think definitely my Dad and Fred have definitely been instrumental in my development within the environmental sector” [RU/Int.02.10].

During her undergraduate degree, she and her peers were notified of a three month internship at an environmental organisation. However, she could not remember why she and her peers did not opt for this. During the time of her undergraduate degree, however, she did do some

part time work at the consultancy where her father worked, and found that she did not enjoy the work.

Mrs Joubert then began her Masters in Wetland Geomorphology at the University of KwaZulu-Natal. During her second year, UKZN went through a restructuring phase, which resulted in the exit of some lecturers, including her supervisor, Professor Ellery, who obtained a job at Rhodes University, as mentioned in section 5.2. Upon completion of her Master's degree, she was contacted by Professor Ellery, with an opportunity to assist with a field trip to the Baviaanskloof catchment, and it was here, she claims that she discovered her passion for educating others within the environmental field. She made a decision to move to Rhodes University to assist Professor Ellery and to pursue her PhD in Wetland Management. "I really enjoyed Rhodes and Grahamstown and the catchment and some of its issues. I had also done a bit of lecturing at UKZN and really enjoyed the teaching side of things... so I discussed it with Fred, and he said, 'Well, if you want to get into teaching at a University level, then you need a PhD', so that was one of the things that drove me to want to study further" [FE/Int.02.06]. She received funding for the first two years of her PhD, and then had a few small jobs to fund herself for her third year. She also became the administrator for the Wetlands ListServer<sup>8</sup>.

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Mrs Joubert, currently a doctoral candidate, identified the following factors as having affected her transition and that of her fellow colleagues. As previously mentioned, she and her fellow students were given an opportunity to participate in a three month long internship at various unnamed conservation affiliated agencies during their honours year which she did not attend. On further questioning, she stated that there seemed to be a complacent attitude towards such opportunities from both herself and her fellow students. She did, however, underline the opportunities she took to attend conferences and *indabas*, whilst still an undergraduate student. She had attended many Indabas and conferences and as a result stated, "I've met some really amazing wetland practitioners within Indabas and conferences... they

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<sup>8</sup> The Wetlands Listserver is an online platform created by Professor Ellery, which allows wetland and freshwater ecologists to access information, policies, job opportunities and workshops, it has been active since its inception in 2008.

have definitely helped just hearing about their work and engaging with them... it does open your eyes as to what consulting can be like” [FE/Int.02.34].

Through her experiences of attending of Indabas, conferences and as the administrator for the Wetlands List server, Mrs Joubert felt there was a demand for freshwater and wetland ecologists, as she witnessed a lack of freshwater ecologists at these events. She said she felt that young graduates could not easily access the workforce and attributed this partially to a lack of working experience. She suggested that young graduates and students close to entering the workforce should be encouraged to network and connect on different mediums, including social media platforms, such as the Wetlands List Server. Mrs Joubert informed me that the list server is consistently monitored by herself and Professor Ellery, in order to keep up to date with any developments within these fields.

Mrs Joubert spoke of a round table at Rhodes University for graduates and students within the biodiversity sector which held monthly talks by speakers from across the biodiversity sector, addressing topics within their specific field. In this way, students are exposed to the professional environment. The round table discussions are advertised across a variety of online networks and are therefore accessible to most students. Mrs Joubert reflected: “That is something really helpful; it is run by Kate Rowntree, who is the manager of the Catchment Research Group, based in Grahamstown at Rhodes University” [FE/Int.02.62].

She informed me that she is also a member of the RAMSAR<sup>9</sup> society and participates in conferences and workshops, and disseminates information and updated management tools from this group to the Wetlands List Sever.

She expounded on the specific tools created to assist in the management and protection of wetlands and freshwater systems. One of the fundamental drivers of this was the Department of Water Affairs and Forestry who produced a set of freshwater ecosystem guidelines which, coupled with the National Environmental Management Act and other pertinent studies conducted on the management of wetlands, had shaped and influenced management tools such as WEThealth and WETEcosystems. She suggested that these tools should be introduced at undergraduate level to students within the ecology field, and further stated that

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<sup>9</sup> RAMSAR is the society for the convention on Wetlands, the first meeting of which was held in Ramsar, Iran, in 1971, from this initial meeting, a society was formed and has since grown to become an international convention on wetlands.

exposure to these tools would set up a student or graduate to enter the workforce by equipping them with the knowledge pertaining to the demands of the workforce. She emphasised that students should utilise websites and social media platforms as these could serve as mediums to gain exposure to the workforce.

### **5.3.3 Case Study 3: [FE/Int.03] Ms Dubazane Rhodes University**

Ms Dubazane is a black female, currently conducting her master's through Rhodes University, in the transdisciplinary field of Wetland Systems. She is also working concurrently for WWF and the Mondi Wetlands Programme. Prior to this, for a period of two years, she was an intern at the Mondi Wetland Project. She is one of five children, born in Ladysmith and was brought up primarily by her grandmother and aunts, as her mother, a nursing sister, works in KwaZulu-Natal. She states that from high school she was interested in environmental clubs and the environmental sector, commenting on her career path: "I ended up doing what I wanted to the most" [FE/Int.03.05]. She is the only one of her siblings who has attended university. She stated that neither of her parents was able to finish schooling and consequently did not attend university, as a result of the macrosystemic influences of apartheid.

She completed her schooling in Ladysmith, KwaZulu-Natal where she had a mentor at high school who led the environmental practicals, as well as the environmental club. Ms Dubazane recognised this mentor as having greatly influenced her passion and desire to follow a career within environmental studies: "She definitely inspired me, she was very passionate about what she did, and she worked in the Eco-Schools and the Environmental Club" [WE/Int.03.06].

After matriculating, she began her undergraduate degree in social sciences at the University of KwaZulu-Natal at the Pietermaritzburg campus. Her undergraduate degree, although in social sciences, was a transdisciplinary degree, focussing on geography and environmental management. She received financial assistance to fund her undergraduate degree through the Financial Aid, an example of a macrosystemic enabling factor; however, for her honours year she was unable to obtain funding and thus self-funded her studies. She noted that it was at this stage that she was informed of an opportunity to become an intern in the Mondi Wetlands Programme, whilst also completing part of her Master's degree. Dr Lindley of the Wildlife and Environmental Society of South Africa (WESSA) approached her supervisor, Professor

Kotze, with this opportunity which constitutes an example of a mesosystemic relationship between the university and an external environmental programme. This programme aided in the promotion of skills necessary for a young professional to enter the workforce.

Whilst working as an intern, Ms Dubazane worked extensively in the areas of community development and environmental awareness. This work provided a socio-ecological context for her master's research. The topic of her Master's thesis is: 'The improved management of wetlands in privately owned forestry land'.

For the duration of her master's, she has received financial assistance and support (an example of mesosystemic relations) from both GreenMatter and Mondi. Both programmes supported and encouraged her decision to conduct her master's on the work she had been doing: "It was nice that I was not restricted to the bio-physical side of things and that I could choose what my focus wanted to be on. And that it was not outside of the programme's scope" [FE/Int0.3.05].

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Although she had praise for the work that universities did, she did state that, "universities taught one to think critically, but not to necessarily prepare one to enter the workforce" [FE/Int.03.10]. To this statement she added, "One does not gain full exposure to the biodiversity field, nor enough practical experience whilst at university". She gave examples of being inadequately exposed to real world problems, conversely having administered countless desktop studies at university. She suggested that this could be remedied by the introduction of an experiential training year, similar to that of a University of Technology. This was an example of a macrosystemic issue prevalent within her university career.

She also identified gaps within her own skill set and stated that she wanted to pursue a managerial and accounting course, to further increase her value to the sector and her development as a young biodiversity professional.

When questioned about her knowledge pertaining to the availability of jobs for freshwater ecologists, she claimed the following: "There are not enough transdisciplinary jobs; they are also not easy to find and consulting jobs are more abundant" [FE/Int.03.19].

#### **5.3.4 Case Study 4: [FE/Int.04 ] Dr Magoba The University of Stellenbosch**

Dr Magoba is a black male, who was born in Mbaye, in the Limpopo Province, and is one of two children. His sister also attended Stellenbosch University and completed her qualification in Environmental Science. He is currently leading the Department of Research and Development at the City of Cape Town, with a particular focus on water and sanitation. Dr Magoba completed his Bachelor of Science degree in Botany and Zoology at the University of Venda, after which he did his Honours in Conservation Biology in 2002 at the same institution. Following his honours degree, he began working as an intern at the Working for Wetlands programme in the North West Province. It was here, he said, that his passion for wetlands and freshwater systems developed: "...with volunteering I saw what they did and asked to be involved in the project" [FE/Int.04.40].

During this time he decided to further his education and enrolled at the University of Stellenbosch to do a Master's degree. He began the Master's in 2004 and his topic focussed on the impact of invasive alien plant species on biodiversity. He was also involved in an aquifer project, where he took up a role as the invertebrate specialist, under the guidance of Professor M. Samways, his supervisor for the Master's degree.

After the completion of his Master's in 2005, Dr Magoba was offered a job at Southern Waters, an environmental consulting company specialising in the impact assessments and mitigation of damages to water systems, including wetlands, mountain catchments and rivers. He worked as an environmental consultant, and at this point, he realised that he would need to obtain a PhD degree: "Being in the consulting environment made me realise I wanted to study further and get a PhD, you mix with people who have PhDs. That made me realise, I didn't have to be satisfied with an MSc" [FE/Int.04.44]. After leaving his post at Southern Waters, Dr Magoba was further assisted by Professor Michael Samways, his Master's supervisor, with part time work at the CSIR during 2006 and 2007, in an example of a mesosystemic relationship. He then began his PhD through Stellenbosch, during which time he joined the Agricultural Research Council in Pretoria and expanded his investigation on the impact of invasive alien species on biodiversity.

After the completion of his PhD, Dr Magoba obtained a job through the City of Cape Town, as mentioned above. In his post he is responsible for finding funding and support within the associated Universities, to conduct projects with students pertaining to water systems and sanitation. He also acts as a supervisor for students who join this department to carry out their

experiential training as well as research pertinent to the department. As a result of this professional context, Dr Magoba was able to share insights, not only about his own transition, but also those of the young graduates and students who form part of his job at the City of Cape Town.

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Dr Magoba felt that the university had given him a sense of confidence and knowledge in the subject matter he was dealing with on a daily basis when he entered the workforce. For this reason, he wished to continue studying, to further himself as a biodiversity practitioner and more specifically, a freshwater ecologist. He did feel, however, that the focus on desktop studies in the curricula to which he was exposed (as well as many of the students he supervises) did not always promote a sense of the real issues facing the biodiversity sector: “For many people, it is a challenge, with no working experience working with people in the field; they lack the experience especially at university level, applicable to that of what is needed in the field” [FE/Int.04.48]. He added:

“There is too much theory and not enough practical part; the practical is restricted to an experiment in a lab. And not always applicable to the real world. It is just for the sake of academic purposes, yes, then it makes sense. I think that the extent of the practicals needs to be changed to include hands-on examples, applicable in the real world.” [FE/Int.04.52].

When asked how he had felt his own transition from university to workplace had been, Dr Magoba commented, “My transition wasn’t as difficult, as I started with consulting work early on. By the time I had finished my degree, MSc, I was aware of what the job, consultancy, involves” [FE/Int.04.44]. He attributed this to having a desire to become involved with volunteering and consultancy from early on in his career. He qualified this statement by saying, “My career isn’t something that I planned, everything happened accidentally, until I got where I am today...” [FE/Int.04.57].

As previously stated, Dr Magoba engages with recent graduates and students during his day to day job, and he had the following observations to make regarding their circumstances:

“...many people find it a challenge, in the position I am in now. I engage with a number of people who really want to get a chance in the job market. They try and explore their skills at this point, they realise they have higher qualifications, but they don’t have the ability to perform the duties you give them. There is still a need for



thorough training before you get results from them, whereas when you get people from Technikons and Universities of Technology, they have lower qualifications, but they can produce results immediately” [FE/Int.04.50].

He added that the available university career counsellors, although helpful, were sometimes unable to assist individuals wishing to specialise in biodiversity related topics at postgraduate level, but were better at assisting individuals within more generalist positions [FE/Int.04.57]. He also added that students were, more often than not, given projects to undertake at postgraduate level, which were not always what these individuals wanted to do. Furthermore, these students were reliant on the lecturers to provide projects and therefore did not employ initiative or creativity in designing the projects they wished to conduct. As a result, he stated that “there seems to be a pre-determinedness to the fate of the students, as the lecturers decide their fate” [FE/Int.04.57].

He underlined the demand for freshwater ecologists and professionals in the South African sector stating:

There is a serious demand and in the job that I am in, one of my tasks is to try and engage academics on where they need it, so that we have projects, those would be much relevant to the skills that are needed in the market... so when the graduates are saying that they need this and this and this skills, then they will be easily absorbed into the marketplace [FE/Int.04.59].

In this example, he emphasised exosystemic factors which would affect the demand and hence the individuals, such as funding for projects, interest in projects. He also highlighted the mesosystemic relationships between the City of Cape Town, its funders and other relevant stakeholders.

However, Dr Magoba countered this statement by saying: “Coming from University without much practical experience, if you were to join a private company, they often do not value the qualifications you’ve got, especially if you’ve not had experiential training, experience, close to the work environment” [FE/Int.04.82]. This he further explained was a result of macrosystemic factors such as the requirements of specific industries in which the individuals applied for employment, the current need or demands for specific skills as well as the mesosystemic relationship between the universities and the workplace.

Furthermore, he felt that many young graduates have inflated expectations of the workplace, which is a disadvantage when entering the workforce: “So usually when you’ve got a higher

qualification they are coming into the industry with their MSc and you look at the remuneration they are offering you, you feel like you don't want that... so you go back to school, then you come back and it is the same challenge..." [FE/Int.04.82]. This statement was also apparent with Mrs Rebelo, Mr Barrows and Ms Luvuno, and is an example of macrosystemic expectation, as these expectations are often media- and peer-related, as was reported by the individuals themselves.

However, Dr Magoba felt that by keeping abreast of the latest courses, technology and tools necessary to adequately carry out tasks required in the field, a biodiversity graduate or professional would add value to companies seeking potential employees. He acknowledged that he, as a professional, ensures that he keeps up to date through the attendance of short courses. When asked where a young graduate could look for work opportunities, he responded by saying that he had found his current job from a newspaper advert. He also made reference to many online platforms (social media and networking groups), such as the Fynbos Forum, the Thicket Forum and the Wetland Forum which individuals could join. And lastly he suggested investigating within various governmental environmental departments, who often place advertisements in both print and social media.

### **5.3.5 Case Study 5: [FE/Int.05] Mrs Rebelo The University of Stellenbosch and The University of Antwerpen.**

Mrs Rebelo is a white female, currently conducting her PhD through the University of Stellenbosch and the University of Antwerpen. She was born in the late 1980s and has a younger brother who is also studying in the environmental field. Both of her parents are renowned environmental scientists within the Western Cape and South Africa. She was raised in Cape Town and attended the University of Cape Town, where she conducted her undergraduate degree in Environmental Science as well as her Honours. She highlighted her passion for the environment as well as the role that her parents and microsystemic relations played in influencing her direction of study and leading her to pursue a career within the environmental and, more particularly, the biodiversity sector: "I kind of followed in their footsteps, studying my undergrad at UCT" [FE/Int.05.14]. Although her parents are well-known in the field, she stated that they had instilled independence in her, and had always encouraged her to network on her own and to pursue further studies before entering the workforce.

After the completion of her undergraduate degree at UCT, she decided to move to the University of Stellenbosch, where she pursued her Masters in Wetland Geomorphology. Her reason for changing universities is situated at the macrosystemic level, as she cited the need to be exposed to another university, in accordance with the expectations within academic circles.

Mrs Rebelo informed me that she had received encouragement from her parents and peers when making this decision and this is an example of a choice the individual made within her own microsystem.

She stated that her supervisor was extremely helpful and provided her with useful guidance and insight into the different opportunities available to her as a young graduate. After her MSc was completed, she applied for an internship through Green Talent, a German programme which offers internships to young graduates within the environmental and biodiversity fields. She was accepted and spent a semester in Germany at the Deutschesluframpsentrum, on their internship programme, where she gained further knowledge and insight in Geographic Information Systems (GIS) and skills relevant to her profession as a freshwater ecologist. Even with this internship to her credit, she found her subsequent job search to be frustrating and could not find any suitable jobs, often due to her lack of experience. She had the following to say: “I’m sure you have heard it in the natural sciences in South Africa that no one hires anyone with less than two years of experience, but I do not have two years of experience, so where am I supposed to find a job?” [FE/Int.02.74]. A lack of experience is understood as a macrosystemic factor, which she had highlighted as one of the primary reasons behind her not obtaining a job. She later informed me that this was also the case for many of her GreenMatter co-fellows. The demand for individuals with both experience and the adequate qualifications is also understood as a macrosystemic factor, and is prevalent within the biodiversity sector. She added: “First of all, the one thing I know about jobs in the biodiversity sector of South Africa... generally they, the companies, have someone in mind... so they are usually doing it as a matter of course, they are looking for someone with experience or someone from a certain demographic” [FE/Int.05.76].

It was on this basis that Mrs Rebelo chose to remain in academia and pursue her PhD; however, she struggled to find a supervisor: “It is important, I am told, that you have degrees from other universities...but my biggest problem was to find supervisors... there was quite a

strong professor from the University of Antwerpen” [FE/Int.05.46]. She made contact with a Professor from Antwerpen University, Belgium through a networking and presentation opportunity, and she requested that he become a co-supervisor for her PhD. She then searched for a co-supervisor from the University of Stellenbosch, as her field work was based in the Western Cape. Once she had found a supervisor from the University of Stellenbosch, for her project, she needed to find funding for it and was informed of the GreenMatter fellowship programme through her previous supervisor. (GreenMatter is a programme that assists young biodiversity professionals and graduates in enhancing their skills in order to integrate them into the biodiversity sector). She was successful in her application to this programme, during which she was exposed to a number of like-minded individuals. She highlighted the guidance and support she experienced within the programme, as invaluable to her development as a young biodiversity professional. She further stated that being able to choose the topic of her project freely and the support by GreenMatter in this decision, made her choice of moving into doing her PhD a more comfortable one.

Prior to beginning her PhD, Mrs Rebelo married and her new husband, a classical musician, travelled with her to Antwerpen, where he is focussing on the development of his musical career. “I’m married and living with my husband now, I can’t just make decisions on my own” [FE/Int.05.38]. This is indicative of a microsystemic factor determining her career trajectory.

As Mrs Rebelo was born into the age of digital technology, her development has been influenced by the presence of computers, digital technology, social media and technological advancements within the field of freshwater ecology, all examples of chronosystemic enabling factors. As a result she stated that such advancements have assisted her with networking with other professionals within the same or related fields, aided her research and been instrumental in her gaining experience for the work force. “So things I’ll use later, like GIS skills... using Statistica” [FE/Int.05.54].

However, the software taught at university undergraduate level changes in accordance with the curriculum and the focus of the specific university. “My brother is doing his honours year now and has just done a course in R<sup>10</sup>. When I was in honours, we used Statistica. I am envious now, as I too would like to have used that programme” [FE/Int.05.66]. The presence

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<sup>10</sup> R<sup>12</sup> is a statistical analysis software, utilised in a variety of contexts, including environmental management.

of these digital and technological advancements, are testimony to the macrosystemic factors of the current needs of the sector and the chronosystemic influences.

### **The issues facing the need for and supply of biodiversity professionals**

Mrs Rebelo stated that, on a macrosystemic level in South Africa, there is a need for ecologists of all types; a need, she felt had not been adequately addressed in terms of integration of ecologists into governmental levels and policy-generating systems. She qualified this by emphasising the uniqueness of the South African biomes and ecosystems, and noting that there had been severe degradation of these entities. She felt that there were well-trained scientists able to attend to these problems, but further integration of these individuals into the policy and decision making levels was necessary.

She felt saddened by the loss of young biodiversity professionals to overseas opportunities as well as alternative job markets, often driven by the motivation to gain sectoral experience: “I think it is such a waste that there are all these people leaving university each year and they have this degree, which essentially means nothing really... They are still a raw product; they are not a finished product a company can use” [FE/Int.05.66].

Although she herself is currently conducting her PhD between the University of Stellenbosch and the University of Antwerpen, Mrs Rebelo maintained that she wished to return to South Africa in four to five years, expressing her passion and love for the country’s biodiversity. She highlighted that the exposure she was gaining from her time in Belgium was invaluable to her as an individual and to her career as a freshwater ecologist. She stated that although she had a postgraduate degree and was working toward achieving her doctorate, she felt that she still lacked real-world scenario knowledge, which was mandatory for her entering the workforce. This, she suggested, could be remedied by being aware of short courses for continuing professional development, some of which she had already identified as being potentially useful for her future career. She added that the knowledge, integration and usage of tools such as the WEThealth series, the National Environmental Management Act, NEMA and Acts particular to freshwater systems, would also be of great use to her as a freshwater ecologist, as well as those new to the field, as these acted as guides. These tools and acts, she stated, were only briefly integrated into her postgraduate degree and she felt that this would have been beneficial at the undergraduate level. She made a reference to a close friend, Ms De Abreau, a fellow MSc colleague, who had previously completed her National Diploma in

Nature Conservation and Biodiversity Management through the Cape Peninsula University of Technology, and had as part of the curriculum, been taught about the legislative acts and tools.

Concerning the level of skills gained from university, Mrs Rebelo felt that she still had a vast amount to learn, including critical skills particular to the freshwater ecology field and generic skills, such as communication, administrative roles and management of staff. She added that she and her GreenMatter fellows had held conversations which highlighted similar concerns. She stated that she felt “naïve” and not ready to enter the workforce. She also mentioned that being able to sell oneself was an important skill to obtain and this was not offered at a university level, but could be encouraged and developed through networking opportunities and attending conferences.

## **5.4 POSTGRADUATE AND UNDERGRADUATE STUDENTS**

### **5.4.1 Rhodes University Representation:**

#### **Student A: Ms Schlegal [FE/Int.07a]**

Ms Schlegal is a white female who was born in Johannesburg. She is one of two children and her sister is studying engineering at the University of Stellenbosch. Her parents are geologists and she stated that her love for nature, the environment and travelling, partially stemmed from her parents and their jobs. “The environment and all living creatures has interested me from a young age, it was just a natural progression to follow my passion within the academic world” [FE/Int.07a.05]. In her relatively short life, she has moved extensively due to her parents’ work opportunities. She informed me that this exosystemic factor has shaped her dynamism as a biodiversity professional: “This sort of moving around I think has had a very marked and positive effect on my life and how I interact with people” [FE/Int.07a.02].

In 1995, her parents moved to Chingola in Zambia for work purposes where she and her sister were placed in a local school. After 1997, she and her family relocated to Kitwe, also in Zambia. And in 2003, she and her family moved again, this time to Cape Town and she and her sister attended Reddam House, a private school. In 2006, she and her family moved to Mpumalanga where she and her sister attended a private school in White River. After matriculating, Ms Schlegal enrolled at Monash University to conduct her undergraduate degree, in International Studies, majoring in Geography and Environmental Science. This degree, she informed me, was varied and allowed her to “taste” a multitude of subjects. From

this exposure, she was able to decide which subjects she wished to pursue at postgraduate level. She then enrolled at Rhodes University to conduct her Honours in Water Management and subsequently attended the wetland management course run by Professor Ellery. She emphasised the role that he, as her supervisor, had played in her academic career: “My supervisor for my project is amazing and so full of information, and willing to share knowledge and listen to any and all ideas I might have” [FE/Int.07a.08].

### **The issues facing the need for and supply of biodiversity professionals**

Ms Schlegal sees herself as a passionate and dedicated environmentalist who is concerned with the status of water and aquatic systems within South Africa, and qualified this by stating: “Water is the lifeblood of our planet, and with the economic and capitalistic focus, runs this world and it is very important to have people fighting on our environment’s side” [FE/Int.07a.16]. She felt that her parents’ field contributed greatly to the degradation of the environment and so she felt it part of her duty to study within the environmental sector. She added that there was a need for freshwater ecologists, however did not elaborate further. With regard to her transition from university into the workplace, Ms Schlegal felt positive and had already managed to obtain a part-time job, which would facilitate her transition into the sector, upon completion of her studies. She emphasised the following: “I think if you work hard and always have a good attitude in everything you do, good things will happen for you” [FE/Int.07a.10]. She presented an optimistic view, saying that any opportunity which presented itself should be taken and one should not be afraid to try. She felt that the skills that one gained from university were knowledge of the subjects one was studying and potential contacts, as well as encouragement to go out and seek work.

### **Student B: Ms Mgaba [FE/Int.07b]**

Ms Mgaba is a black female, who was born in Peddie, in the Eastern Cape. She is the middle child of five children and the only one in her family to have reached university level. This can be attributed to macrosystemic factor, namely the effects of apartheid. Her mother is a retired house keeper and her father passed away in 2006. Through her current internship, she assists her family financially.

She attended Matomela High School in Peddie and received a scholarship from the African Scholar Fund for the duration of her high school education. Post matric, she enrolled at the Nelson Mandela Metropolitan University to do an analytical chemistry course funded by the

National Student Financial Aid Scheme. Once she had completed her undergraduate degree, she moved to the Institute for Water Research at Rhodes University to conduct an internship related to her studies in analytical chemistry. During her internship, she was informed by a colleague about the Environmental Water Management course and, as this was in line with her previous course and would add to her knowledge on water management, she decided to pursue it and registered for the honours level course. “As part of analytical chemistry requirements at the Institute for Water Research, that’s when I heard about the Environmental Water Management course... since I was planning to *continue* my study, I decided to do something that’s related to what I am doing as an internship...”[sic] [FE/Int.07b.02].

When asked what motivated her to pursue this career, Ms Mgaba answered: “It’s because I have a passion for it, I am enjoying to do it and I would also like to be a part of environmental change” [FE/Int.07b.5]. Part of her rationale is: “Because water is in demand, everywhere you go there is a problem with drinking water or waste water” [FE/Int.07b.16].

She informed me that she does have a supervisor, although did not provide the individual’s name; however, she said that he helped her immensely. She also stated that she felt that Rhodes University was one of the top universities in the country and that their system produces a large number of graduates into various working sectors.

### **The issues facing the need for and supply of biodiversity professionals**

As both a student and an intern, Ms Mgaba initially reported that she felt optimistic about her transition from university to workplace saying, “I hope when I reach the workplace I will be able to do work because of the background I get from the course. The overall aim of these studies is to prepare me to enter the working place” [FE/Int.07b/11]. She felt that she had already learnt, through her internship and her course at university, about challenges she could face within the workplace and how to deal with these. Furthermore, she felt that the university had exposed her to professional discussions pertaining to the topic she was studying as well as a certain amount of practical experience related to the workforce. However, she felt that there was potential for the university to include more practical work, to equip her and her fellow students with more hands-on experience. She stated that she could prepare herself to enter the workforce by, “Trying to find someone who is already doing the work I want to do and ask him or her about the work, so when I enter the workforce I can know what is expected of me” [FE/Int.07b.15].



In contrast, she expressed concern about finding a job and a sense of being left behind and lost: “I can say I am nervous, I know that at university they prepared us for the workforce, but you feel as if you do not know anything. For example, as I mentioned that the above course I was doing you need to do an internship to have full qualifications. When I came to work as a lab analyst in the Institute for Water Research, I felt like I knew nothing, because I did theory more than practical. At work you do practical. If you notice you can know some instruments, how they work and what their use is, but if you have never *operated* it before, you will be like someone who does not know it at all. So that *cause* you are not ready and you are under pressure, it can make you lose some confidence. So I think it will be more helpful for the higher education institutes to teach their students exactly what is expected of them when they get to the workforce” [sic] [FE/Int.07b.20]. This was indicated as a macrosystemic factor of the demands of the sector on young graduates, and the repercussions of these demands. When asked what she knew of the availability or scarcity of the freshwater ecologist skill, Ms Mgaba stated: “All I know is that my skills are in demand, even though when I look for a job in this field, I don’t find any advertised post.”[FE/Int.07b.20]

#### **5.4.2 Stellenbosch University Representation:**

##### **Mr Barrows, Masters Student [FE/Int.08]**

Mr Barrows is a white male, born in the Western Cape and is one of two children. His brother, a geo-hydrologist, also completed his degree through Stellenbosch University. Both Mr Barrows’ brother and his father, a retired farmer, served as two of the pivotal microsystemic individuals who lead to him pursuing a career in the environmental field. Before beginning his degree, Mr Barrows spent a considerable amount of time with his brother, who was beginning his career as a geo-hydrologist, observing and gaining experience. Mr Barrows felt that this was where he began to feel he knew which career trajectory he wanted to enter into. “This was the type of job I wanted one day; I didn’t want to be working inside all day... I wanted a job outside” [FE/Int.08.18]. “He, my brother, started working before I chose to do this degree, so I worked with him a little bit and saw the kind of stuff he was doing and I liked the kind of job... he gets to balance his work between being in the office and being in the field, which is kind of nice” [FE/Int.08.14].

Mr Barrows attended Stellenbosch University where he conducted his undergraduate degree in Conservation Biology; this degree was funded by his parents. He informed me that the degree broadly dealt with a variety of conservation related elements and did not include a

large practical work component. Skills he identified as having gained through his undergraduate degree included: report writing, research, presentations, writing skills, mapping and GIS, SASS and Statistics, organisational skills and being able to work on his own.

During his second year, Mr Barrows recalled that he and his fellow students had conducted a course work module which focussed on the South African Scoring System (SASS). The SASS is a monitoring tool used to evaluate river health and freshwater ecosystem health. He had the following to say regarding this tool: “We did in second year a course on the Eerste River, where we did SASS with the invertebrates, but you have got to have an actual course in order to be accredited” [FE/Int.08.118]. At a later stage during the interview, Mr Barrows informed me that he wished to be able to complete the SASS course in the future.

Once he completed the undergraduate degree, he enrolled for his Honours which focussed on an indigenous fish species of Redfin, during which time he had established a working relationship with Dr Jordaan from CapeNature, who subsequently became one of his Master’s degree supervisors. Thereafter, he was given a paper written by Professor Guile from the South African Institute for Aquatic Biology (SAIAB) at Rhodes University and was impressed with the standard of the paper, leading him to approach Professor Guile to become his second supervisor. With these two professionals and Professor Esler from Stellenbosch as his supervisors, he enrolled to do his master’s, also through Stellenbosch. This is an example of the establishment of two mesosystemic relationships, as a result of Mr Barrows’ project a relationship between the Research Centre at CapeNature and the Conservation Ecology Department at the University of Stellenbosch as well as Rhodes University were initiated. His master’s degree continued his work on the Redfin species as this project was of importance to CapeNature, Stellenbosch University and Rhodes University conservation related objectives.

He received financial support in the form of a bursary from the Centre for Invasion Biology, and the South African Institute for Aquatic Biology. When asked if he planned to move to Rhodes University, he informed me that he was enrolled at the University of Stellenbosch and his research work was based in the Cederberg within the Western Cape. Furthermore, with two of his three supervisors based in Stellenbosch and the surrounding area, he felt it was beneficial for him to remain in Stellenbosch. He added that he got married in the first year of his Master’s and that his wife was working in the Cape Winelands area. He did

inform me that being married posed some restrictions on his movements and he felt it could potentially affect his job-seeking options once he graduates.

### **The issues facing the need for and supply of biodiversity professionals**

As a Master's candidate, and nearing his transition to the workforce, Mr Barrows had the following to say about the factors which he felt could affect his transition. He felt there was a demand for the skills of freshwater ecologists:

There is a need and water is such a big issue that people need to be understanding where our water comes from and how it is being managed. ... a lot of work is being done by Geo-hydrologists... so purely on a chemical kind of background... not much ecology work going into it, so I don't think there is a massive demand in terms of people offering jobs [FE/Int.08.104].

Mr Barrows highlighted the macrosystemic concern about the availability and management of water, as well as the management of this resource by adequately trained professionals. However, when asked about the availability of jobs and how he felt his transition would most likely occur, he stated: "I feel fairly pessimistic. Most opportunities require quite a few years of experience, and the ones that don't offer almost negligible pay... So ja, that's not great, and there are not tons of jobs available... when there are a few... you only see a handful of jobs" [FE/Int.08.50].

When asked to elaborate on what he meant by experience, he explained: "I can understand why they want work experience, because I'd feel like I can still learn a lot if I were to start working... I know that my kind of master's and the information needed for that, or I have needed so far, but in terms of understanding the ecology in a stream, I feel there is so much more I could learn, so I'd be hoping for a company that is willing to kind of help me learn on the job" [FE/Int.08.54].

He expressed a widely shared macrosystemic perspective on the availability of jobs within the biodiversity sector, and said that a number of his student colleagues had shared similar worries with him. He added that in order to locate jobs, he had utilised a variety of networking platforms, including online and social media, as well as popular search engines, such as Google and LinkedIn. He informed me that he and many of his colleagues had joined the Conservation Ecology Alumni Facebook page, as has been set up by Professor Esler (see section 5.5.1). Furthermore, he stressed the importance of networking whilst at conferences,

such as the Fynbos Forum and Wetlands Indaba. He admitted that during his undergraduate degree he had not always gone out to seek vacation opportunities to gain small amounts of experience, “No one was saying anything... I wish someone had said to me like every holiday, ‘Why aren’t you doing work experience?’ ... I always thought, ag... it wasn’t worth it” [FE/Int.08.78].

He emphasised the importance of exposure to and inclusion of tools applicable to the management of freshwater systems, as well as the roles of new technology and the skill sets he had developed such as GIS, statistics and mapping, all of which could assist his search and application for a new job within the freshwater ecology field.

When asked what he thought could be improved at the university level or within his undergraduate curriculum, he stated, “ I think they could give us more training, in actual skills, such as GIS and stats, so we can at least say, ‘Well I can do this” [FE/Int.08.72].

**Ms Luvuno, Doctoral Student [FE/Int.09]**

Ms Luvuno is a black female, who was raised in the Mpophomeni township in Howick, KwaZulu-Natal. Her immediate microsystem comprised of her grandmother and aunts, who raised her from an early age, as her mother is a nursing sister who spent a large portion of Ms Luvuno’s childhood away in Durban. Ms Luvuno attended Russel High School in Pietermaritzburg, which she described as being the “coloured or black school” [FE/Int.09.02]. When asked where she thought her interest in the environment had come from she commented:

Growing up in a rural township, which is now more developed, I spent time helping to burn fields and green spaces for cattle. I also grew up watching National Geographic and I really enjoyed Geography. The world interested me, how it operated. I would remain glued to National Geographic... Then this whole idea of Climate Change came along and I thought, I want to go and work on Marion Island, I want to tackle this. I want to be one of those people as well. You know, on TV, looking at climate... [FE/Int.09.20].

Ms Luvuno shared with me that she had initially wished to become a pilot, but this was prohibitively expensive and she was unable to achieve this. As a result, with her passion to assist in the environmental sector, she enrolled at the University of KwaZulu-Natal, where she had hoped to enter into a climatology degree. However, as the university did not offer this as a course, she conducted her undergraduate in Environmental Science, with a view to

pursue climatology in the future. She mentioned the following about her experience as an undergraduate at university: "...we had a Prof who would lecture us in Geomorphology, and never return any of the tests or assignments, so you never knew if you were grasping any of what was taught" [FE/Int.09.69]. She alluded to the impact that a good lecturer could have on a student's performance and enthusiasm, as well as interest in a subject: "A good lecturer can make or break a student" [FE/Int.09.75]. Whilst saying this, she added that this had impacted on her work as an intern at Mondi Wetlands programme: "When I got into wetlands, I realised geomorphology is important, but the way in which it was taught... no interaction from the lecturer, you never knew if you were ... you know, the reason why you write a test is to know if you are getting this and or not getting this... so at the end of the day, you might as well watch YouTube videos" [FE/Int.09.73]. Ms Luvuno expressed extreme frustration toward the lecturing style of some lecturers at her previous university. She went on to discuss her own academic performance as an undergraduate: "I obtained fairly average marks, but they became better and better the more my focus narrowed, because if I am not particularly interested, I don't do greatly in it. Subjects like Geography, remote sensing and GIS I did ok in" [FE/Int.09.28].

After the completion of her undergraduate degree, she was offered a dual position of an internship and Master's studentship through the Mondi Wetlands Programme (see section 5.2, Dr Lindley.) This opportunity was made possible because of the existing exosystemic relationship between the Mondi Programme and the University of KwaZulu-Natal, in response to the macrosystemic demand for scarce skilled individuals within the wetland ecology field. Ms Luvuno reflected upon her opportunity of becoming an intern at Mondi Wetlands programme by stating:

I feel I was lucky to be taken in by MWP, Mondi Wetlands Programme, right after my honours. I feel it was a good transition, but I do feel that there is a disconnect between what one learns, at university, and the workforce. But I felt our transition was good, we worked mainly on our Master's, with some additional wetland assessments [FE/Int.09.30].

Ms Luvuno felt that although her undergraduate had given her a broad spread of knowledge pertaining to environmental issues and topics, she did find that in comparison with what her fellow students from Rhodes University and the University of Stellenbosch had learnt in their undergraduate degrees, she identified knowledge gaps which had not been addressed in detail. She gave an example of regime shifts:

I discovered regime shifts, in one of the chapters in my Masters, and I thought it was really awesome and it opened me up to an area of research I'd had a hint I was interested in. My masters was based in looking at the effects of fires on wetlands, and I decided to take it a step further and look at it from a landscape level. [FE/Int.09.14].

Upon completion of her Master's and the internship, her mentor, Dr Lindley, encouraged her to continue with the programme by undertaking a PhD, sponsored by Mondi Wetlands. During this time, she was offered an alternative PhD scholarship through the University of KwaZulu-Natal, she stated that she was unsure of which offer to take, however she realised that although she wished to remain in research, she felt she needed to move to a different Higher Education Institution which is an example of macrosystemic pressures of the academic society. She was aided in making this decision by her peers. Subsequently, she was introduced by her mentor Dr Lindley, to her current PhD supervisor, Dr O Biggs, who was working extensively in the climate change mitigation sector with both the University of Stellenbosch and the Stockholm Resilience Centre. Through this introduction, she applied for a PhD post and then set out to find funding. She learned about GreenMatter and its fellowship programme, which she joined and received funding for her PhD studies.

### **The issues facing the need for and supply of biodiversity professionals**

As a doctoral candidate she recalled the following issues encountered as a student and then as an intern at Mondi Wetlands programme. The skill set acquired whilst conducting her undergraduate degree, she informed me, was not entirely applicable to the workforce and in saying this, felt that she had to obtain new skills whilst in her internship:

You go to university and are taught certain things and then most other jobs require other skills; it does not really match up with what you are being taught... Alana<sup>11</sup> says 'you have a skill set but the job does not really require what you have. Even the stuff we were doing for the Mondi Wetlands Programme, other than the mapping part. We did not do wetlands at all in undergrad! So we came in and had to do pretty much everything from scratch. Maybe this is the nature of jobs? But when you look at job posts and you are like 'what do you have that is actually required in this post? [FE/Int.09.36].

In saying this, she foregrounded a macrosystemic concern that is shared by her student colleagues. Furthermore, she expressed anxiety related to entering the workforce.

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<sup>11</sup> "Alana" Is Mrs Rebelo, FE/Int.05

She described extensive writing capabilities and exposure to in-depth research as a core skill set she had obtained through her undergraduate and Master's degrees. Thereafter, she recalled the differences in emphasis placed on subjects apparent at other higher education institutions experienced by herself and her colleagues:

Rhodes is good at this; I'm learning systems thinking and core management at MSc level... I didn't even know that there were all these different ways of doing research and that they were not always problem-based. As I was still being taught concepts at honours level! I think they, the universities, could integrate more practical stuff [FE/Int.09.46].

Ms Luvuno gave an example of some of the skills she would need as a researcher and until she entered the workforce as an ecologist, "At some point I'd like to do a project management course" [FE/Int.09.50].

A lot of universities offer project management, I'd also need to learn how to write proposals and if there are facilitation courses, I'd like to hold workshops... I know that university does a lot to prepare us or could do a lot to prepare us. But I suppose you are young and naïve; you don't know these things, no one says... Maybe someone should give us one or two lectures on this side of things [FE/Int.09.52].

Through this statement she alluded to the macrosystemic factor of exposure to the workforce at a university level.

Ms Luvuno stressed that exosystemically, the universities could work in unison with employers in the sector to equip recent graduates with appropriate skills and knowledge to assist their entry into the workforce. "At the end of the day the universities and the workforce should be working together... so you get a chance to work at or learn research in different ways" [FE/Int.09.46]. This she felt would improve graduates' chances of a successful transition into the workplace.

She supported this statement by saying that, as a member of the GreenMatter programme, she had worked with a number of the GroenSebenza interns and had noted a level of confusion, frustration and expectation expressed by these individuals:

I didn't know this, when you get into the workplace and some people are like: 'This isn't what I studied!' Especially, when I was speaking to some of the Groen Sebenza interns. Some of them are happy, but some of them are not. At the end of the day you are excited when you get a job, but then it is not actually the job you wanted or you are trained for... it's just a job... then you know nothing about that job [FE/Int.09.55].

And in conclusion, when asked what she knew about the supply and demand for the scarce skill of a freshwater ecologist, she stated the following:

I have no idea honestly about the supply and demand, I know there is a need; we have destroyed and transformed a number of our wetlands. And I feel like people always go to the same people they know, so if you are in KZN, it's MWP, Mondi Wetlands Programme or Groundtruth... but it's like, there are very few specific places you can go... I don't know about the demand [FE/Int.09.59].

## **5.5 LECTURERS AND CURRICULUM ADVISORS PERSPECTIVES ON TRANSITIONING**

### **5.5.1 Stellenbosch University Representative: Professor Esler [FE/Int.10]**

Professor Esler is the head of the Conservation Ecology Department at the University of Stellenbosch, and began her studies in the late 1980's at the University of Cape Town where she completed a BSc in Zoology and Botany. She was given the opportunity to complete a double major, but stated that she preferred the Botany aspect of her degree, for personal reasons. She continued her postgraduate studies at UCT and, upon completion in 1993, accepted a post-doctoral position at the University of California, Los Angeles. She stated in the interview that this exposed her to conservation practices at an international level, which she found to be very advantageous. In 1995 Professor Esler accepted a post advertised for a position within the Environmental Department at the University of Stellenbosch, and remained there until 2004, when she was offered the position she currently holds, as Head of the Conservation Ecology Department at Stellenbosch University. Her role is diverse in that she not only lectures and advises on the curricula, but serves as a mentor and supervisor to both undergraduate and postgraduate students. As the head of the department, she explained the contents of the curriculum and the incorporation of wetlands and freshwater systems into the curriculum. "Our degree is a three plus one. ...We want to be quite applied in our training, especially with that number of students. ... Our undergraduate degree does prepare one for work, it is quite a vocational thing, so that they can with an undergraduate go out and look for a job" [FE/Int.10.36-40]. She explained that in the last year of the degree, the students are encouraged to go and network with a conservation agency and complete a mini-thesis or management plan after their interaction with the agency/ies.

Although the undergraduate degree in Conservation Ecology does not focus specifically on freshwater systems, she informed me that there are modules which focus on elements of



freshwater ecology, namely the SASS indexing, which is held in the second year. “Alison Leslie teaches the students SASS, and they go out and learn the whole SASS monitoring protocol” [FE/Int.10.98]. She added: “We try to get them exposed to those kinds of information or anything that is obviously going to provide them with information that they can take into their jobs that they do” [FE/Int.10.102]. She emphasised that the exosystemic relationship between the University of Stellenbosch and the Centre for Scientific and Industrial Research (CSIR) exposed students to individuals who are employed within the biodiversity workforce, through a series of lectures and interactive opportunities, such as the abovementioned SASS workshop. Within her position as head of department, she forms a critical link between the University and the biodiversity sector and serves as one of the committee members on the Fynbos Forum which was established in the 1980’s. These are all examples of mesosystemic relationships in which she is a pivotal member. In these roles, Professor Esler is able to provide support and networking opportunities between her students and the biodiversity conservation sector. She was also instrumental in the development of a mailing list which alerts current and past students to opportunities in the sector. This list was email-based until she decided to change it to an interactive Facebook page, which is open only to specific alumni and current postgraduate students. She remains the administrator for this platform. “It started with a mailing list, which did not work, as students are in a transition time of their life and emails change and the maintenance of it is really hard” [FE/Int.10.12]. “I now run a Facebook page, targeted toward all our Alumni” [FE/Int.10.08]. This example is one of the chronosystemic influences, of rapidly evolving technology and the advent of social media platforms, serving as networking spaces for individuals. Although, by initiating this platform, she has taken steps towards addressing barriers to the workplace transition, she recognises that there are a significant number of issues facing students and recent graduates.

### **The issues facing the need for and supply of biodiversity professionals**

As the head of the Conservation Ecology Department, she noted that over the past decade the numbers of students had been rising: “Our numbers were climbing quite alarmingly and that was worrying us because we felt that we might be producing more students than the market could bear and we weren’t able to train... you know we felt that field training became more complicated... we then capped, we tried to ask the university to cap the numbers we were admitting to around 40 in the first year, but our classes remained large in the last year. It does make things quite challenging and complicate things a bit, because we are quite applied in

our training, especially with the number of students and, for one thing, CapeNature does not want us traipsing 70 students through their sensitive habitats” [FE/Int.10.38]. Professor Esler informed me that since the undergraduate degree in conservation ecology was so broad, and had to cater for various students from across the agricultural, forestry and environmental departments, the resulting degree had to take into consideration the space and time allowed for specific subjects and the opportunities for experience, and practical demonstrations. Although the curriculum was reviewed every four years by a panel of experts from within the biodiversity sector, as well as the final year students, the ability for each sphere of biodiversity to be addressed in depth, was not always met. And as a result, some of the topics included were not covered in great detail, for example evolution and conservation history. She also stressed the aforementioned factor that students came from various disciplines, such as forestry, agriculture and as such, it was difficult to keep in touch with those who were not from the Conservation Ecology Department.

She indicated the difficulty of trying to trace in what direction the undergraduates went upon graduation. However, with the postgraduates who specialise in wetlands and freshwater ecological systems, this is substantially easier: “I’d say, probably just me personally, I’ve had about 50 odd postgraduates graduate with me and probably, at least 5 to 10 of them have moved towards the wetland and freshwater direction” [FE/Int.10.42].

Professor Esler voiced concern over the disconnect between the university and the sector, coupled with the lack of experience acting as constraining factors to many recent graduates: “Often there lies where the disconnect is, connecting the students to that experience... sometimes there are things advertised, you can go for it without any experience... but how do you get experience if you do not have a job?” [FE/Int.10.02]. When asked about how students could find work opportunities, she made reference to her Facebook site, and informed me that certain students, so-called “go getters”, who are willing to go out and look for opportunities, are more likely to be successful in their search for work: “Go getters have vision and a goal, and they just accumulate that knowledge and experience to apply for that. Those are your most successful... Mr Barrows is also very motivated, connected up with CapeNature in his fourth year and continued on with his master’s” [FE/Int.10.44].

As an example of a macrosystemic factor affecting the students gaining experience, Professor Esler informed me of the following opportunities aimed at black students and from historically disadvantaged backgrounds as a ramification of the apartheid era:

There's quite a lot of interest for example from our students in the internships, but a lot of them get depressed because they think (a lot of our students are white) that they are not in line for these opportunities... that is definitely a depressing factor for a lot of our white students who really want to stay in the country and who really, really want to contribute [FE/Int.10.54].

Professor Esler commented that there was a loss of individuals to the overseas biodiversity market and or to other sectors. Whilst she did understand the need for transformation, she felt sad at the loss of many talented individuals.

She commented on institutions offering students or recent graduates the opportunity to gain hands-on experience and enhance their skill sets, however, at a price. During the interview, she found an example of one such conservation-related institution advertising such a post on her Facebook wall and read it: "We have special prices for South African students, so please have a look at our information brochure" [FE/Int.10.120].

On a macrosystemic level, Professor Esler also alluded to students leaving university with a set of preconceived expectations about the workplace, especially pertaining to working within a specific area, such as Cape Town or with a set salary to match their qualifications. Coupled with this factor was that of the newer generation of black students attending the university, who have to support their family and often leave after obtaining an undergraduate degree:

I think certainly for our black students finances are an issue. I do not think they see it as an appealing vocation or job, as it is not necessarily up on the high earning scale... if you are first generation higher education trained... there seems to be a great deal of expectation on those kids [FE/Int.10.58].

Professor Esler noted that both of these factors can also be influenced by the interest of the students in the actual subject, as often the environment and biodiversity sectors are viewed as unappealing and do not offer large salaries. These are identified as macrosystemic pressures stemming from culture and society.

She identified the exosystemic demand for qualified, experienced ecologists of differing specialities within the biodiversity sector, stating: "There is a strong need for more professional people within the conservation field" [FE/Int.10.73]. And this, she informed me,

was what the Conservation Ecology undergraduate degree and the specialised post graduate degrees at the University of Stellenbosch were trying to achieve.

### **5.5.2 Rhodes University Representative: Professor Ellery [FE/Int.11]**

Professor Ellery, as previously introduced, is a white male who is the Head of the Geography Department at Rhodes University. He began his academic career at the University of Witwatersrand, where he conducted his undergraduate and postgraduate degrees (as presented in section 5.2).

He outlined the basic structure of the Geography curriculum, which caters for this dynamic and integrative discipline by using South African and, more especially, Eastern Cape examples. “Teaching research in the Department of Geography promotes the discipline in the Eastern Cape, Southern Africa and internationally, by developing critically thinking graduates who are able to contribute positively to the environment and society” [DFE.03], see appendices G and H. Although the undergraduate degree does not specifically focus on water-related ecosystems, it does include elements of freshwater and wetland ecology, and aims to address societal and environmental issues facing the biodiversity sector. Professor Ellery mentioned that the curriculum aims to equip students with pertinent knowledge regarding current and historical factors affecting the environmental sector, such as, catchment management, rural development, watershed services, learning through simulations and an introduction to Geographical Information Systems [DFE0.3].

In the Honours year, the Geography Department offers two unique courses: Geography and Environmental Water Management, both consisting of four modules, a research project and two seminars by external biodiversity professionals. One of the modules, integrated catchment management, is compulsory. “The Environmental Water Management Honours aims to produce graduates who are well equipped to contribute to meeting the challenge of managing the nation’s most precious resources in a sustainable manner” [DFE.03]. Furthermore, this course employs a multidisciplinary approach.

This degree and its courses, however, are reliant upon staffing capabilities as well as time table allowances. It is mandatory that students wishing to enrol in this degree are in possession of a prior undergraduate degree, majoring in Geography, Hydrology or an environmental-related science. However, as in the case of Ms Mgaba, students will be accepted with years of prior learning.

## **The issues facing the need for and supply of biodiversity professionals**

Professor Ellery maintained that although trained, adequately educated and experienced individuals were needed to perform specific field-related tasks, there was a definite need for young, talented and enthusiastic individuals within the biodiversity sector as a whole. He gave the following accounts about the issues he felt that students and recent graduates faced prior to finding work and once employed. Many of his students felt drawn to pursue careers overseas and have informed him that they were unable to find opportunities within South Africa as a result of racial transformation within the sector. In his role as a lecturer and supervisor, he finds it hard to see talented young individuals leave the country which is unique with an enormous amount of potential<sup>1</sup> (see section 5.2). Professor Ellery acknowledged the impact of internship programmes such as GreenMatter and the Mondri Wetlands Programme where individuals were exposed at an internship level to the critical skills needed to work within the sector. He was saddened about the end of the Mondri Wetlands Programme's internship opportunities, but commented on how the successful transition of the individuals from the University into the field of wetland ecology was not as successful as was originally envisaged. Upon completion of their contracts within the Mondri Wetlands Programme, many graduates opted to enter different fields or remain in an academic institution; this he maintained was out of personal choices made by the individuals.

Professor Ellery noted that graduates entering the field of freshwater ecology were affected by the recent national requirement to register as a scientific professional and furthermore as a registered wetland practitioner. He informed me that this could be seen by graduates as another "hurdle" in their transition before being able to practice in the field in which they had received training. When asked if the students are informed of this in their undergraduate degree, he replied that they were not always informed of this requirement.

He did, however, say that there were many platforms, such as the Wetlands Working Groups throughout the country, which students and graduates were notified about and encouraged to join. Another wide reaching platform and the example of a mesosystemic relationship, was the Wetlands Indaba, a large annual conference where freshwater and wetland practitioners, students and university representatives met and presented current research and papers pertaining to the management of wetland ecosystems. He emphasised the potential for

individuals to gain networking opportunities and the chance to gain invaluable experience through the attendance at such conventions.

## **5.6 ESTABLISHED PROFESSIONALS PERSEPCTIVES ON TRANSITIONING**

### **5.6.1. Dr Simaika: The University of Stellenbosch**

Dr Simaika is a German-Canadian conducting his post-doctoral research through Stellenbosch University as well as part time environmental consulting. He was raised by his parents and grandfather, all of whom played instrumental roles in his life and aided his passion for the environment. His grandfather owned a large plot of land, “I used to be taken for interpretive walks... so it was kind of like a treasure trove for me” [FE/Int.13.46]. He followed this passion to university and conducted a double major in Anthropology and Biology after which he realised he wished to pursue his studies further. “I suppose another level of education means that you can potentially increase your salary and the competition is not quite as tough at PhD and Master’s level” [FE/Int.13.28]. However, this being said, he had to decide whether to remain in Canada or come to South Africa; he opted to move to South Africa.

He arrived in South Africa in the mid 2000s to conduct his Master’s research at the University of Stellenbosch in an entomological aspect of freshwater ecology. At his previous university in Canada, where he completed his undergraduate degree, Dr Simaika informed me that there had been a specific programme which had linked the students and recent graduates to the workforce through a series of experiential training opportunities. During his experiential training period, he had been exposed to three different environmental agencies, through which he stated he gained invaluable experience. He suggested that this kind of programme should become integrated into the environmental curricula at South African universities. He found that, through this programme and the exposure it gave him, he learnt to depend upon himself and develop a self-learning capability, as he had found “a lot of the focus in university is on the tests and absorption of knowledge” [FE/Int.13.20].

Once he had arrived in South Africa, he was given opportunities by his supervisor to contribute actively to several biodiversity publications and this, coupled with the exposure he received by attending environmental conferences, added much value to his professional career. He stressed the importance of attending conferences and networking with like-minded individuals, and highlighted that on one such occasion he had been invited to write a paper

with another biodiversity professional. Since his arrival in South Africa, he has had 18 peer-reviewed articles, 3 international reports, 3 consultant reports and a book chapter. He attributes this success to networking, self-motivation and an encouraging supervisor.

The disadvantages of university studies he ascribed were often related to the subjects offered and the lack of critical skills taught. “One big complaint is that you do not get any business training at any point during the education and I think it should form an essential part for professional business traits” [FE/Int.13.32]. He also added that the manner in which the sciences were taught, placed a great deal of emphasis on the undergraduate intake and less attention on the materials, tools and equipment, being utilised to teach the undergraduate degree. He attributed this to the contemporary way in which universities were increasingly being managed in a business like fashion. Instead of producing a low number of high quality students, there seemed to be an abundance of generalist graduates entering the workforce, “There seems to be a bottleneck and there is a need for freshwater ecologists; I know this from the reports we get from consultants in the field” [FE/Int.13.50 -52].

Dr Simaika stated this might be attributed to the closure of the institutions which specialised in postgraduate training, which had contributed to the sectoral demand for and supply of freshwater ecologists. “I think the demand will actually increase with time, especially now with these major research centres, UCT and UKZN, closing shop; there’s a huge gap that needs to be filled when it comes to capacity building” [FE/Int.13.54]. Dr Simaika added that there was a need for freshwater consultants and individuals with specific skill sets aimed at assessing freshwater ecosystems. He also elucidated a sense of expectation from employers of recent graduates: “...at a certain point you actually need to complement your education with experience... because there is a certain expectation that you actually have your doctorate... as well as managerial skills” [FE/Int.13.60]. In closing, Dr Simaika spoke of several platforms where students and graduates could seek jobs, namely, the Water Research Commission (WRC) and governmental advertisements both online and in print media.

#### **5.6.2. Dr Reinecke: The University of Stellenbosch and Southern Waters Consultancy**

Dr Reinecke is a recent PhD graduate; however, he has been working in the environmental consulting industry for nearly a decade, prior to which he was a biology and science teacher at a school in Cape Town. He had always been interested in Biology and as a result had undertaken his undergraduate degree in Biology and a Master’s in Zoology at the University

of Cape Town. He informed me that, unlike many of the individuals interviewed, the key to his involvement within the biodiversity sector is not necessarily passion, but interest. He felt that in order for him to remain satisfied within a job, he needed to remain interested, and felt that consultancy work provided him with an adequate degree of interest. Additionally, he stated that, “I’ve just dealt with it as just going where doors opened... not choosing to walk through doors that have or have not opened” [FE/Int.13.56]. Upon completion of his Master’s, he became a Biology teacher for two years before returning to the University of Cape Town to take up a position as a researcher within the environmental sciences. As part of his research post, he lectured part-time and it was there that he experienced initial exposure to the workforce, through a single lecture he attended. “I lectured whilst working as a researcher... I ran some of the courses. Kate Rowntree, manager of Southern Waters, gave a lecture to the students, which I attended, about consulting and opportunities available. I just sat and listened... it was just in that course and that lecture, was the only time I was exposed to the workforce” [FE/Int.12.44]. After six years as a researcher, he was offered a consultancy job at the Southern Waters consultancy, and it was at this point he decided to conduct his PhD. He, like Dr Magoba, stressed the need for a postgraduate degree in a consultancy position: “You can’t really consult without a Master’s; no one takes you seriously with an honours. Also, this is necessary at an international level” [FE/Int.13.72].

Instead of continuing at the University of Cape Town, he conducted his PhD through the University of Stellenbosch. Dr Reinecke also explained that his move from the University of Cape Town to the University of Stellenbosch had been partially determined through macrosystemic influences from the academic expectations of his peers and secondly, his choice of supervisor, Professor Esler, a well-known individual within the Conservation Ecology field. Here, he highlighted the impact that a supportive and understanding supervisor has on a graduate, in relation to both the education and overall preparation for their transition.

When asked about his initial feeling about his transition, he emphasised that having two degrees made him confident about looking for work. However, he stated that the university had provided him with a foundational knowledge basis and skills in report writing, but with no critical skills or applicable experience whatsoever. He informed me that the critical skills he had gained since entering the workforce were both generic and particular to the field, such as presentation skills, word processing, analysis, GIS and spatial analysis, critical engagement with colleagues and managerial skills.



He explained that there is a demand for educated and experienced freshwater ecologists, and noted that the consulting agency he works for is often requested to assist with projects which it cannot always respond to. With the closure of the freshwater departments at both the University of KwaZulu-Natal and the University of Cape Town, coupled with the increasing need for environmental impact assessments particular to freshwater systems, he felt this added to the demand for these specialists. He added that a new requirement of biodiversity professionals, required them to register with the South African Council for Natural Scientific Professionals (SACNASP), should they wish to practice as a freshwater ecologist.

### **5.6.3. Mrs Hiestermann: Rhodes University and the University of KwaZulu-Natal with previous involvement in the Mondi Wetlands Programme.**

Mrs Hiestermann was one of the mentors involved in the Mondi Wetlands Programme. I held a brief interview with her regarding her insights into the programme itself and factors she had witnessed with the interns at the Programme during 2009-2013. One of her interns was Ms Luvuno. Mrs Hiestermann explained that the aim of the Mondi Wetlands Programme was to equip honours graduates with critical skills to assist them upon entering the workforce within the fields of freshwater ecology and wetland ecosystems. These outcomes were accomplished through the provision of opportunities for learning and application of knowledge learnt at university level to the workplace setting, as well as short courses and working alongside well-established professionals within the field. Through this programme, the interns were able to gain invaluable experience, whilst conducting Master's projects based within the internship, ultimately contributing to the research and development aims of the programme.

Mrs Hiestermann pointed out the factors which had affected the interns: first, she mentioned finances and a lack of start-up capital, second a lack of experience and exposure to the work environment, which she also attributed to the lack of practical experience evident at undergraduate level, third she identified unrealistic expectations of environmental issues, which she suggested could have been as a result of desktop studies instead of hands-on experiences. When asked where a young graduate could find work opportunities, she informed me that there were several platforms, such as online and social media, which individuals could make regular use of. Her examples were: the Wetlands List Server, the various regional forums (such as the Grasslands, Thicket or Fynbos Fora), as well as LinkedIn and JobsPortal.co.za. And, in conclusion, she informed me that there was a demand

for these scarce skills and that she felt that with the ever-increasing development and transformation of the natural environment, there was a definite need for trained professionals.

## **5.7 Conclusion**

In this chapter, the aim was to present the data obtained through the three data collection methods and in doing so, illuminate the factors affecting the transition of freshwater ecologists from tertiary education into the workplace. In Chapter Six, this data, together with the case study data of wildlife veterinarians will be discussed in the light of the study's research questions, guided by the study's theoretical framework of transitioning and basic critical realism.

## **Chapter 6: Dynamics of supply, demand and transitioning of scarce skills**

### **6.1 INTRODUCTION**

The purpose of this final discussion chapter is to provide insights into the factors affecting the transition of the young, scarce skill biodiversity professionals<sup>12</sup> from tertiary education into the workplace, as reported in Chapters Four and Five respectively.

The chapter begins by reconsidering the research questions and sub-questions which have guided this study. Thereafter, analytical statements pertinent to the two case studies are presented. These statements summarise the main findings of the study as identified through the data generated and reported on in Chapters Four and Five, through the methods employed and the use of analytical memos (see section 3.5.2.2). As reported in Chapter Three, principles of the human ecological systems theory, underpinned by critical realism, were utilised in conducting these analyses. These theoretical perspectives also informed the construction, interpretation and analysis of the analytical statements where I make use of abductive and retroductive modes of inference as outlined in table 3.3 in Chapter Three. Each analytical statement is discussed separately, followed by relevant recommendations. Lastly, this chapter concludes with critical reflections on the study and recommendations for further research.

To provide the orientation for this chapter, and for ease of interpretation of the results reported on and discussed here, I repeat the research questions (see section 1.3.1). As indicated in section 1.3.1, the main research question is divided into two parts, namely:

- A) How do enabling or constraining factors influence the transition of scarce skill biodiversity professionals from a higher education institution to the workplace?
- B) How does this affect the supply and demand dynamics associated with the scarce skills within the biodiversity sector?

Also reported on in section 1.3.1, were a range of more specific sub-questions which were designed to help me address the two main questions above:

- What factors enable the supply of wildlife veterinarian and freshwater ecologist scarce skills in the biodiversity sector?

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<sup>12</sup> In this chapter, the professionals will be referred to by their name, and when directly quoted, by their index code, as both case studies are integrated to allow for cross referencing.

- What factors constrain the supply of wildlife veterinarian and freshwater ecologist scarce skills in the biodiversity sector?
- What demand-side practices influence the scarcity (relative or absolute) of wildlife veterinarians and freshwater ecologists?
- To what extent do the higher education institution's curricula for the specified scarce skill occupations reflect and respond to demand-side critical skills?
- How are the scarce skilled graduates' individual transitions between the higher education institution and workplace affected by enabling and constraining factors?

In this chapter, the research questions are addressed via nine analytical statements which, in a synthetic way, address these research questions. The analytical statements are:

- **Analytical Statement 1:** Early experience, passion, sustained interest and exposure to a biodiversity field are factors enabling supply (addresses sub-question 1 above)
- **Analytical Statement 2:** Availability of certain qualifications or skills at specialisation level only can constrain the supply of scarce skilled individuals to the biodiversity sector. (addresses sub-question /s 2, which speaks to the Main question A and B, above)
- **Analytical statement 3:** Factors specific to higher education institutions impede the supply of scarce skills (addresses sub-question/s 2 above and this contributes to Main question A and B)
- **Analytical Statement 4:** Demand-side information is not always shared with higher education institutions and graduates, and the lack of career information influences supply (addresses sub-question/s 2,3,5 above and contributes to Main question B)
- **Analytical Statement 5:** Obtaining workplace experience is an essential bridge between HEIs and the work place (addresses sub-questions 1 and 5, above and contributes to Main question A and B respectively)
- **Analytical Statement 6:** The presence of a mentor is beneficial for the transition from an HEI to the work place (addresses sub-question1and 5, above and contributes to the Main question A)
- **Analytical Statement 7:** Dynamics of the contemporary workplace society influence individual's transitions and career choices (addresses sub-question 3 above and contributes to the Main question A and B respectively)
- **Analytical Statement 8:** HCD structural interventions such as bursaries, internship programmes, professional registration, and other factors affect supply (addresses sub-question 1 and 5, above and contributes to the Main question A and B respectively)

- **Analytical Statement 9:** The biodiversity professional transitioning occurs within a relational human ecosystem that is also related to the broader ecological systems.(addresses sub-question 5 above and contributes to both Main question A and B)

I now discuss each analytical statement in more depth.

## **6.2 Analytical Statement 1: EARLY EXPERIENCE, PASSION, SUSTAINED INTEREST AND EXPOSURE TO A BIODIVERSITY FIELD ARE FACTORS ENABLING SUPPLY**

Across the two case studies described in Chapters Four and Five, it was evident that individual's exposure to a biodiversity field, as well as personal experience and sustained interest in the field often contributed significantly to their career choices within the two scarce biodiversity skills fields. In many cases, these factors occurred as a result of relationships within the early microsystemic setting. A setting, according to Bronfenbrenner (1979), is understood as any place in which individuals can closely engage in face to face dealings, examples of which could be the home, workplace and education institution. Additionally, the setting is comprised of foundational elements such as roles, relationships and activities, which are subject to change in the event of an ecological transition, as described in section 2.4.3.

In the cases of three of the wildlife vets, namely Dr Simmonds, Dr Pretorius and Dr Breed, a passion for the biodiversity field, as well as early microsystemic experiences and exposure to the field contributed to them following their common interest in wildlife veterinary science: "I grew up in the country-side, rural England, I was always surrounded by animals ...". In the case of wildlife veterinarian one, Dr Simmonds, her passion for animals was further enhanced by her mother's encouragement, and eventually became integrated into Dr Simmonds' life, in the areas of schooling, extra curricula activities and her home environment.

Additional examples of the aforementioned microsystemic influences can be found in the data provided by Dr Pretorius and Dr Breed, as these individuals were both exposed to wildlife and animal husbandry from a young age through parental influences, resulting in them following the veterinary career trajectory and ultimately being involved in wildlife veterinary science. A similar example is found in the case of one of the freshwater ecologists

Mrs Joubert, whose parents, through their vocations, exposed their daughter to the field of biodiversity in the form of trips to nature reserves and national parks. This, coupled with her own passion for nature, served as particular influences in her decision to continue her education in the field of freshwater ecology. Thus, parental influence is a common microsystemic factor in some career choices, while other participants cited the influence of friends and their own interest in the biodiversity field as significant factors in their trajectories.

Through microsystemic friendships, and not familial or parental relationships, two of the veterinary participants interviewed Dr Roxburgh and Dr O'Dell, had access to game parks and farms and it was this privilege, coupled with individual self-motivation to develop this interest, which the individuals perceived as instrumental in their pursuit of a particular career trajectory.

Dr Magoba and Dr Reinecke, the two established freshwater ecology professionals, claimed that an interest in the field of biology, freshwater and wetland ecology, and not exposure to the field, lead to them pursuing their studies and, later, employment in this field. Additionally, both individuals made reference to pursuing opportunities where 'doors had opened' and where they had ignored 'closed doors'. Thus, a variety of microsystemic and individual factors played a role in individual education and career choices.

#### *Recommendation:*

Further opportunities to be exposed to and gain practical experience in the biodiversity field should be made available within primary and secondary education to facilitate the attraction of biodiversity professionals to the field from a supply perspective. There are a number of possible mechanisms to achieve this. First, wildlife or environmental clubs could be established at both primary and secondary schools, and environmentally focussed holiday clubs could be offered. Furthermore, through these clubs, school children could become involved in activities in local nature reserves. These objectives could be achieved by schools partnering with various environmental organisations and programmes.

The above projects could have an influence on children's microsystemic development and foster an interest in, or a passion for, the natural environment which, as suggested in these

case studies, was influential in the respondent's choice of study and career in the biodiversity sector.

### **6.3 Analytical Statement 2: AVAILABILITY OF CERTAIN QUALIFICATIONS OR SKILLS AT SPECIALISATION LEVEL ONLY CAN CONSTRAIN THE SUPPLY OF SCARCE SKILLED INDIVIDUALS TO THE BIODIVERSITY SECTOR**

As shown by the data in Chapter Five, in freshwater ecology, and especially in the consulting industry, a specialist background appears vital, not only to enter the field of biodiversity, but also to advance to more senior positions in the workplace. However, as discussed in section 2.3.4, this kind of specialisation is only offered at postgraduate level. Although graduates can enter the workplace with an undergraduate degree, this appears to limit their development as biodiversity professionals since the demand appears to be for highly specialised skills. Both Dr Magoba and Dr Reinecke, freshwater ecologists who have worked within the consultancy industry, stated that the possession of a PhD was 'mandatory'.

Bronfenbrenner (1979) recognises such issues as being associated with the greater or more dominant ecological systems, namely the macrosystem and the chronosystem which extend dominance over the lower order or lesser ecological systems of the microsystem, mesosystem and exosystem, as described in section 2.4.3. He continues by describing the macrosystem as being inclusive of consistencies within the form of the lower order systems for example: ethnic groups, social classes and religious groups that exist or can exist at the level of the culture or subculture collectively, and is inclusive of ideologies and belief systems underpinning such consistencies, yet the macrosystems between different cultures differ. The broader biodiversity sector and higher education institutes, can be identified as individual communities of sorts, which possess and are governed by their own set of ideologies and belief systems. This being said, the macrosystemic expectations associated with the broader biodiversity community pertaining to the specialisms or scarce skills taught at university and the actual function of a university, differ. Professor Esler provided me with an explanation of how these two different macrosystems could be bridged, the Conservation Ecology undergraduate degree<sup>13</sup> would equip the graduates with a broad knowledge on different biodiversity related issues, allowing the graduates to enter into the work place with this broad

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<sup>13</sup> This degree is held at the University of Stellenbosch.

knowledge and exposure to the different facets of biodiversity and conservation. Yet, should a graduate decide to specialise, this was available at a postgraduate level. Bronfenbrenner also indicates that each ecological system is interlinked and that events occurring within each system can be influential in other ecological systems and ultimately in an individual's transition and overall development, as seen in the experiences detailed in Chapters Four and Five. For example, related to the issues of scientific specialism, good quality schooling is a significant factor affecting the possibility for specialism, and in all of the cases, those who had 'made it' into the specialist areas had also completed science subjects at school.

In this research, the dominance of macrosystemic issues that determine high levels of specialism was identified and evident within the following cases. Certain individuals noted the difficulties involved in attaining specialist postgraduate qualifications. Two of the freshwater participants Ms Nhleko and Ms Mgaba, as well as Professor Esler, indicated that the progression from an undergraduate degree to a specialist postgraduate degree posed challenges and this was often due to the macrosystemic and broad chronosystemic events that occurred in South Africa's past, namely apartheid which a) led to poor quality education and b) left many individuals without adequate resources to pursue extended periods of higher education. The lack of financial resources and the absence of adequate scholarships for postgraduate study, often results in potentially high skilled individuals seeking work in order to support their families thereby affecting both their microsystemic relations and roles, and the supply of skilled professionals into the biodiversity sector. This further affects the possibilities for them to volunteer during their undergraduate degree or after graduation, as was noted by both Ms Nhleko and Professor Esler (reported on in Chapter Five). Through the process of retroductive analysis, it is possible to gain further insight and understanding into how the historical legacy of apartheid continues to act as a generative mechanism. This is associated with actualising and affecting people's choices and opportunities two decades later and this can be seen in the outcomes, challenges and experiences that individuals still face in the present day. As shown in this study (section 2.3.2), such factors combine to limit individuals' opportunities to access postgraduate education, as well as constraining their job-seeking efforts, thereby affecting supply into the biodiversity sector.

However, despite the demand for high levels of specialism, the availability of work opportunities and a smooth entrance into the workplace is not guaranteed, even with a specialist degree at master's or doctorate level, as outlined in section 2.3.2.1. The case of Mrs



Joubert illustrates this point as she stated that she enrolled for a PhD as a result of her inability to find work within the freshwater ecology field. During this time, she developed an interest in lecturing and decided to pursue postgraduate level lecturing in the biodiversity field instead.

Unlike the freshwater ecology field, the possession of a specialist degree was not essential within the field of wildlife veterinary science, unless one wished to specialise in a specific aspect of wildlife veterinary science, such as in the case of Dr O'Dell, who was enrolled in the M.M.Ed Vet. degree in wildlife health. The completion of this particular degree, as mentioned in section 4.4.2, although a valuable qualification to possess is hampered by the lack of qualified veterinary supervisors and their geographic location relative to the student. Veterinary graduates or established veterinarians wishing to pursue this degree are required to obtain work within the same geographical areas as their supervisors. These factors are identified as structural constraints, which have ultimately led to the overall shaping of the degree as well as the difficulties associated with it. This in turn has had an effect on the numbers of postgraduate specialist wildlife veterinarians entering the workplace.

Until recently, the undergraduate veterinary degree has produced veterinary graduates who are prepared to carry out generalised veterinary tasks, yet are not well practised within the field of wildlife. This has served as a motivating factor for three of the veterinary participants, namely Dr Simmonds, Dr Breed and Dr O'Dell, to continue into a postgraduate wildlife veterinary specialist programme. Dr O'Dell explained: "I think most vets who walk out of here are more than competent to handle small animal cases, dogs, cats, but when you get to other species, birds, wildlife, cattle ... I think the guys are less willing to do it ... but it did not stop me, and if you have a passion for wildlife or production animals, it is definitely not going to be a constraining factor ..." (WV/Int.05/144).

It is also possible that an individual can be too highly specialised and may encounter challenges in the long term when seeking a suitable job. The wildlife veterinary Focus Group was concerned about this particular point:

Ja, yes, you choose your specialisation in the new programme so a generalised degree and then you at the end say, 'Oh OK, I want to do equines and then you just do equines. Ja ... it's also quite controversial in a sense as those people who did come out won't have such a broad knowledge of everything ... They'll sort of be stuck in

that field of work ... so when you leave here qualified in equines and you don't find work in equines ...you are kind of stuck ... [WV/Int.06.183].

*Recommendation:*

The spectrum of choices available to an individual from the early stages of an undergraduate programme should be made more explicit and potentially also broadened to allow a certain amount of specialisation at this level. This can be achieved through integration of specialist subject options or electives within the curriculum, supported by mentors or supervisors, at an early undergraduate level, and not only during the final year of the programme. Following the introduction of the various specialist areas early in the undergraduate degree, exposure to these options should be sustained throughout the degree. Exposure to, and earlier experience of some aspects of specialisation could also be facilitated by work integrated learning experiences (e.g. service learning or job shadowing activities).

As reported in Chapter Four, changes in the veterinary undergraduate curriculum allowing for early specialism have recently been implemented, as seen by the inclusion of the One Health principles into the revised veterinary curriculum. However, a recommendation in relation to this early specialism is that the progress of this specialism should be carefully monitored, for two purposes: firstly, to ensure that students do not narrow the scope of their career through specialism and secondly to ensure this curriculum remains up to date and responsive to the changes and needs of the global veterinary field.

#### **6.4 Analytical Statement 3: FACTORS SPECIFIC TO HIGHER EDUCATION INSTITUTIONS IMPEDES THE SUPPLY OF SCARCE SKILLS**

Danermark et al., (2002) explain that reality is stratified into three integrated layers or domains, namely, the Real, the Actual and the Empirical. As described in section 2.5.2.5, retroductive analysis has helped me to gain a greater understanding of the structures, generative mechanisms and intransitive progressions affecting the events and experiences of the research participants, within the domain of the real. In this study, retroductive analysis helped me to gain insight into factors specific to higher education institutes, such as how the limited numbers of higher education institutions offering qualifications in wildlife veterinary science and freshwater ecology can affect the supply of these skills to the biodiversity sector, as outlined below.

As described in Chapters Four and Five, the specialist and undergraduate levels of the two scarce skills investigated were constrained by the availability of higher education institutes offering undergraduate and specialist postgraduate programmes. For example, despite there being over 40 other veterinary higher education institutions in Africa, Onderstepoort in South Africa is the only institution offering veterinary training, and although it offers a highly regarded postgraduate wildlife specialist degree and is widely known for providing excellent undergraduate training, it only trains a limited number of vets per annum, with few of these specialising in wildlife veterinary science. The emergence of a dominant focus on livestock veterinary practice instead of wildlife veterinary practice at Onderstepoort can be explained by examining the historically constituted causal mechanisms present within the domain of the real, in this instance, the presence of the threats to the agricultural sector caused by wildlife which led to the establishment of this veterinary station and subsequent educational institute, as described in section 2.3.3. As a result, the entrance of undergraduate students is limited to between 120 and 140 per annum, as described in section 2.3.3. Within this intake approximately 50-70 individuals choose the WOC610 in their last theoretical year before their clinical final year begins. From this group, it is uncertain the exact number of individuals who actually pursue wildlife veterinary medicine upon graduation. However the evidence is there that number of wildlife veterinarians entering the workforce is limited. As reported in Chapter Four, individuals interviewed alluded to the chronosystemic event of the recent emergence of a booming game capture industry as being a new mechanism attracting veterinarians with an interest in wildlife veterinary science. This also draws individuals away from purely conservation wildlife veterinary careers. As can be seen from the evidence in Chapter Four, few spoke of pursuing conservation medicine or charity based work. Furthermore, little is known about the number of people entering the workplace via these diverse avenues. Currently, the feasibility of conducting a study to investigate this is constrained by a dearth of funding as well as a lack of interest from the Veterinary Council as discussed in section 2.3.3. This confirms the issues raised by the BHCDS (2010) and the GreenMatter Skills Priority List (2012) described in section 2.2.4.2, which agree that there is a severe knowledge gap pertaining to biodiversity skills, and especially scarce skills.

A further issue raised by the wildlife veterinary focus group was the discrepancy between the veterinary undergraduate education curriculum, which often taught out-of-date skills, and the sectors needs. See section 4.4.1.

Similar to the wildlife veterinary field, the freshwater ecology field is also affected by higher education institution factors which limit the numbers of specialist freshwater ecologists produced. The closure of the departments focussing on freshwater ecology related studies in two of the foremost reputable higher education institutions has had an effect on graduate numbers. The Freshwater Department at the University of Cape Town closed in 2013 due to a variety of constraints, namely financial shortfalls and a lack of student projects, these constraints are furthermore identified as causal mechanisms, which became actualised and led to the closure of this department, see section 2.3.4. Problems around the chronosystematic event of the merging of the University of KwaZulu-Natal with the University of Durban-Westville resulted in several of the key freshwater specialists and lecturers leaving for other higher education institutions or consulting agencies. Thus alternative higher education institutions have been under pressure to produce specialised individuals within the freshwater ecology field in order to meet the sector's demand for these professionals, as discussed in section 2.2.4.2. Hence, higher education factors, in both the wildlife veterinary field and the freshwater ecology field, had a considerable impact on the biodiversity sector.

#### *Recommendations:*

First, from the supply side, additional research is required into how specific scarce biodiversity skills are addressed within the curricula of universities offering undergraduate or postgraduate veterinary and freshwater ecology programmes. Insights gained from such research could help universities identify and then reduce the knowledge gap pertaining to these scarce skills.

Second, from the demand side, a critical skills requirement list could be compiled by the HEIs and relevant department/s in consultation, with professionals already working in the biodiversity sector. Such an understanding of the skill sets and knowledge actually required for employment as a scarce skilled professional in the biodiversity sector could guide relevant higher education institutions insights to better align their curricula, thereby enabling the successful transition of graduates from HEIs to the workplace.

#### **6.5 Analytical Statement 4: Demand side information is not always shared with HEIs and graduates, and the lack of career information influences supply**

The study revealed the need for both of the scarce skills under discussion; although the demand for individuals with relevant qualifications as well as complementary years of workplace experience is indicative of a macrosystemic requirement. This became evident in a review of advertisements for biodiversity professionals, more especially for freshwater ecologists and wildlife veterinarians, which, within the list of requirements, make special mention of the prerequisite of at least 2 years of working experience.

Considering that graduates do not usually gain extensive experience, and rely on experiential or volunteer opportunities and vacation jobs, this is difficult to achieve. Professor Esler supports this claim by referring to a disconnect between the higher education institution and the workplace. She experienced this despite being involved in a sector-related Facebook group driven by previous students and being a member of Fynbos Forum, a Western Cape biodiversity related group which is involved in a number of activities which should promote the link between HEIs and the workplace, see section 5.5.1. These activities include the annual conference which illuminates research pertaining to the facets of South African biodiversity, as well as advertising jobs and bursaries within this field. Coupled with the issue of disconnect, Professor Esler stated that tracking of graduates once they had left the academic system, especially at undergraduate level, was a difficult task and required a lot of administration. This sentiment was echoed by Professor Burroughs, who stated that this was not a simple task. However upon graduation, young veterinarians were required to register with the Veterinary Council and through this become members, which is reliant on an annual renewal system. In this way the register of veterinary professionals was kept current.

New graduates, both veterinarians and the freshwater ecologists, who have recently being employed would have insight into the jobs and opportunities in their particular organisations and or workplace and could therefore act as a link from the workplace to their respective higher education institutions. This potential feedback loop between higher education institute and workplace however, is not working, as highlighted by Professor Esler.

This suggests that the poor feedback loop and communication from the graduates to the HEIs involved may be a significant cause of the sector's lack of knowledge on the specific scarce

skills, as highlighted in Chapter Two, of the Biodiversity Human Capital Development Strategy (2010).

The discrepancy between training and sector demands described above has led to graduates seeking opportunities in alternative fields or choosing to study further, as reported in Chapters Four and Five. This was often coupled with respondents reporting feeling unsure of how to proceed. Mrs Rebelo stated that she felt naïve and wary about entering the field, as she did not possess current knowledge pertaining to her field. She commented that she did not know where to start looking for opportunities, attributing this to insufficient exposure to the workplace as an undergraduate. Despite her parents being renowned within the biodiversity field, she did not want to rely on them to make a name for herself. As a result of the lack of working experience and her inability to find a suitable job, she had chosen to continue with her postgraduate studies.

In light of the disconnect between the HEIs and the workplace, the interviewed students and recent graduates called for universities and workplaces to work in unison to provide a platform for students and recent graduates to network with academics and industry representatives, to gain exposure and potentially organise employment opportunities. The lecturers interviewed supported this suggestion.

Ms Mgaba, a freshwater participant, alluded to an additional macrosystemic event, in the form of career fairs and guidance available to students at her university; however she stressed that these had been limited, with little to no focus upon biodiversity or environmentally related careers. She expressed her frustration at this and felt the university could do more to facilitate increased emphasis on these career paths. On further investigation as the researcher in this study, I was told about two opportunities available to students at Rhodes University, one of which was a monthly biodiversity roundtable discussion and the other was the nationally focussed <sup>14</sup> career lounges held by GreenMatter. Although the number of biodiversity related opportunities available are limited and in their infancy, I as a biodiversity professional and graduate paid careful attention to several career lounges advertised in relation to exposure to the workplace. What I discovered upon attending these sessions was the poor turnout of the students who had initially requested these sessions. The situation did not improve with subsequent sessions. This could be attributed to a lack of knowledge of the

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<sup>14</sup>The career lounges had occurred throughout various universities as part of the GreenMatter Programme.

event and / or choice to attend or not attend, as this session had been held after university hours. However, there still remains a disconnect between the demand side information and students or graduates wanting to attend.

As has been previously discussed, the dominance of a specific ecological system, such as the macrosystem, over the other ecological systems, can further affect both the development and transition of an individual. In order to gain greater insight into the macrosystemic events and structures which lead to the issue of information not being adequately shared with HEIs and graduates, one is required to identify and investigate these factors. As shown above, these include a disconnect between the HEIs and the workplace, a discrepancy in the training received through tertiary education and that required in the workplace, and the need for at least two years worth of workplace experience .

#### *Recommendations:*

Firstly, there appears to be a need to establish additional biodiversity online networks within higher education institutions, where various biodiversity related opportunities could be advertised, like the Alumni Facebook page for the University of Stellenbosch's Conservation Ecology Department.

Secondly, the feedback and integration of workplace needs and demands within the relevant departments from differing workplaces or institutions could be more closely aligned, this would include awareness raising efforts pertaining to the needs and demands of the careers.

Thirdly, the possible integration of a careers focussed session built into the curriculum situated at the end of each semester across higher education institutions. Alternatively, there could be an 'introduction to the workplace' involving a series of presentations by actual workers who are "at the coal face" and can, first hand explain the needs, demands and challenges of the workplace to the students prior to entering the workplace.

And lastly, more regular communication of career information as a normal 'part' of postgraduate training could also be considered, in addition to events such as the 'career lounge' events noted above.

## **6.6 Analytical Statement 5: Obtaining workplace experience is an essential bridge between HEIs and the work place**

All of the participants interviewed highlighted that workplace experience was an invaluable asset when beginning one's transition and this has additionally been identified as a critical factor by a range of authors as described in section 2.3.1 (Allais & Nathan, 2012; Breier & Erasmus, 2009; Kraak & Press, 2008). Through the interview processes, I identified four different means of gaining workplace experience and the specified type of skill gained through these procedures as described in section 2.3.1. The mechanisms of gaining experience and the skills attained are discussed below in sections 6.6.1 to 6.6.4.

### **6.6.1 Networking through conference attendance or through mentors or supervisors facilitation**

One of the freshwater ecologist participants, Mr Barrows, stated that he now, as a postgraduate, understood the value of experience for his development and transition into the workplace, he did not fully appreciate this as an undergraduate. This caused him some concern, although through his honours and master's research he had made inroads into networking and had worked extensively with CapeNature and Rhodes University. This networking was as a result of two factors, firstly the links formed through supervisors within the setting of the HEI he attended and his own determination. Hence, he felt that he could draw on these experiences and networks to assist in securing potential opportunities.

Unlike Mr Barrows, Dr O'Dell, a veterinary participant, did not enjoy the help of a mentor with his networking as an undergraduate, but made a point of attending conferences, including the SYMCO conference. This conference provides a two week period of theoretical and practical experience for veterinary students from across the globe, see section 4.2. The event is supported by a variety of biodiversity and veterinary related sponsors, in order to allow for the attendance of local students. Furthermore, Dr O'Dell sought practical experience by drawing upon local veterinary clinicians and arranging to assist in clinical activities at Onderstepoort which later afforded him the opportunity of becoming a veterinary assistant.

### **6.6.2 Internships or experiential training opportunities**

Two participants, Ms Dubazane and Ms Luvuno, noted that macrosystemic structure of an internship programme was a significant enabling factor in their transition. Ms Dubazane was



expressive about her experiences gained during her internship at the Mondi Wetlands Programme and stated that this had assisted her in further critical skill development, as well as workplace exposure. As reported in section 5.3.3, she cited the following aspects of the programme as being instrumental in her successful transition to her current workplace: the presence of a mentor, the flexible structure of the programme and the experiences gained through this internship.

Dr Breed gained invaluable experience and was able to develop her skill as a wildlife veterinarian through the presence of her initial workplace mentor, an established veterinarian who had hired her as his assistant veterinarian. She stated that he had imparted both taught and tacit knowledge during the two years she worked as assistant veterinarian at his practice. Eraut (2000), describes tacit knowledge as that which one acquires over time and in the presence of another, usually a senior or established professional.

Dr Breed commented that, through tacit and self-taught knowledge, one acquires skills with which to operate and practice as a wildlife veterinarian, outside of the sterile and structured environment of a clinic or animal hospital, and that during her two years as an assistant veterinarian, she had established these skills.

The above statement was supported by Dr Simmonds who had carried out a period of compulsory workplace experience prior to her entrance into the veterinary college. She felt that this was invaluable and had equipped her with knowledge about the veterinary sector and she further recommended that this be integrated across the biodiversity sector.

### **6.6.3 Volunteering and work shadow experiences**

Mrs Rebelo had spent a portion of a summer vacation working for an unnamed non-governmental organisation, where she was tasked with handling administrative duties unrelated to her specific job, yet she gained valuable critical generic skills. Dr Magoba spoke of approaching the Working for Wetlands programme, as a young undergraduate and expressing his interest in assisting in the programme as a volunteer. This, he stated, was a pivotal factor allowing him to gain experience and advance his networking capability. In both of these examples, the individuals had taken a decision to pursue a form of volunteering or work shadowing, to boost their levels of experience. This determination, they both claimed stemmed from the immediate familial microsystem.

#### **6.6.4 Familial or parent workplace exposure**

Although Mrs Joubert stated that she declined the offer of the experiential opportunity during her undergraduate degree, she did join her father temporarily in his consulting agency and through this opportunity garnered experience within the field, subsequently deciding not to continue into the consultancy field.

Another participant who enjoyed the benefit of having family in the sector was Dr Pretorius, who gained much of his exposure to the veterinary field from a young age at his family's veterinary practice. He conveyed how much his participation had allowed him to gain valuable veterinary skills. Furthermore, as a youth, he had been involved in a number of hunting trips with his father, and it was during these trips that he learnt skills associated with darting. He emphasised that darting was a mandatory skill for a wildlife veterinarian and mentioned that it should be taught in more detail at the undergraduate level.

Similarly, Dr Breed had learnt how to dart from an early age: "Darting is – it's a skill - an acquired skill that's learnt over time" [WV/Int.03.07]. The family circumstances which allowed for this were the fact that she was brought up on a farm and that her father carried out basic veterinary procedures with which she was required to help. Thus, she gained valuable animal husbandry experience, which further assisted her upon entering Onderstepoort.

Bronfenbrenner (1979) describes the abovementioned relationships as existing within the level of the microsystem, these relationships have an effect on the individual in both their development and transition ability.

#### *Recommendations:*

Compulsory experience prior to entrance into an HEI could equip aspiring biodiversity professionals with invaluable generic and specific operational skills for their future career and also ensure they are suited to their chosen field.

Alternatively, a mandatory short term workplace experience or experiential learning period plus a mini thesis or project could be included in the curriculum as was implemented in the Conservation Ecology undergraduate degree at the University of Stellenbosch, according to Professor Esler.

## **6.7 Analytical Statement 6: The presence of a mentor is beneficial for the transition from an HEI to the work place**

As reported in Chapters Four and Five, participants interviewed stated that the presence of a mentor, often in the form of HEI staff, had positively influenced their transition. Ms Luvuno emphasised this point by stating: “A good lecturer can make or break a student” [FE/Int.09.75]. Ms Dubazane emphasised that her mentor at the Mondi Wetlands Programme had supported her consistently and had allowed her and her colleague, Ms Luvuno, to employ creativity in approaching their master’s work. This, she felt, was a great enabling factor and had left her feeling prepared and positive about her future. In contrast, Ms Luvuno explained that whilst as an undergraduate student, a lecturer who was meant to serve both a mentoring and lecturing role was not particularly helpful and as a result she and her fellow students struggled with grasping concepts in the course.

Throughout the interviews the presence of mentors within specific settings became a common theme and from this I was able to identify and categorise the different types of mentor by three broad microsystemic categories according to setting, these are further described in sections 2.4.3 and 6.2 respectively. The categories are described below.

- **Familial or friend mentors**, such as Dr Simmonds’s mother or Dr Pretorius’s father and Dr O’Dell’s friends, were influential and readily available to the individuals involved. Opportunities associated with these mentors included, immediate microsystemic development of a passion or interest in the biodiversity related field, exposure to the field of work and assistance in entering the higher education institution.
- **Supervisory or peer mentors**, including clinicians in the veterinary field such as Mrs Joubert and Dr O’Dell, are present within the university setting. In the instance of Dr Simmonds and Dr Breed, the supervisors and mentors played pivotal roles in them attaining jobs and becoming involved in postgraduate projects. Opportunities associated with these mentors included, but were not limited to, enhanced networking capabilities and exposure to both postgraduate projects and job openings as mentioned above.
- **Workplace mentors**, such as those who mentored Dr Simmonds and Dr Breed and Dr Magoba, are often established colleagues or managers. These workplace mentors

imparted tacit knowledge and critical skills of generic and specific operational importance. Additional opportunities associated with these mentors included enhanced networking capabilities and exposure to future job openings. Furthermore, from an individual perspective the presence of a workplace mentor allowed for the development of the individual's identity in their new role.

#### *Recommendations:*

A number of recommendations can be derived from these insights. First, HEIs should recognise the significant role of mentors in the students' learning and development within the setting of the specific biodiversity field of study. A mentoring system should be formally established within these institutions from the onset of the undergraduate degree. This has funding implications which could be outsourced, along with additional mentors from external companies active across the biodiversity sector.

Second, the workplaces taking on young graduate could consider introducing a more formalised mentoring system in order to boost and shape the skill sets of individuals transitioning from university to the workplace.

Third, additional individuals could be accepted into programmes such as GreenMatter, GroenSebenza and other biodiversity focussed programmes and projects in partnership arrangements with higher education institutions in order to form stronger links between the sector and the HEIs, offering young people access to a network of potential mentors.

### **6.8 Analytical Statement 7: Dynamics of the contemporary workplace society influence individuals' transitions and career choices**

An ecological systems perspective recognises that the social dynamics of the workplace are influenced by wider societal factors, and that these in turn influence individual's transitions. Each of the systems is both complex and interlinked and therefore affect one another, as is described below.

Microsystemically, the career trajectory of an individual will be affected by the desires and responsibilities associated with their immediate family, the individual's schooling and their social standing. Within the macrosystemic domain, specific cultural expectations associated

with factors such as the political climate can affect the supply of and the demand for specific skills. Professor Esler mentioned that young black individuals who were the first of their generation to pursue higher education qualifications were often dissuaded from pursuing a career within the environmental or biodiversity field. The reason for this is that these fields are not lucrative and often these individuals were relied upon to support their families financially. This domain is linked to the chronosystemic domain which relates to socio-historical events such as apartheid, stock market decline, or other events associated with the specific time which one has been born into. These factors affect the transitions encountered and can affect the choices and the trajectory of an individual hoping to enter into a specific workplace. The chronosystemic factors are influenced by the external or exosystemic domain. The exosystemic domain, which includes factors such as economic or environmental issues and on a smaller scale, familial changes and dynamics, is not directly related to the individual, yet these issues shape an individual's trajectory, and ultimately affect the demand or the supply of specific skills to the workplace.

At present there is a demand for skilled and experienced biodiversity professionals to respond to global pressures on natural resources, as described in the BHCDS (2010) (see section 2.2.4.1). It is for these reasons that the workplace demands individuals with an equivalent ratio of education to experience, which can serve as a constraint for newly qualified individuals who possess little to no experience. On more than one occasion, I was informed that the demand for at least 2 years' worth of work experience resulted in demotivation of graduates and at times led to these individuals seeking work within alternative vocations or continuing with postgraduate studies. Furthermore, I was informed that this is not only a local issue, but a global phenomenon according to Professor Burroughs, and is also reported on in the literature (Ecclestone et al., 2009).

However, this need for experienced individuals is gradually being realised and there are several HEIs offering continuing professional development courses, for example, the courses conducted by Professor Burroughs periodically including: avian anaesthesia and wildlife chemical immobilisation (see DWV2 in Appendix F).

#### *Recommendations:*

Although many of these factors cannot be modified from within the biodiversity sector, for example, political power, financial constraints, some of the effects of the chronosystemic and

exosystemic factors may still be addressed. Some of the factors which could be addressed are for example, for young black graduates supporting family members, sufficient funding for postgraduate studies and living expenses, community based education pertaining to environmental issues and awareness of the environment and the creation of jobs to encourage microsystemic enabling factors. Many of the previously mentioned recommendations under other statements would also serve to address factors discussed in this section.

#### **6.9 Analytical Statement 8: HCD structural interventions such as bursaries, internship programmes, professional registration, etcetera, affect supply**

Various human capital development interventions or structures became apparent upon interviewing the participants. Structures of finance and bursaries, loans and sponsorships influence the individuals' entrance into higher education institutions and further assist with networking abilities, conference attendance and research funding, all of which aid in developing these individuals into qualified biodiversity professionals.

Furthermore the availability of internships, work placements and vacation jobs organised through higher education institutions and workplaces can ensure a graduate's smooth transition from higher education institution to the workplace. However, Dr O'Dell and Ms Mgaba and Ms Nhleko claimed that these opportunities are not always easily accessible and that the graduates often have to use their initiative and seek opportunities themselves.

The aforementioned structures of bursaries, and some internships, have arisen as a result of the higher education institutions and workplaces recognising the need to facilitate and rectify previous historical shortcomings and remain close to the demands of the workplaces. (South Africa. Department of Environmental Affairs, 2010; South African National Biodiversity Institute & Lewis Foundation, 2010). Consequently, there has been a focus on improving access to opportunities for previously marginalised students, with the repercussions being that many white students have no choice other than to either leave the country to seek employment overseas or to move out of the industry. This has contributed to the recognition of the study's scarce skills as migratory, as per section 2.3.2.1(Reddy et al., 2004; South African National Biodiversity Institute & Lewis Foundation, 2010).

This is as a result of the chronosystematic event of apartheid and its mechanisms which allowed for the marginalisation of the majority of the country's population. This has had an effect on the macrosystem in which a number of the participants have grown up and

moreover, influences the exposure to new opportunities that they are now afforded. Sayer (2010) highlights these sorts of events as having been actualised through specific structures and mechanisms, the effects of which are still being witnessed and experienced by individuals today.

Lastly, biodiversity professionals, including the featured scarce skilled individuals, are required to belong to groups or councils which have been established in order to ensure that individuals practice within the boundaries of their job descriptions. For example, the South African Veterinary Council is an established body and it is mandatory for all veterinarians upon graduation to register as practising professionals and to renew this licence on an annual basis. Since this has been in effect for some time, the students are aware of this and are prepared to meet the requirements of the council. However, the more recent councils and or professional bodies, are still in relatively new territory and according to Professor Ellery, these can serve as yet ‘another hurdle for the graduate to jump through before they can practice professionally.’ Often these registration bodies are unknown to the graduates and consequently, may delay the entrance of graduates into the workforce. It is therefore important that the individuals are made aware of these bodies and the necessary registration in order to practice legally and within ethical boundaries as per their job requirements. An example of a biodiversity related professional body is that of the South African Council of Natural Scientific Professionals.

#### *Recommendations:*

First, consideration could be given to issues of exclusion pertaining to internships and bursaries, as highlighted by a number of the participants, as well as two of the lecturers. Sufficient funds should be made available to allow for selection according to need and merit.

Second, linked to the aforementioned point, the funding opportunities and bursaries should be well advertised to ensure that all the interested parties have access to the information.

Third, HEIs should provide an introduction to the specific councils with which the graduates need to register, thus ensuring a smoother entrance into the workforce.

#### **6.10 Analytical Statement 9: The biodiversity professional transitioning occurs within a relational human ecosystem that is also related to the broader ecological systems**

Bronfenbrenner (1979) asserts that an ecological transition is both the product of the consequence and instigator of developmental processes. He continues that transitions are a joint function of altered environmental circumstances and biological changes and therefore represent examples of the process of mutual accommodation between the individual and its surroundings, understood to be the ecology of human development. He concludes this by saying that transitions can occur across any of the ecological systems.

What became apparent through this study, was that the influence of the domains of the ecological system differed across participants and changed throughout each individual's life. The individual's transitioning process is adequately explained and understood in terms of Bronfenbrenner's ecological system, as this transition occurs due to the confluence of many influences. This was evident during the different transition stages, such as during the transition from secondary education to tertiary education where their course and career choices were subject to various influences. Within each setting these individuals entered, they assumed a specific role and acted accordingly; however, upon transition to a new setting, the old role would fall away and the individual would need to assume a new identity and role within this new setting. This can also be described as 'emergence', whereby the individual goes through an ecological transition. Critical realism suggests that emergence is shaped and influenced by the presence of interacting causal mechanisms such as; obtaining a relevant qualification or gaining workplace experience, coupled with structural components such as the higher education institution they attended, the featured curriculum and the skills obtained. More factors are represented throughout the analytical statements 6.2-6.5. All of these factors combined have resultant properties, which, under specific conditions will allow for the actualisation or emergence to occur, in this incidence in the individual's transition into the workplace.

As described in section 6.3, the ecological systems are complex and interlinked and any event occurring within a specific system will and can affect the other systems and ultimately the transition and development of an individual. Finally, exosystemic pressures, coupled with macrosystemic demands, expectations and events occurring within the chronosystem,



essentially shape how individuals embark on their career trajectories, and how these individuals remain in these careers, as is evident with Dr Pretorius.

*Recommendations:*

First, cognisance should be taken of the mechanisms by which an individual's human ecological system affects their transition. Various factors should be taken into account, such as the individual's background and microsystemic relationships which can be tailored into a career guidance package for these individuals.

Second, the factors mentioned in the first recommendation above can also be factored into the selection process for specific biodiversity courses. According to Dr O'Dell, the interview process which was previously part of the Onderstepoort selection process, could highlight an individual's preference for a specific field of veterinary science. Dr O'Dell also maintained that individuals who initially expressed interest in wildlife veterinary science, would often continue into this field. Thus, the selection process could be vital in increasing the supply of scarce-skilled individuals.

Finally, the acknowledgement of an individual's ecological system and the associated circumstances is imperative, especially in relation to the ability to accrue volunteering or experiential training, as was the case with Ms Nhleko. Ms Nhleko was the main breadwinner, as her mother was no longer working and her father had passed away. Moreover, she was the groundbreaker in her family, as none of her family had attended university and thus they were largely reliant on her financial support.

The critical realist lens in this study has highlighted the following underlying generative mechanisms that interact and influence the emergence of transitions of individuals into scarce skill occupations in the biodiversity sector:

- Power relations, historically constituted exclusions, and access to education and training systems, including qualifications.
- Funding mechanisms, especially for those with familial earning responsibilities.
- Availability of institutions offering relevant specialist qualifications and availability of appropriate courses at the right level at these institutions.

- A demand for specialism at a high level in the biodiversity sector which is partly related to the specificity of the biodiversity that requires either management and/or care.
- Economic influences on the sector (e.g. new game farming and forms of wildlife trade) and/or competitiveness of salaries.
- Career orientation, knowledge of career possibilities and opportunities and supportive orientation into careers.
- Individual motivation and values.

As can be seen across this study, these factors variously shape and influence the entry of young skilled professionals into the biodiversity sector, and combine in various ways to shape their transitions from HEI to workplace. The study has also shown that paying greater attention to the range of factors shaping successful transitioning could potentially facilitate easier entrance and transitioning into a sector that has an expressed demand for the two scarce skills which are the focus of this study.

Overall, the study shows that transitioning is an important emphasis for research into supply and demand, and that supply and demand analysis involves more than simply identifying what courses are on offer, and how many people are needed in the sector. *How they make their way into the sector* is equally important in supply and demand research. This study has shown that an ecosystems approach to supply and demand research, underlaboured with a critical realist analysis of generative mechanisms shaping emergence into the sector can potentially provide more nuanced research tools for supply and demand research focussing on scarce skills, thus helping to fill the ‘knowledge gap’ that exists around scarce skills in the biodiversity sector. While this study was not able to focus on all universities and all graduates making transitions into the sector for these two scarce skills, it was able to provide a distinct understanding of the supply and demand factors influencing the two scarce skills under study. However, additional research could be done, which I now reflect on.

### **6.11 Recommendations for further research and critical reflection on the study**

Recommendations for further study were evident throughout the interviewing process, with several of the participants calling for a more in-depth investigation of one or both of the scarce skill occupations under review. This was summarised in analytical statement 3:

Factors specific to higher education institutions impedes the supply of scarce skills. The need for further research on scarce skills and the supply thereof via higher education institutions, was derived from comments made by a number of the participants. However, financial and research support factors were identified as constraints to the further development of such research in this study, and as reported on in section 4.5.1, I was only able to work with a limited number of HEIs, and scarce skills. A longitudinal, and more expansive study on this topic could be conducted at a PhD level, over a specified timeframe.

Certain obstacles were encountered during this research. The study had initially sought to focus upon wetland ecologists and wildlife veterinarians; however due to difficulties in locating wetland ecologists, I had to broaden the scope of research to focus on freshwater ecologists, a group which included wetland ecologists. Methodological limitations are explained in section 3.9.

Additionally, the time constraints associated with a master's study determined the number of participants and the depth of analysis. As has been suggested, there is scope for research to probe deeper into supply and demand issues associated with one or both scarce skills, perhaps at a doctoral level. The aim would be to track individuals during their tertiary education careers and into their transition to the workplace, allowing for a more extensive examination of the inhibiting factors identified during this study.

I also recommend the approach to researching scarce skill supply and demand issues for application to a wider range of scarce skills in the biodiversity sector (outlined in the GreenMatter Scarce Skills List) (SANBI & Lewis Foundation, 2012) as this research has shown that the two scarce skills under study have diverse factors enabling and constraining them which need to be fully understood in order to respond to the scarce skill demand in the sector. There are also similarities that were found across the two scarce skills and further analysis of these in relation to other sets of scarce skills could help GreenMatter to refine BHCDS interventions in ways that could target more generic issues (e.g. funding access) and more specific issues (e.g. registration support for specific councils, or specific career guidance support). Critical realist analysis of the generative mechanisms can potentially be helpful for informing more generic responses via the BHCDS (as Danermark et al., 2002 suggest it is possible to generalise from the level of the mechanism), while analysis of ecosystemic factors at the micro and to some extent the meso level can help to inform skill-

specific responses in the BHCDS; thus the methodology used in this study can potentially be useful for further development of the BHCDS and for skills planning more broadly.

## **6.12 Conclusion**

This study was based on an attempt to understand the supply of and demand for scarce skilled biodiversity professionals to the biodiversity sector and investigated factors enabling and constraining the transition of a scarce skilled biodiversity professional from their higher education institution to the workplace.

It comprised of two individual case studies of scarce skills as listed by the biodiversity priority scarce skills list, (SANBI & Lewis Foundation, 2012), and supported by the National Environmental Management Act, the Biodiversity Human Capital Development Strategy, the Environmental Skills Strategy for South Africa and the National Skills Development Strategy III. The study identified the enabling and constraining factors present in the participants' views of their transitions into the workplace. This research aimed to provide new knowledge and insights pertaining to the transitions made from a higher education institution to the workplace by the following groups:

- Biodiversity professionals and graduates,
- Higher education institutions and their career centres
- Individuals advising within policy and governmental levels
- GreenMatter and the South African Biodiversity Institution.

This was achieved through the nested case studies in which individuals within these two scarce skill occupations were interviewed and some of the participants were observed in the field. Through these methods and the employment of Bronfenbrenner's Ecological Systems theory, underlaboured by critical realism, a greater understanding of a) the factors (also constituted as generative mechanisms) and b) the unique transitions of these individuals was achieved. The theoretical employment of Bronfenbrenner's Ecological Systems theory was underpinned by the philosophical underlabourer of Critical Realism and its principles of stratified ontology, emergence and retroductive analysis. These principles were utilised to firstly, further assist in identifying the causal mechanisms existing within the domain of the real, which affected the transition of these individuals and secondly, to understand why these

skills are identified as scarce. Arising from this process, a set of nine analytical statements were drawn up with their emergent findings.

The findings below are directly linked to the nine analytical statements drafted, and revealed that the transitions of the individuals, although unique to each participant, featured commonalities. Exposure to biodiversity at an early age in an individual's life as a result of family or immediate friends, paved the way for the development of an interest or passion in biodiversity (analytical statement 1). Experience gained prior to entry into the workplace was recognised as a strong enabling factor and in four of the cases this experience was obtained as a result of parental and family influences (analytical statement 5). However, the converse of this also had an effect on the transition of an individual and the ramifications of the supply of the skill to the greater biodiversity sector. This constraint was identified as a particularly troublesome one to graduates and had repercussions for the later entrance into the workplace. The presence or absence of a mentor was identified as being pivotal to the initial pursuit of a biodiversity related career and it emerged that three types of mentor were present during the different transitions.

Linked to support and mentoring was the presence or lack of demand-side or workplace information which could facilitate an individual's transition. Many of the student participants and recent graduates emphasised the role of their supervisory or peer mentors in the identification of such information and pertinent opportunities (analytical statement 6). A secondary suggestion was the strengthening of the relationship between the higher education institutions and the workplace, further allowing for the advertisement of such opportunities (analytical statement 4). This in turn was influenced by workplace dynamics and how these affected the demand for, and eventual supply of biodiversity professionals in response to the need for specific biodiversity related skills (analytical statement 7).

Other factors relating to supply included human capital development strategies and structures, such as bursaries, internships and career guidance, which were viewed as beneficial to an individual's transition. However, there were concerns pertaining to the availability of these aids to all potential students rather than to a selected few. Furthermore, the recent establishment of professional councils for the regulation and monitoring of biodiversity professionals was viewed as a human capital development strategy which could both advance and constrain biodiversity professionals (analytical statement 8). Finally the overall

ecosystemic development of an individual had an effect on the supply of specific scarce skilled individuals to the workforce, as this guided the individuals to follow specific trajectories into the scarce skills in which they had been trained (analytical statement 9).

Thus, this study has identified and discussed the factors involved in the transitions of individuals entering scarce skilled positions and from this, has derived appropriate recommendations. It is hoped that that these findings could inform future developments and research in the biodiversity field.

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## Appendix A : Letter to the university



Environmental Learning Research Centre

Tel: +27 (0) 46 603 8390

Fax: +27 (0) 46 622 8028

20 February 2014

Dear Head of Department

### REQUEST TO UNDERTAKE MASTERS RESEARCH

I am a master's student at the Environmental Learning Research Centre in the Department of Education at Rhodes University, Grahamstown. My study is investigating the transition of newly-qualified biodiversity professionals from their Higher Education Institutions into the workplace, and I am doing a case study of wetland ecologists and wildlife veterinarians. As the qualified wildlife veterinarians in this case study completed their studies through your department in the past three years, I hereby request permission to collect part of this study's data with the support of your department. The attached letter is a formal request from my supervisor and contains more detail regarding the purpose and description of the research.

To understand the course curriculum as well as students' and lecturers' experiences of the factors that constrain or enable them as they start their careers, I would like to:

- a) Collect documents relevant to the course curriculum (for example, course outlines, handbooks, assignments);
- b) Conduct interviews (of 20 – 60 minutes duration) with relevant staff;
- c) Conduct one focus group interview with a group of 4 – 7 senior students – preferably those considering a career as a wildlife veterinarian.

Participation in the study will be voluntary and all information collected from individuals will be done with their informed consent. The research process will be guided by confidentiality, mutual respect and anonymity.

I would like to propose the following dates to undertake my research at your institution: 01 March to end of April 2014.

Should you require further information about the study, please do not hesitate to contact me at [Leanne.mckrill@gmail.com](mailto:Leanne.mckrill@gmail.com)

Sincerely

Leanne Joy Mckrill (Ms)

MEd (Environmental Education) Student

## Appendix B: Participant letter



**RHODES UNIVERSITY**

*Grahamstown • 6140 • South Africa*

**Environmental Learning Research Centre**

**Tel: +27 (0) 46 603 8390**

**Fax: +27 (0) 46 622 8028**

**PO Box 94, Grahamstown, 6140**

**E-mail: [elrc@ru.ac.za](mailto:elrc@ru.ac.za)**

Dear Student

I am a Master's Student studying at the Environmental Learning Research Centre in the Department of Education at Rhodes University, Grahamstown. The study is provisionally entitled "An investigation of enabling and constraining factors affecting the supply and demand of specific biodiversity scarce skills to the biodiversity sector: Wildlife Veterinarians and Wetland Ecologists." The study aims to uncover the enabling and constraining factors affecting the transition of professionals in the biodiversity sector from their Higher Education Institutions to their places of work, Research findings will be shared with the national GreenMatter programme and could provide insight into the implementation of the 2010 Biodiversity Human Capital Development Strategy, with a view to addressing issues of the supply and demand of scarce skills in the sector.

Currently, I am identifying potential research participants who are currently studying to become or enhance their skills as wetland ecologists and wildlife veterinarians. As you match this profile, I would like to ask if you would be willing to participate in the study. I would like to conduct an interview with you pertaining to your skill, the transition experience.

Your participation is voluntary, that is, you have the right to withdraw from the study at any time during the research process. Your case study in the research report will be entirely anonymous and any information provided during the research will be securely stored and kept confidential. I will share the findings of this study via email or per telephone should you be interested. Any further queries or information can be obtained from myself, Leanne Mckrill, via email: [leanne.mckrill@gmail.com](mailto:leanne.mckrill@gmail.com) or telephonically on 0824747127.

Your signature below indicates that you have read and understood this letter, and are willing to participate in the study. If you are not willing or able to participate in the study, please let me know accordingly via email.

Thank you in anticipation,

A handwritten signature in black ink, appearing to read 'Leanne Mckrill'.

Leanne Mckrill



CONSENT TO PARTICIPATE IN THIS MASTERS CASE STUDY:

Your Name:

Signature:

Cell:

---

Email Address:

---

Date:

## Appendix C: Ethical letter of consideration



RHODES UNIVERSITY  
*Grahamstown • 6140 • South Africa*

CENTRE FOR HIGHER EDUCATION RESEARCH, TEACHING AND LEARNING  
P O Box 94, Grahamstown, 6140, South Africa  
Email: [chertl-admin@ru.ac.za](mailto:chertl-admin@ru.ac.za)  
Tel: +27 (0)46 603 8171/3  
Fax: +27 (0)46 622 8587

2 February 2014

To whom it may concern

**Approval of M.Ed proposal and ethical clearance: Ms L. McKrill  
(Student number G13M8150)**

This letter confirms that Ms McKrill's M.Ed proposal was approved at a meeting of the Faculty of Education Higher Degrees' Committee on 5 December 2013. Her study is provisionally entitled:

The investigation of enabling and constraining factors affecting the supply and demand of specific biodiversity scarce skills to the biodiversity sector:  
Wildlife Veterinarians and Wetland Ecologists.

In the event that the proposal demonstrates an awareness of ethical responsibilities and a commitment to ethical research processes, the approval of the proposal by the committee constitutes ethical clearance. This was the case with Ms McKrill's proposal and the committee thus approved ethical clearance.

Ms McKrill's supervisors are Professor H Lotz-Sisitka and Dr L Olvitt.

Yours sincerely

Prof S. McKenna  
Chairperson of Education Higher Degrees' Committee  
[s.mckenna@ru.ac.za](mailto:s.mckenna@ru.ac.za)

## Appendix D: WOC610 Course Outline


Fakulteit Veeartsenykunde  
Faculty of Veterinary Science


Centre for Veterinary Wildlife Studies

**Wildlife, Ostriches and Crocodiles**

**WOC 610**

Programme Manager: Dr REJ Burroughs  
2014





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UNIVERSITY OF PRETORIA  
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Leading Minds

### Organisational component

#### 1. General educational approach

premise and

##### Significance of this module

Veterinary involvement in wildlife is expanding substantially and is becoming increasingly specialised. This module is designed to provide an overview of the veterinary field of wildlife and the skills needed to practice in the field.

It is a prerequisite module for admission to the elective clinical rotation in the Kruger National Park and other Parks during the course of the final year.

##### Instructions for using the study guide

Use this study guide to prepare in advance for each of the individual lecture sessions.

##### Educational approach

Students are required to gain sufficient understanding during prior preparation to participate in discussions during the course of each lecture.

Lecturers are not required to provide or deal with all the required information during lectures, but only with the relevant concepts on an integrated basis.

So-called 'full notes' will not be supplied. Ample information is available in the Onderstepoort library and on the Web.

#### 2. Contact information

	Name	Location	Telephone number	E-mail address
Programme manager & Lecturer	Dr R Burroughs	Old Faculty Building 2-11	012 529 8908	<a href="mailto:Richard.burroughs@up.ac.za">Richard.burroughs@up.ac.za</a>
Lecturer	Prof NPJ Kriek	Pathology 2-11	012 529 8668	<a href="mailto:Nick.kriek@up.ac.za">Nick.kriek@up.ac.za</a>
Lecturer	Prof H Bertschinger	OVAH 3-08	012 529 8214	<a href="mailto:Hank.bert@up.ac.za">Hank.bert@up.ac.za</a>
Lecturer	Dr A Olivier	Oudshoorn		<a href="mailto:A.Olivier@kennelcare.com">A.Olivier@kennelcare.com</a>
Lecturer	Prof G Fotsgate	PAS 2-2	012 529 8257	<a href="mailto:Godfrey.fotsgate@up.ac.za">Godfrey.fotsgate@up.ac.za</a>
Lecturer	Dr M Kock	PAS 1-	012-5298496	<a href="mailto:Mike.kock@up.ac.za">Mike.kock@up.ac.za</a>
Lecturer	Dr Prof A Michel	DVTD 2-31	012 529 8426	<a href="mailto:Anda.michel@up.ac.za">Anda.michel@up.ac.za</a>
Lecturer	Dr J Myburgh	Paraclinical Sciences 1-58	012 529 8350	<a href="mailto:Jan.myburgh@up.ac.za">Jan.myburgh@up.ac.za</a>
Lecturer	Dr V Schwan	DVTD 2-44	012 529 8099	<a href="mailto:Volker.schwan@up.ac.za">Volker.schwan@up.ac.za</a>
Lecturer	Dr H Stoltz	DVTD 2-17	012 529 8265	<a href="mailto:Hein.stoltz@up.ac.za">Hein.stoltz@up.ac.za</a>
Lecturer	Prof R van Aarde	Zoology and Entomology	012 420 2753	<a href="mailto:r.vanaarde@zoology.up.ac.za">r.vanaarde@zoology.up.ac.za</a>
Lecturer	Prof M van Vuuren	DVTD 2-30	012 529 8329	<a href="mailto:mortiz.vanvuuren@up.ac.za">mortiz.vanvuuren@up.ac.za</a>
Lecturer	Prof Luis Neves			<a href="mailto:Luis.neves@up.ac.za">Luis.neves@up.ac.za</a>
Centre Administrator	Dr C Bocchino	Old Faculty Building 2-12		<a href="mailto:clara.bocchino@up.ac.za">clara.bocchino@up.ac.za</a>
	Marie Watson	Old Faculty Building 2-11	012 529 8658	<a href="mailto:Marie.watson@up.ac.za">Marie.watson@up.ac.za</a>

# Wildlife, ostriches and crocodile health: WOC 610

## Venues:

- Lectures: Lecture Hall – Old Faculty Building (Ethology/Physiology building)
- Consult the 5<sup>th</sup> year lecture roster; locality of practicals to be announced in class
- Consulting hours: on appointment

## 3. Study materials and purchases

References to the prescribed textbook and other additional study material such as books for further reading, subject periodicals, class notes, and internet references will be made available by the individual lecturers

## 4. Learning activities

### 4.1 Contact time and learning hours

WOC610 Roster: 2014. Lectures commence on the 8<sup>th</sup> of January 2014

## Venue: Lecture Hall – Old Faculty Building (Ethology/Physiology) - Proposed

Date	13:45 – 14:25	14:30 – 15:10	15:15 – 15:55	16:00 – 16:40
8/1	Dr R Burroughs (Intro)	Dr C Boechino (Intro)	Dr M Kock (Principles of Physical and Chemical Capture)	Dr M Kock (Applied Pharmacology)
15/01	Dr M Kock (Projectile and Gert Systems)	Dr M Kock (Practical field craft: 1st, bushcraft, discussion with a single case study)	Dr M Kock (Stress, Safety and First Aid)	Dr M Kock (Species Requirements)
22/01	Dr R Burroughs (Species requirements)	Dr R Burroughs (Species requirements)	Prof G Fogata (Epidemiology)	Prof G Fogata (Epidemiology)
29/1	Dr L Meyer (Applied physiology)	Dr L Meyer (Applied physiology)	Dr L Meyer (Applied physiology)	Dr R Burroughs (Legislation)
5/2	Prof R van Aarde (Conservation Ecology)	Prof R van Aarde (Conservation Ecology)	Prof R van Aarde (Conservation Ecology)	Dr V Schwann (Helminths)
12/2	TEST (14:00-15:00)	TEST	Prof A Michel (Bacterial Diseases)	Prof A Michel (Bacterial Diseases)
19/2	Dr J Myburgh (Crocodiles)	Dr J Myburgh (Crocodiles)	Dr H Stoltz (Ext parasites)	Dr H Stoltz (Ext parasites)
26/2	Dr H Stoltz (Ext parasites)	Dr H Stoltz (Ext parasites)	Prof S Penzhorn (Protoz)	Prof S Penzhorn (Protoz)
6/3	Prof M van Vuuren (Viral Diseases)	Prof M van Vuuren (Viral Diseases)	Prof M van Vuuren (Viral Diseases)	Prof N Kriek (Path - forensic)
13/3	Prof H Bertschinger (Reprod)	Prof H Bertschinger (Reprod)	Prof H Bertschinger (Reprod)	Prof N Kriek (Path - forensic)
19/3	Dr A Olivier (Ostriches)	Dr A Olivier (Ostriches)	Dr A Olivier (Ostriches)	Prof N Kriek (Path - forensic)
26/3	TEST	TEST		

3

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Wildlife, ostriches and crocodile health: WOC 610

5/4				
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Block test:

Two announced tests according to the test schedule during the course of the module

#### 4.2 Contact sessions

##### Specific information, rules and requirements:

- Contact sessions with lecturer as per the schedule in 4.1
- Practical sessions will be scheduled for immobilization and game capture. These sessions are not compulsory and participation in them may involve travel and time away from the Faculty. Students will be kept informed of opportunities as they arise

#### 5. Assessment

##### 5.1 Assessment policy and approach

- Admission to examinations are in accordance with the Faculty's rules
- Two announced tests will be scheduled during the course of the semester. Their results will count on an equal basis towards compiling the semester mark.
- The semester mark comprises 50% of the final mark
- A final written examination will be scheduled during the block examination period during April 2014

#### 6. General

- Policies, rules and arrangements regarding professional conduct are in accordance with general Faculty and University regulations

### Study component

#### 1. Module specifications

##### 1.1 Purpose statement

This module is a one-semester elective structured to provide veterinary students with basic background knowledge of the scope of the activities and the skills required to function in the field of wildlife, and farmed ostriches and crocodiles.

It is anticipated that attendance of this module would allow students to make an informed decision whether to enter these fields of activity after they qualify as veterinarians

##### 1.2 Learning presumed to be in place

Students are assumed to have retained a good understanding of basic anatomy and physiology, immunology, pharmacology, infectious and parasitic diseases and pathology of domesticated animals dealt with in BVSc I – III. These concepts will serve as the basis for the discussions in this module



**1.3 Articulation with other modules in the programme**

This module is a prerequisite for students interested in the field of wildlife and who wish to be admitted to the wildlife elective in the Kruger National Park and other conservation areas during the course of the final year. Successful completion of this module is a prerequisite for admission to these rotations.

**2. Study themes of the module**

	Theme	Specific outcome and assessment criteria
Unit 1	Introduction	<ol style="list-style-type: none"> <li>1. Understanding the term wildlife and the varied role of veterinarians in the different fields of wildlife</li> <li>2. Develop an opinion about the broad context and relevance of wildlife</li> <li>3. Have an understanding of the national and international organisations active in the field of wildlife</li> <li>4. Focus on the interface: Understanding One Health in the context of human development.</li> </ol>
Unit 2	Conservation Ecology	<ol style="list-style-type: none"> <li>1. Understanding the basic concepts of ecology with emphasis on the mechanisms whereby individuals function within a population, and populations interact with each other.</li> </ol>
Unit 3	Capture and immobilization	<p>Have an understanding of:</p> <ol style="list-style-type: none"> <li>1. Drugs used in game capture               <ol style="list-style-type: none"> <li>1.1. Capture of carnivores</li> <li>1.2. Capture of herbivores</li> <li>1.3. Capture of primates</li> <li>1.4. Long-acting tranquilisers</li> <li>1.5. Safety measures and emergencies</li> </ol> </li> <li>2. Delivery systems               <ol style="list-style-type: none"> <li>2.1. Darting systems</li> <li>2.2. Pole syringing</li> </ol> </li> <li>3. Mass capture methods               <ol style="list-style-type: none"> <li>3.1. Passive capture</li> <li>3.2. Active capture</li> </ol> </li> <li>4. Applied physiology in relation to capture</li> </ol>
Unit 4	Viral diseases	<ol style="list-style-type: none"> <li>1. Have a knowledge of the most important viral diseases of important species of wildlife</li> </ol>
Unit 5	Internal parasites	<ol style="list-style-type: none"> <li>1. Understand the role, importance and interpretation of the presence of internal parasites in wildlife</li> </ol>
Unit 6	Protozoa	<ol style="list-style-type: none"> <li>1. Have a knowledge of the most important protozoan diseases of wildlife</li> </ol>
Unit 7	External parasites	<ol style="list-style-type: none"> <li>1. Understand the role, importance, and interpretation of the presence of external parasites in wildlife</li> </ol>
Unit 8	Ostriches	<ol style="list-style-type: none"> <li>1. Understand the extent and issues of ostrich farming as they pertain to veterinary inputs and skills</li> </ol>
Unit 9	Crocodiles	<ol style="list-style-type: none"> <li>1. Understand the extent and issues of crocodile farming as they pertain to veterinary inputs and skills</li> </ol>
Unit 10	Bacterial Diseases	<ol style="list-style-type: none"> <li>1. Understand the dynamics of bacterial infections in populations of wildlife</li> </ol>
Unit 11	Epidemiology	<ol style="list-style-type: none"> <li>1. Understand the basic principles of epidemiology and information management in wildlife</li> </ol>
Unit 12	Path (Forensics)	<ol style="list-style-type: none"> <li>1. Understand the basic principles of forensic pathology pertaining to wildlife</li> </ol>



**WOC 610 Practicals - 2014 - proposed**

- 18<sup>th</sup> January 09h00 Visit to Pretoria Zoo Veterinary Hospital (Groups)  
4 groups of 20 each for 30 / 40 minutes
- 1 February 09h00 Visit to Game quarantine – Wildlife Assignments
- 22 February 09h00 Darting Practical I (group 1) (4 LECTURERS)  
10h30 Darting Practical I (group 2)  
**OR**
- 1 March 09h00 Darting Practical I (group 1) (4 LECTURERS)  
10h30 Darting Practical I (group 2)
- 9 March 09h00 Visit to Crocodile Farm – to be confirmed  
Visit to Ostrich Farm – to be confirmed.  
Visit to Game Auction – date to be confirmed in March, April, or later in the year.  
Weekend visit to game farm of Dr Peter Oberem – date to be confirmed

All visits self-drive, self-catering.

## Appendices D 2: Centre for Wildlife Studies Pamphlet

### Services

The following persons may be contacted for assistance:

- Onderstepoort Veterinary Academic Hospital and the Bird and Exotic Animal Clinic
  - ▲ Clinical services: Prof Paul Bland-van den Berg (Director) paul.bland@up.ac.za
  - ▲ Bird and exotic animals: Dr Doreen Elliott at fruitbat@op.up.ac.za
- Department of Companion Animal Clinical Studies
  - ▲ Routine diagnostic clinical pathology - Dr Amelia Goddard amelia.goddard@up.ac.za
  - ▲ Large animal surgery - Dr Cynthia Donnellan cynthia.donnellan@up.ac.za
- Department of Veterinary Tropical Diseases
  - ▲ Diagnostics in the listed fields of research
- Department of Production Animal Studies
  - ▲ Reproduction: Prof Henk Bertschinger at henk.bertschinger@up.ac.za
  - ▲ Medicine and surgery: Prof Tony Shakespeare at tony.shakespeare@up.ac.za
- Department of Paraclinical Sciences
  - ▲ Diagnostic pathology: Prof Leon Prozesky at leon.prozesky@up.ac.za or Dr Johan Steyl at johan.steyl@up.ac.za
  - ▲ Immunoperoxidase diagnostics: Mrs Marie Smit at marie.smit@up.ac.za
  - ▲ Immobilization and individual animal needs: Dr Leon Venter at leon.venter@up.ac.za

### Centre for Veterinary Wildlife Studies

Faculty of Veterinary Science  
University of Pretoria



[www.veterinary.up.ac.za](http://www.veterinary.up.ac.za)



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

### The Veterinary Wildlife Programme focuses on:

- The health and welfare of African wildlife
- Conservation medicine
- Facilitating the involvement of and contribution by veterinary science to the conservation of biodiversity
- Sustainable utilization of indigenous wildlife
- Training, research, and service



### It facilitates and coordinates:

- Formal under- and postgraduate training
- Continuing education courses
- Research
- Consultation and clinical services
- A community-based interface programme
- Networking with local and international partners



### Academic programmes:

The various degrees offered in wildlife are the responsibility of the Departments in the Faculty, housing the disciplines.

For specific details about the fields of study and opportunities for postgraduate students, contact the Head of the relevant Department in which the discipline is dealt with. Information can also be found at

<http://web.up.ac.za/default.asp?ipkCategoryID=1206&subid=1206&ipklookid=13>

or contact the Director of the Centre for Veterinary Wildlife Studies, Prof Nick Kriek at

[nick.kriek@up.ac.za](mailto:nick.kriek@up.ac.za)

### The following programmes are offered:

- Undergraduate electives
- Postgraduate programmes
  - ▲ BVSc (Hons)
  - ▲ M Med Vet (Fer)
  - ▲ MSc (Veterinary Science) – research-based degree
  - ▲ MSc – Web-based modules: Career path: wildlife (diseases; parasites)
- PhD in disciplines dealing with wildlife
- Continuing education
  - ▲ Wildlife Chemical Immobilisation Course



### Research focus area:

*Wildlife and Environmental Health* with emphasis on

- The interface between wildlife, domestic animals, and humans
- Conservation medicine
- Sensitivity and specificity of diagnostics, and vaccines
- Epidemiology of economically important diseases and zoonoses

The Centre for Veterinary Wildlife Studies facilitates and coordinates this specific research focus area within the Faculty

The responsibility for the various projects, their funding and the postgraduate students involved in them, is that of the individual Heads of Department in the Faculty. For further information go the Website of the Faculty of Veterinary Science at

<http://web.up.ac.za/default.asp?ipkCategoryID=50>





**Game Farming** | Returns can be astonishing, but beware the unscrupulous dealers out there, writes **Tina Weavind**

## Breeders sink teeth into profits

WANT to beat the stock market? Get into game breeding. Specifically, breed astonishingly rare such as sable antelope, rhinoceros, or kudu, with unusual colouring.

In the past five years, the selling price of sable antelope and healthy buffalo has grown by as much as 40% and 50% respectively. The JSE All Share Index crawled up 12% in the same period.

The catch, however, is that it is a lot easier to get into the stock market — just go to any number of online brokerages and put down a few hundred rands.

But with game farming, the barriers to entry are colossal.

John Robie, biochemist, Harvard MBA graduate and game



FARMER: Cyril Ramaphosa at an auction in Rustenburg, North West, before he became South Africa's deputy president

DNA testing and parent verification have taken off in the industry

breeder for the past 15 years, says you need about R20 million if you decide to breed sable antelope and disease-free buffalo.

A 500ha property — the smallest farm you can have for buffalo and sable — would set you back R7 million to R8 million and the fences and other infrastructure another R5 million.

A good start would be one buffalo bull and nine females, but a quality breeding herd costs about R2 million. Then there is the R4-million to R5-million needed to buy a breeding herd of sable antelope.

There are ways around this problem, and one of the increasingly common solutions is for people to buy a stake in an animal. It is a lot less financially onerous getting into the market for colour variants. You can get the necessary approval to keep antelope the size of impala and wildebeest on a property as small as 50ha, so you can have one foot in the city and one on your weekend game farm.

But it is the inexperienced weekend game farmer who

seems most likely to lose his shirt — unless he is getting expert advice.

And, warned Herman Barnard, manager of Wildlife Ranching SA, "There are a lot of snakes (tricks)."

Even South Africa's deputy president is involved in game ranching. Cyril Ramaphosa owns Phala Phala Wildlife, a 2 500ha reserve west of Bela-Bela where his manager, David Freeborn, oversees the breeding of rare game.

Of course, this is not necessarily a vote of confidence. Remember Ramaphosa's spectacular four-pan when he bid R16 million for a buffalo cow and her calf? He dropped out of that particular bidding war, but spent R16 million at the same auction on other animals.

Would-be game farmers need inside knowledge of the best breeding practices on various farms and the lineage and quality of their stock. Then there is the ability to distinguish a great specimen from a good one.

Even spotting the genuine se-

ctile can be useful. Last year, one aspiring — but inexperienced — farmer handed over several hundred thousand rands for a few black impala.

A few days later it rained and the paint washed off.

Crossed dealers have also been known to be about an animal's lineage and so, not surprisingly, DNA testing and parent

verification have also taken off in the industry.

A top-quality black impala ram can sell for an eye-popping R500 000. The average price at auction for these animals increased from R102 000 in 2003 to R154 000 in 2013.

Two years ago, a golden wildebeest was sold for a record R14 million, about three times

the usual price of R4 000. In 2010, however, wildebeest prices averaged R350 000.

Colour variants are much harder to replicate than breeding a quality African buffalo or sable antelope. The gene for colour variance is recessive and it takes a few generations to

increase your chances of getting the right look. But once you

have the optimal gene pool, your numbers increase exponentially. But there are a lot of people vehemently against this kind of breeding.

Ken Mood, a businessman turned conservationist, believes these animals have "genetic deficiencies" and would normally be targeted by predators.

Robie disagrees: "These are

not man-made gimmicks. They occur naturally, but because the genes responsible for the unusual colour are recessive, they are seldom found in nature."

"Yes," said Mood, "but they are found in small numbers for good reason."

He believes the exotic game industry is a disaster waiting to happen and an investment busi-

ness waiting to pop. Supply had far outstripped demand, said Mood, and referred to the theory that the industry kept prices at "insane" levels by breeders adding "up" their own animals and then peddling the gigantic piles of cash being handed over.

Well, allegedly handed over. Another rumour doing the rounds is that the "buyers" are often just a friend doing the broker a "favour" — and no money actually changes hands.

The breeders, buyers and middlemen disagree. "I've heard the rumour, but there's no basis for it whatsoever," said one insider, who asked not to be named.

Still, looking at the industry objectively, these kind of mammoth returns look too good to be true. However, there are about 16 000 private reserves in South Africa and a new one is registered just about every day. They all need to be stocked with animals.

Robie said in 2004 he had a choice: breed cattle or game. It did not take long for him to work out which would make the most money — even a decade ago,

A top-quality black impala ram can sell for an eye-popping R500 000



ROARING SUCCESS: In countries such as Kenya, Botswana and Tanzania, where hunting has been banned, wildlife numbers dwindle because the game no longer has any monetary value, but in South Africa the demand has soared

PICTURE: SHIRAZI NIWALI

TINA WEAVER

THERE might be one almost every week, but game auctions are still major events out in the bush.

At the end of May, about 300 people and two helicopters arrived for the Mpumalanga auction in the Waterberg, Limpopo.

A lot of people hung out eating and drinking at the outdoor restaurant, but inside the bidding hall things were deadly serious: about 200 mostly khaki-clad men

## Big money in this bull market

sat in rows, contemplating how to spend big chunks of cash.

An expected, many prices were eye-balling. A pregnant roan antelope went for R420 000, a pregnant buffalo and her heifer calf fetched R1.2 million.

There were some bargains: a six-year-old buffalo bull went for a mere R25 000. It was bought by a hunting

outfit that planned to sell it in the next few months for R50 000 (R214 470 in a group ending out from the UK). They would pay about \$475 a day over two weeks for the pleasure of shooting the bull and a few other animals.

There is money in hunting the Professional Hunters' Association of South Africa said foreign hunting brought R1.34 billion to the

country last year.

Some of the animals were on view from wooden walkways raised about 2m above corrugated stalls.

Photographs — fashion-model flattering — of the animals were pinned in a thick catalogue with their horn size, father's horn size and where they were bred.

Bidding moved along at a cracking pace, although,

said auctioneer Brandon Leet, no records were broken at Nqamacha.

So, is rare game breeding worth a look as an alternative investment?

Asked whether he would advise a client to go that route, Darryl Bennett, financial adviser at Sasfin Securities, said: "It would depend on how long I wanted to keep my job."

Then again, Bennett didn't know the average sale price of a disease-free buffalo.

prices were rising steadily.

So Robie bought 34 quality buffalo heifers for R120 000 each, the same it would have cost to buy 600 beef cows. He grewed at his odds for a while, but was vindicated within a few years. Now, few of his animals are worth less than R500 000 and he has far more now than he had then. Cattle, on the other hand, are still trading at pretty much the same prices they were 30 years ago: R10 000 to R15 000.

Hartbees Africa's head of agriculture, Ernst Janse, said the bank was "quite excited" about the game industry.

Part of the reason is that hunting has been banned in traditional destinations like Kenya, Tanzania and Botswana, and so demand has soared in South Africa. Wherever the ban has been implemented, the game declines because it has no value," he said.

Conversely, game numbers in South Africa are soaring and Janse says a likely scenario trend is value in the foreseeable future.

INVITATION TO REGISTER ON

UNITED NATIONS CHILDREN'S FUND  
Request for Consultancy Assignment

## Appendix F: Document Log A – Wildlife Veterinarians

<b>Code Document Number</b>	<b>DOCUMENTS</b>	<b>DATE OF PRODUCTIONS</b>	<b>WHO PRODUCED THE DOCUMENTS</b>	<b>TYPE OF DOCUMENT</b>	<b>MAIN CONTENTS OF DOCUMENT</b>	<b>VALUE OF THE DOCUMENT TO THE RESEARCH TOPIC</b>
DWV1	Wildlife ,Ostriches and Crocodiles, WOC610 Course Prospectus	2014	The University of Pretoria	Prospectus and Course Outline	Course outline and expectations	Layout of the WOC610 course
DWV2	Centre for veterinary wildlife studies pamphlet	2014	The University of Pretoria	Pamphlet	Pamphlet of the courses on offer at the Centre for veterinary wildlife studies	Outlines the focus on Wildlife at Onderstepoort
DWV3	Newspaper Article: Breeders sink teeth into profits	June 15, 2014	The Cape Times : Business Times	Newspaper Article	Newspaper	Newspaper article pertaining to the Game industry
DWV4	Monitoring charts	2014	Unnamed Marine Institution	Veterinary Monitoring charts	Used for animal patients	Provide an outline to the daily tasks of the veterinarian.
DWV5	Online Article for WRSA regarding drugs legislation	2014	Wildlife Ranching South Africa	Online Article	Online Article	Regarding the current legislation pertaining to the usage of dangerous drugs
DWV6	South African Veterinary Council Annual Newsletter	September 2013	South African Veterinary Council	Online Newsletter	Newsletter	Detailing the drugs legislation and court case with WRSA
DWV7	The Philosophy of wildlife management (Conservation and Preservation) Chapter 13	Not stated	Given by Prof R Burroughs	Handbook	Background information on the management of wildlife	Outline of management of wildlife preservation and conservation.

## Appendix G: Document Log B – Fresh Water Ecologists

<b>Code Document Number</b>	<b>DOCUMENTS</b>	<b>DATE OF PRODUCTIONS</b>	<b>WHO PRODUCED THE DOCUMENTS</b>	<b>TYPE OF DOCUMENT</b>	<b>MAIN CONTENTS OF DOCUMENT</b>	<b>VALUE OF THE DOCUMENT TO THE RESEARCH TOPIC</b>
DFE1	Ground Truth Wetland Scientist Advert	10 April 2014	Ground Truth Wetland Company	Advertisement	Advertisement of a Job	Availability of specific skill
DFE2	Honours in Environmental Water Management Geography Departments of Geography and Environmental Science Course Outline	March 2013	Prof F Ellery at Rhodes University	Course outline/ Curriculum	Prospectus of Honours in Environmental management course Rhodes University	A course related to the scarce skill
DFE3	Geography Degree outline( Rhodes University)	2012	The Geography Department: Prof F Ellery at Rhodes University	Course Curriculum Outline	Prospectus of Geography Undergraduate Rhodes University	The foundation course for undergraduates
DFE4	Prospectus of Faculty of AgriSciences	2014	The University of Stellenbosch	Prospectus	Outlines of the courses within the AgriSciences faculty	Provide an outline to the undergraduate and postgraduate course, including focus on freshwater systems.
DFE5	Advertisement for Project Manager for Working for Water and Working on Land Project	May 2014	South African National Parks	Advertisement	Advertisement for a job for a fresh water consultant	Availability of the scarce skill



## Appendix H: Outline for Water Management course at Rhodes University



### HONOURS IN ENVIRONMENTAL WATER MANAGEMENT

#### DEPARTMENTS OF GEOGRAPHY & ENVIRONMENTAL SCIENCE

The Honours degree in Environmental Water Management aims to produce graduates who are well equipped to contribute to meeting the challenge of managing the nation's water resources in a sustainable manner. Water is our most precious resource which is not only essential for human life, food supply and economic development, but also supports crucial ecosystems that depend on the various freshwater bodies – rivers, lakes and wetlands – for their existence. Balancing water for human use with the need to protect the water resource and its associated ecosystems is a major challenge that faces water managers throughout the world, a challenge that is being addressed in South Africa through recent legislation: the National Water Act of 1998. This Act, based on the philosophy of Integrated Water Resource Management, represents a new way of thinking about water and opens up exciting opportunities for careers related to sustainable management of water. We hope that this degree in Environmental Water Management will provide you with appropriate qualifications to enter this field.

Understanding issues around water management requires an interdisciplinary approach. Environmental Water Management Honours is offered collaboratively by the departments of Geography and Environmental Science, with input from the Institute for Water Research at Rhodes University.

Students are required to take four courses and complete a research project. One course is compulsory: Integrated Catchment Management. They must also select three other courses from those offered by the departments of Geography or Environmental Science; recommended courses include Catchment Systems, Wetland Ecology and Management, Environmental Water Quality and Geographical Information Systems. The courses offered may be subject to timetable and staffing constraints. The research project must be relevant to a degree in Environmental Water Management and approved by the Head of Course. Fieldwork is an important learning activity; field excursions are integrated into courses where appropriate. Students may be required to attend a field week in late January-early February, before the formal start of term.



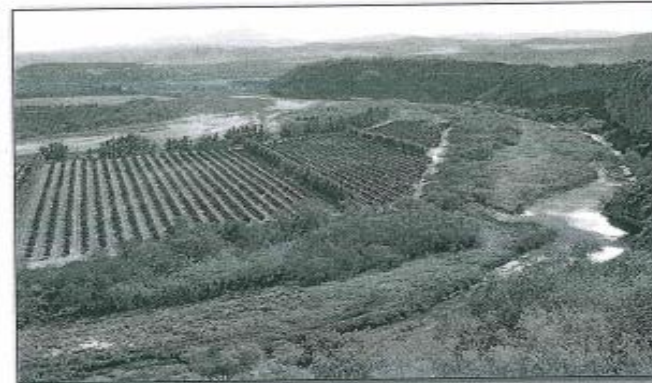
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#### Prior learning

Candidates must be in possession of an appropriate Bachelors degree, normally majoring in at least one of Geography, Environmental Science or Hydrology. Other candidates with appropriate professional experience in water resource management may be considered.

#### Environmental Water Management – a catchment focus

Catchments are the land surfaces that provide humankind with one of our most precious resources – water. This is also the land surface on which we all live. Humans thus both depend on and impact catchment processes and resulting services. Catchments also consist of complex water dependent ecosystems, including the terrestrial ecosystems on the hillslopes and the aquatic ecosystems in river channels, wetlands and lakes. The aim of this degree, therefore, is to equip students with the conceptual understanding and practical knowledge that is needed to make an effective contribution to the sustainable management of catchment systems and their water related ecosystems. Southern Africa is the geographical focus of the course; an area that encompasses a wide range of environments in which lecturing staff contributing to the courses have worked.



For further information please contact:

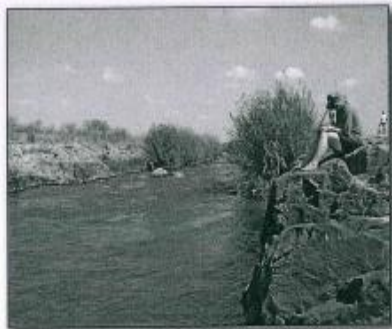
Professor Kate Rowntree, Catchment Research Group, Department of Geography, Rhodes University.

Tel: 046 6038024; Email: [k.rowntree@ru.ac.za](mailto:k.rowntree@ru.ac.za)

Professor Fred Ellery, Department of Environmental Science, Rhodes University

Tel: 046 6037003; Email: [f.ellery@ru.ac.za](mailto:f.ellery@ru.ac.za)

Visit the departments' web page at <http://www.ru.ac.za/academic/departments/geography> OR [environsci](http://www.ru.ac.za/academic/departments/environsci)





## Appendix I: Outline for Conservation Ecology Course at Stellenbosch University

### MASTER'S PROGRAMME

#### Master's programme in Forestry and Wood Sciences (MScFor)

#### Forestry and Natural Resource Sciences or Wood and Wood Products Sciences

##### Programme Description

The master's programme in Forestry and Wood Sciences leads to the qualifications MScFor in Forestry and Natural Resource Sciences or Wood and Wood Products Sciences. The programme consists of a one-year MScFor after the four-year BScFor degree. A relevant honours degree, the Postgraduate Diploma in Forestry and Wood Sciences, as well as other qualifications approved by Senate for this purpose give access to the programme.

11061 : Biometry	771(6): Postgraduate biometry
11290 : Forest Science	875(14): Forest Science research methodology
11290 : Forest Science	873(120): Master's thesis
57584 : Wood Product Science	875(14): Wood Product Science research methodology
57584 : Wood Product Science	873(120): Master's thesis

Students must register for Biometry 771 and can choose between Forest Science 875 in combination with Forest Science 873 or Wood Product Science 875 in combination with Wood Product Science 873.

##### Elective Modules

11290 : Forest Science	881(40): Advanced forest eco-physiology
11290 : Forest Science	882(40): Advanced timber-harvesting logistics
11290 : Forest Science	883(40): Advanced forest management
11290 : Forest Science	884(40): Forest growth and wood formation
11290 : Forest Science	885(40): Advanced forestry development
11290 : Forest Science	886(40): Advanced nursery practice and tree improvement
57584 : Wood Product Science	880(40): Wood mechanics and wood-based constructions
57584 : Wood Product Science	881(40): Wood quality factors
57584 : Wood Product Science	882(40): Physical wood properties

Students must choose one of the 40-credit elective modules. Students must successfully complete Biometry 771, Forest Science 875 or Wood Product Science 875, and the elective module before continuing to the Master's thesis.

### DOCTORAL PROGRAMMES

#### PhD programme in Forestry and Wood Sciences [PhD (For)]

##### Programme Description

This programme leads to the qualification PhD (For) in Forestry and Natural Resource Sciences or Wood and Wood Products Sciences. A dissertation containing original research is required. The programme focuses on research in various specialist fields of forestry and ensures that students become specialists in these fields.

A relevant and practically oriented research project is undertaken in one of the said fields leading to innovation or the solving of a problem through high-level research in the discipline and in the industry concerned. This educates and prepares students on the highest academic level for entering the research or career market. Students thus become professionals who can, either as a member of a team or individually, play a meaningful role in national and international research, teaching and policy-making in specialist fields in an environmentally friendly way.

11290 : Forest Science	978(360): Doctoral dissertation
57584 : Wood Product Science	978(360): Doctoral dissertation

#### DSc programme in Forestry and Wood Sciences (DScFor)

##### Programme Description

The degree DScFor is awarded to candidates who have held the PhD (For) degree of this University, or some other equivalent (in the opinion of Senate) qualification for at least five years, or who have held the MScFor degree of this University, or some other adequate (in the opinion of Senate) qualification for at least seven years, who have produced advanced original research and/or creative work in the Forestry and Wood Products Sciences and have submitted original and previously published work(s) of a high standard which indicate(s) that the candidate has made a real and high-quality contribution to the enrichment of the knowledge in a forestry discipline.

11290 : Forest Science	998(360): DSc research collection
57584 : Wood Product Science	998(360): DSc research collection



### CONSERVATION ECOLOGY

More information is available on the following website:

<http://consent.sun.ac.za/> (Department of Conservation Ecology and Entomology)

#### BACHELOR'S PROGRAMME

This undergraduate (bachelor's) programme leads to the qualification BSc in Conservation Ecology. The programme is a collection of modules that will produce a general outcome, allowing a student to choose from a broad range of careers in conservation ecology. The following major outcomes are the most popular careers among students graduating from the programme in Conservation Ecology:

1. Environmental impact assessment (terrestrial and freshwater).
2. Restoration ecology (employment in mining and agriculture, as well as peri-urban

## Appendix I: Outline for Conservation Ecology Course at Stellenbosch University Pg

organisations for the rehabilitation of soil to its original, natural condition).

3. Conservation biology (suited to jobs in academia, national and provincial parks boards, urban parks and private nature reserves).
4. Game reserve and ranch management.
5. Ecotourism (careers can be followed in various conservation-related fields of ecotourism).
6. Community-based natural resource management (dealing with rural communities and the sustainable use of their natural resources).
7. Environmentally conscious (sustainable) agricultural and forestry production (including organic farm management).

This programme focuses on outcomes 1-5 above.

The interests of students wanting a career in community-based natural resource management (outcome 6) will be best served by the Forestry and Natural Resource Sciences programme, which includes some Conservation Ecology modules, while the environmental agricultural production outcome (outcome 7) is best obtained by taking a programme in either Crop Production, Animal Science or Forest Science, with Conservation Ecology modules as minor subjects. Students interested in a greater emphasis on animal sciences (e.g. management of mixed livestock-game ranches) should take Animal Science programmes with Conservation Ecology as field of study.

Students take part in practicals in each of the four study years. Additionally in the fourth study year, a one-week field trip is attended. More importantly, an integral part of this programme is the production and submission of a management plan or research project by every student in the fourth study year.

The prescribed modules of the various years of study in this programme are set out below; the module content is given on pages 82 - 165.

### Bachelor's Programme (BSc) in Conservation Ecology

#### First Year (132 credits)

##### Compulsory Modules

Biology	124(16), 144(16), 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Geo Environmental Science	124(16), 154(16)
Mathematics (Bio)	124(16)

#### Second Year (141 credits)

##### Compulsory Modules

Biodiversity and Ecology	212(16), 264(16), 214(16), 224(16), 234(16)
Computer Skills	272(5)
Conservation Ecology	212(8), 244(16)
Geography and Environmental Studies	214(16)
Microbiology	244(16)

### Third Year (136 - 140 credits)

#### Compulsory Modules

Biometry	212(8), 242(8)
Biodiversity and Ecology	324(16), 334(16), 364(16)
Conservation Ecology	314(16), 344(16)
Industrial Psychology (Special)	354(12)

#### Choose two of the six modules (as possible within the timetable).

Genetics	214(16) and/or
Soil Science	214(16) and/or
Biodiversity and Ecology	315(16) * and/or
Geographical Information Technology	241(16) and/or
Biodiversity and Ecology	345(16) and/or
Sociology	334(12) **

\* Note this is a restricted module; acceptance only through application. Classes presented outside formal term time.

\*\*Special arrangement made with timetable.

### Fourth Year (136 credits)

#### Compulsory Modules

Agricultural Economics	262(8)
Agroecology	424(16)
Conservation Ecology	414(16), 424(16), 448(32)
Entomology	464(16)

#### Choose 32 credits from the following modules (as possible within the timetable)

Entomology	418(32) or 464(16) and/or
Soil Science	314(16) and/or
Geographical Information Technology	312(16)

### POSTGRADUATE PROGRAMMES

#### MASTER'S PROGRAMME

##### Master's programme in Conservation Ecology (MScConsEcol)

##### Programme Description

The master's programme in Conservation Ecology leads to the MScConsEcol degree. The research component (minimum time span six months, 180 credits at NQF level 8a) entails independent research on an approved topic in conservation ecology, conducted by the student under the supervision of a supervisor. As part of the process, students are expected to present a seminar to the Department of Conservation Ecology and Entomology on their proposed thesis and, on completion of the thesis, to present a seminar in which they defend their thesis. The results must be written up and submitted in the format of a thesis, which must meet the requirements for a master's thesis as prescribed by the Department of Conservation Ecology and Entomology and Stellenbosch University.

55638 : Conservation Ecology	878(180): Master's thesis
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## Appendix J: Advert for a Fresh Water Ecologist



### JOB ADVERTISEMENT

#### WATER SOURCE AREAS PROGRAMME MANAGER Freshwater Programme

(2 year Contract based in Newlands, Cape Town)

WWF is one of the world's largest and most respected independent conservation and environmental organizations, with almost 5 million supporters and a global network active in more than 100 countries. Our mission is to stop the degradation of the earth's natural environment and to build a future in which we all live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

Our work is challenging and exciting and we love what we do. To join our team you need to be brilliant at what you do, passionate, results-orientated and have a positive attitude.

#### Background

8 % of South Africa's land area provides half our river run-off (12% of the land area including Lesotho and Swaziland provides 50% of our run-off). A project recently completed by the WWF- Freshwater Programmes with CSIR has defined these areas, our Water Source Areas. These areas are the 'crown jewels' of our ecological infrastructure for water security, the headwaters of our major river systems that sustain our food security and economic development downstream. One of the principal objectives of the Freshwater Programmes is to secure the healthy water provisioning from these Water Source Areas (WSAs).

WSAs face multiple threats in the different areas: forestry; alien invasive plants; poor agricultural land management; mining. We will need to engage multiple tactics with different stakeholders to secure the ecological functioning of these areas, including engagement with national macro plans (National Protected Area Expansion Strategy; Strategic Integrated Projects; etc) and prioritising these areas with DWA and DEA. We have started this process and now need to employ additional water and planning expertise to develop the tactics in more detail and assist with implementation.

The Freshwater Programmes needs a capable person to focus on this area over the next two years and ensure this principal outcome of the Sanlam – Freshwater partnership. This role will report to the Senior Manager of Freshwater Programmes.

#### Responsibilities:

- To lead the development of a strategy and regional tactics to ensure optimal functioning of water source areas and the implementation of this strategy.
- To develop necessary partnerships in support of this strategy.
- To determine sustainable funding models with private and public partners to ensure the security of the water source areas (WSAs).
- To liaise with other programmes within WWF-SA and other NGOs to establish implementation of stewardship and protected environments within these areas.
- To liaise with CMAA, SANBI and DWA on implementation of Resource Directed Measures and the River Health Programme in the WSAs.

#### Competencies/Skills Required:

- An M.Sc or higher in water resources management or integrated land-use planning;
- Strategic thinking and an understanding of the implementation of stewardship for water and biodiversity in South Africa;
- A holistic understanding of the water sector in South Africa and drivers of change;
- An understanding of the regulatory and policy environment for spatial planning;
- Experience in developing spatial plans with multiple stakeholders and sectors;
- Ability to inspire various networks to act on freshwater challenges
- Excellent interpersonal & communication skills;
- Experience in managing multi-stakeholder processes and projects.
- Highly driven, self-motivated individual
- Valid driver's license and willingness to travel

#### Further Information:

To apply for this position, please provide a detailed CV and covering letter fully motivating why you should be appointed, together with the names, current e-mail addresses and telephone numbers of three relevant references to [hr@wwf.org.za](mailto:hr@wwf.org.za). Applications close on 31 January 2014.

WWF seeks to promote diversity among its staff. Candidates who have not received a response within three weeks of the closing date are kindly requested to assume that their application has not been successful in this instance. WWF-SA reserves the right not to fill this position.

## Appendix K: Examples of an Interview Schedule Working Professional

# Interview Schedule

---

Name of University :

Department :

Interviewee no.:

Position :

Time of interview:

Date :

### Introduction

My name is Leanne Mckrill, I am a Masters student at the Environmental Learning Research Centre at Rhodes University, Grahamstown. I am conducting a Masters research study entitled: “The investigation of enabling and constraining factors affecting the supply and demand of specific biodiversity scarce skills to the biodiversity sector: Wildlife Veterinarians and Freshwater Ecologists.”

### Purpose

I would like to ask you some questions about how you have found or envisage the transition between your specific HEI and the workplace(to be) and the factors that have affected (constrained or enabled) your transition. The aim behind the study is to uncover the enabling and constraining factors affecting the transition of Biodiversity professionals from their Higher Education Institutes to places of work, also referred to as their occupations. Through this research insight will be provided to the Biodiversity Human Capital Development strategy (BHCDs, 2010) as well as the GreenMatter programme, in order to address issues of transition and scarce skills within the Biodiversity Sector.

### Motivation

Through the information I obtain through interviews and observations, I hope to add to the current knowledge and assist in addressing the challenges and opportunities facing biodiversity professionals, such as yourself.

### Time line

The interview should take approximately 45 minutes of your time, I thank you for your time and value your input.

## Questions:

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*Please let me begin by asking you to tell me a little bit about yourself. (Below is a guideline of what to emphasise)*

***Please tell me briefly about the following:***

*-Background (family, home etc.):*



<u>Currently employed individuals</u>
Current status of employment and position.
Years in the job?
What were you doing prior to this job? (Studying/ Intern/ Basic job)
If you were to look at your skill set you gained from University, which skills do you feel you utilize most (I will explain Critical skills- Particular operational and generic skills)
<b>Transitions:</b>
<ul style="list-style-type: none"> <li>What is your initial feeling about the transition/ progression from HEI to workplace, do you feel optimistic or pessimistic about the experience?</li> </ul>
<ul style="list-style-type: none"> <li></li> </ul>
<ul style="list-style-type: none"> <li>Why do you feel this way?</li> </ul>
<ul style="list-style-type: none"> <li></li> </ul>
<ul style="list-style-type: none"> <li>How do you feel the university prepares you to enter the workforce?</li> </ul>
<ul style="list-style-type: none"> <li></li> </ul>
<ul style="list-style-type: none"> <li>Do you have any examples of ways in which the university <u>does</u> prepare one to enter the workforce?</li> </ul>
<ul style="list-style-type: none"> <li></li> </ul>
<ul style="list-style-type: none"> <li>Or any further examples of where a university <u>could</u> (Further) help prepare you to make this transition?</li> </ul>

<ul style="list-style-type: none"> <li>Do you have any ideas on <u>how you could</u> prepare yourself to enter the workforce?</li> </ul>
<b>Supply and Demand for your skill And its scarcity:</b>
<ul style="list-style-type: none"> <li>Why did you choose to pursue this specific career?</li> </ul>
<ul style="list-style-type: none"> <li>/ How did you decide or move into this field?</li> </ul>
<ul style="list-style-type: none"> <li>What do you know about the supply or demand of your specific skill into the workforce?/ What do you know about the availability of your specific occupation in the current workforce?</li> </ul>
<ul style="list-style-type: none"> <li></li> </ul>
<ul style="list-style-type: none"> <li>How do you feel about the field you are going into or are already in- is there a demand for the job?</li> </ul>
<ul style="list-style-type: none"> <li>If there is a demand, why do you say so?</li> </ul>
<ul style="list-style-type: none"> <li></li> </ul>
<ul style="list-style-type: none"> <li>If there isn't why do you say so?</li> </ul>
<ul style="list-style-type: none"> <li>Do you feel this is a relatively simple career to enter into?</li> </ul>
<ul style="list-style-type: none"> <li>Have you often seen posts advertised for your specific line of work? If so, where?</li> </ul>
<ul style="list-style-type: none"> <li></li> </ul>
<ul style="list-style-type: none"> <li>If not, how did you come to find out about this post?</li> </ul>
<ul style="list-style-type: none"> <li>Further thoughts/ contributions</li> </ul>

<b>Constraining Factors affecting the HEI to work transition (Individuals within the occupation)</b>
<ul style="list-style-type: none"> <li>Themes are: (Migration, affirmative action, location, finances, experience)</li> </ul>
<ul style="list-style-type: none"> <li><i>Have you faced any adverse or constraining factors in your transition from your HEI to workplace.</i></li> </ul>
<ul style="list-style-type: none"> <li></li> </ul>
<ul style="list-style-type: none"> <li><i>What would you say could be a constraining factor that majorly impacted your transition.</i></li> </ul>
<b>Enabling Factors which have helped your transition:</b>
(Themes are: Education at HEI, internship, experiential learning/ volunteering, contact within a network)
<i>During your transition from HEI to your current or previous job, can you recall factors having enabled or helped you to make this transition a successful one?</i>

**Appendix L Examples of an Interview Schedule: Curriculum advisor/  
Lecturer**

# Interview Schedule

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**Name of University :**

**Department :**

**Interviewee no.:**

**Position : Lecture/ Curriculum Advisor**

**Time of interview:**

**Date :**

## Questions: Curriculum Advisor/ Lecturer

*Please let me begin by asking you to tell me a little bit about yourself.*

### Questions specific to Curriculum advisors (c )/ Lecturers (L)

- ( c /L) -how many would you say your department enrolls per year?

- -(c / L) in the years that you have been at this HEI, how many students have gone on to specialize in WV/ WE?

- (c /L)-why do you think that is?

- -from those who initially start out as doing a BSc Vet/ Bsc Ecology, who progress to specialism in Wildlife veterinary/ **Fresh Water Ecology** (Hydrology)? And why so?

- (c /L) / H &M - How can one progress to specializing in the WV/ WE course, is this based on marks or is it individual choice?



- *Do you feel there are enabling or constraining factors present at this level, which could ultimately affect the numbers of students entering the field of work?*
- *-if so, in what way? And if not, why?*

### **Supply and Demand for your skill and its scarcity:**

- *What do you know about the supply or demand of your specific skill into the workforce?/ What do you know about the availability of this specific occupation in the current workforce?*
- *How do you feel about the field your students are going into or are already in- is there a demand for the job?*
- *If there is a demand, why do you say so?*
- *If there isn't why do you say so?*
- *Further thoughts/ contributions*

### **Transitions:**

- *How do you feel the university prepares students to enter the workforce?*
- *Do you have any examples of ways in which the university does prepare one to enter the workforce?*
- *Do you feel that your previous students/ alumni remain relatively close to the HEI?*
- *Are posts and or opportunities advertised through this medium? (For current and past students)*

### **Constraining Factors affecting the HEI to work transition**

- *Are you aware of any adverse or constraining factors in the young professional/ alumni's transition from your HEI to workplace.*

- *What would you say could be a constraining factor that majorly impacted their transition.*

**Enabling Factors which have helped students/ young professionals transition:**

(Themes are: Education at HEI, internship, experiential learning/ volunteering, contact within a network)

*Are you aware of any of the alumni's responses regarding specific factors having enabled or assisted them in to making this transition a successful one?*

## Appendix M: Examples of an Interview Schedule: Student participant

# Interview Schedule: Student

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Name of University :

Department :

Interviewee no.:

Position : Student

Time of interview:

Date :

## Questions:

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*Please let me begin by asking you to tell me a little bit about yourself.* (Below is a guideline of what to emphasise)

*Please tell me briefly about the following:*

*-Background (family, home etc.):*

*-Educational Background and funding*

*Current Course (Education level)*

*-Previous Courses taken, how did these allow for your progression from your 1<sup>st</sup> degree to your second or current degree?:*

*What motivated you to pursue this course and not another?*

*Did you perhaps have a family member or mentor who did this course or went into this profession?*

*-Student's performance in terms of marks (but I do not require students marks, just a*

<u>general overview)</u>
<u>-Supervision, do you have a supervisor? Do you think they could help you with this transition?</u>
<u>-Status of University- Operational, Traditional University....</u>
<u>-Location</u>

### Transitions:

<ul style="list-style-type: none"> <li>• <u>What is your initial feeling about the transition/ progression from HEI to workplace, do you feel optimistic or pessimistic about the experience?</u></li> </ul>
<ul style="list-style-type: none"> <li>• <u>Why do you feel this way?</u></li> </ul>
<ul style="list-style-type: none"> <li>• <u>How do you feel the university prepares you to enter the workforce?</u></li> </ul>
<ul style="list-style-type: none"> <li>• <u>Do you have any examples of ways in which the university does prepare one to enter the workforce?</u></li> </ul>
<ul style="list-style-type: none"> <li>• <u>Or any further examples of where a university could (Further) help prepare you to make this transition?</u></li> </ul>
<ul style="list-style-type: none"> <li>•</li> </ul>
<ul style="list-style-type: none"> <li>• <u>Do you have any ideas on how you could prepare yourself to enter the workforce?</u></li> </ul>

## Supply and Demand for your skill And its scarcity:

<ul style="list-style-type: none"> <li>• <u>Why did you choose to pursue this specific career/ course?</u></li> </ul>
<ul style="list-style-type: none"> <li>•</li> </ul>
<ul style="list-style-type: none"> <li>• <u>/ How did you decide or move into this field?</u></li> </ul>
<ul style="list-style-type: none"> <li>• <u>What do you know about the supply or demand of your specific skill into the workforce?/ What do you know about the availability of your specific occupation in the current workforce?</u></li> </ul>
<ul style="list-style-type: none"> <li>•</li> </ul>
<ul style="list-style-type: none"> <li>• <u>How do you feel about the field you are going into - is there a demand for the job?</u></li> </ul>
<ul style="list-style-type: none"> <li>•</li> </ul>
<ul style="list-style-type: none"> <li>• <u>If there is a demand, why do you say so?</u></li> </ul>
<ul style="list-style-type: none"> <li>•</li> </ul>
<ul style="list-style-type: none"> <li>• <u>If there isn't why do you say so?</u></li> </ul>
<ul style="list-style-type: none"> <li>•</li> </ul>
<ul style="list-style-type: none"> <li>• <u>Further thoughts/ contributions</u></li> </ul>

## Appendix N: Excerpt from an Observation Schedule

### Research Observation Diary: Private / Welfare Wildlife Vet

#### Individual 4: Dr Breed (DB)

#### Case Study: Wildlife Vet

Date 11 June, 16 June, (20 June?- second visit) 2014.

- **Notes:** DB had started out as a normal vet, with an interest in wildlife due to her background – in the agricultural and hunting fields.
- She completed his BSVC in 2006 at Onderstepoort, she has been doing her Masters through the University of Edinburgh, which is focussing on wildlife, it is here, furthermore that she says her passion for wildlife has been supported.
- Works at a mixed practice, DB also has signed a contract (recently) with the “ Human and Wildlife Organisation, as the chief veterinarian. This is a welfare based organisation, which deals with the monitoring and health of the baboons within the Cape Peninsula.
- “Darting is an art... not a science!” DB

## Day One:

Date & Time	Activity	Reason/ Explanation
11 June : 08:13	I waited to meet the DB, I had arrived at 07:50 and the practice was closed until 08:00.	
08:13	Met DB and her assistant, Thea (T), and Groomer-Zulewka (Z). DB was fixing a barn owl, which she explained was one of the three which had come in from the Koeberg Nature reserve (A close by reserve to the practice). DB was mixing catfood (specialised diet) and charcoal, in an effort to stimulate the bird's body to reject the suspected toxins. DB explained how animals can die really quickly when stressed, especially wild animals.	DB had explained to LM that she feared that the owls were being poisoned, as this was the third from the same reserve. And that they had all died within a matter of days. She used her background in basic toxicology (poisons knowledge) to treat the bird, as charcoal assists to remove poisons from the system of an animal/ creature...
08:20	DB went to collect a syringe and the relevant medicine to inject the owl. During this, she DB showed LM a piece of yellowed baboon liver, which had been collected via a post mortem of a dead baboon, and from this, DB explained, they, she and her colleagues within the baboon management programme/s were hoping to determine the cause of death and the health status of the animal.	Antibiotic and cortisone were placed in the syringe.- Neurotoxic- to do with the nervous system. DB explained to LM that through adequate support of an animal in a fragile state and with an unknown illness/ sickness, the animal can pull through/ survive.
08:35 – 09:10	DB spoke to LM about the lack of conservation orientated wildlife veterinary jobs, in comparison to the game capture companies offering jobs to young wildlife vets. Or in comparison to those wildlife vets who go into the private wildlife industry, which can include game capture.	
09:21	LM and DB began their interview	
09:50	DB was called into to do a consultation, with a Dachshund (dog) which had suspected epilepsy. DB invited the client and her dog into the consultation room, where she, DB, inserted a thermometer into the dogs rectum. She (DB) was taking the general temperature of the dog, to investigate if it had an abnormal temperature. DB then “bounced the spine”, she ran her hand down the spine and “bounced” her fingers along the	DB explained that it could not necessarily be epilepsy, as this would have been evident from a younger age, also, that the dog would not necessarily have fits (suddenly) after never having had fits in the past. DB stated that she would draw blood from the dog, she would be looking for the presence of: White blood cells, glucose level and signs of meningitis in the samples taken.

	<p>spine, checking for irregularities within the spinal cord.. often seen in longbacked dogs and animals. DB asked the owner about the history of the dog, whether it had, had diarrhoea, dog then defecated on the table. (Owner said, no, the dog had not), the dog exuded exceptionally nervous symptoms and even tried to bite the vet, when DB placed the dog on the floor and was testing it's motion in the front and backlegs.</p> <p>DB then stated that she would prescribe some antibiotics for the dog, to see if that would not make a difference and fight any infection the dog might have picked up.</p> <p>DB gave the dog an anti inflammatory, as when she had palpated the dog, she felt an abnormality in the dog's neck, close to the atlas and axis (top two vertebrae).</p> <p>DB injected PETCAM (Antiinflam) into the dog. DB also suggested through investigating the symptoms of the dog, that perhaps it had Addisons disease</p> <p>DB suggested that xays of the dog's neck be taken at some stage, to further investigate the foreign body she had located , previously mentioned.</p> <p>DB showed the owner how the dog "paddled" with the paws as it tried to get onto the table, the one paw on the right hand side lagged- which indicated a nervous condition.</p> <p>DB explained that neck xrays were difficult to do, as the dogs often moved around and therefore difficulty in obtaining such xrays.</p>	<p>Addisons disease is linked to the under secretion of Cortisol into the body (Natural secretion) it is the opposite to Cushings disease, whereby the endocrine glad oversecretes cortisone.</p>
10:17	Consultation finished	
10:21	<p>DB went onto consulting a large Labrador, which had signs of lethargy and possibly kidney issues. DB said that the dog only being three years old, was young for a degenerative kidney disorder and said it could have possibly damaged the kidney or it was a hereditary condition.</p> <p>DB spoke to the owners about the condition and if the dog had eaten or thrown up any food it had eaten the owner answered that the dog was not eating and had not eaten in several days, DB bounced the dogs back, palpated the trunk and abdomen of the dog. DB then picked up and flicked the thermometer, and proceeded to insert the thermometer into the rectum of the dog. This was to take the dog's overall temperature.</p> <p>DB checked the temperature and then cleaned the thermometer.</p> <p>DB checked the dog's heart beat with her stethoscope, after which she requested that she keep the dog in at the vet, under observation.</p> <p>She informed the owner that she wanted to perform an ultrasound scan to observe or try to pick up any irregularities pertaining to the dog's kidneys. She then said good bye to the dog's owner who left and then moved the dog through to a holding cage. In order to perform the scan later.</p>	
10:30	DB finished the consultation	
10:37	DB went to conduct some research on her desktop, she had received a call from a concerned owner, who's cat had suspectedly eaten a portion of Fluetex, a flue tablet for humans, which	** DB stated to LM that it was often problematic for her to access relevant wildlife research online, as the available knowledge was either on cases within a confined environment like a zoo or a breeding facility, or

	contains Paracetamol, which is lethal to cats. DB further looked up Charcoal as an activator.	in game capture and private wildlife medicine... not enough based on pure conservation medicine.
10:38- 10:45	DB called the colleague who had referred the Labrador case to DB, to discuss the general prescan findings and the information provided to her by the owner. DB said that she would perform a scan, over the kidneys and over the bowels/ gut, incase she could find any foreign bodies or irregularities.	DB Had had the dog referred to her, due to the adequate machinery being present at this practice. DB obtained more history from the other vet, who was the dog's regular veterinarian.
10:40 – 11:01	Continued on with part of the interview with LM. Until she (DB) needed to conduct the scan. DB then went to give the dog a sedative, to make him drowsy and able to bring him into the surgery, in order to scan him. DB went to fetch the ultra sound machine. DB then went to collect the now drowsy dog from the holding cage DB and LM hoisted the large dog onto the table and then DB went to get the clippers.	DB informed LM that some sedatives can make a dog with organ issues sick, or more sick, and that one needs to be careful when administering such medication, for incase it has an adverse affect. The meds she used were: Ketamine and Valium... usually she would use Dormitol.. but as mentioned above, there can be issues with this.
11:01	DB shaved the flanks of the dog and then reached for the KY jelly, which she spread over the now shaved flank of the dog. Began scan, showed LM the dog's bladder and how full it was. DB went over the kidneys a number of times. DB stated that as she could not see both kidneys accurately, she would need to scan the otherwise of the dog, but also said that she was wanting to place the dog on his back so she could scan it's abdomen fully. DB then shaved the rest of the abdomen/ trunk area and DB reached for a support- (see drawing in book), to place dog upon this. DB, LM and the Vet Tech Jaena? Lifted the dog onto the frame.	The shaving of the flank is for easier movement and access of the scanner across the abdomen. The importance of this move (Spreading ky jelly), is to ensure the longevity of the equipment with which the vets work. DB informed LM that this specific ultra sound, was originally one for larger animals and had been brought across to this specific practice. LM asked if DB was taught how to shave the animal's hair at university, DB said that this was a skill she had self taught and gained through work experience.
11:20	DB froze a section of the scan and grabbed a piece of paper and pencil, with this, she then recorded the sizes of the two kidneys, length, breadth and circumference. DB scanned from L- R and in small circular motions, over and over the kidneys. She smeared more KY jelly on the dog's abdomen and began again. She depressed the probe with a medium pressure over the abdomen. DB froze the screen again, again she took measurements of the kidneys.	She needed to take measurements to see what the differences were in the kidneys, if any at all. This could affect the overall functioning of the kidneys.  DB informed LM that it was important to measure the kidneys, as this could adversely affect the kidney function, as well as excessive or decrease in enzyme secretion could affect the functioning. ** drawing in book.
11:52	Finished the scan. LM, DB and Thea lifted the dog off of the table and onto the floor of the surgery, so he could wake up. DB gave the dog some Antiseed (?) as a waking up drug.	DB stated to LM that there was a discrepancy between the sizes of the kidneys, one was 6.5cm in length, whilst the other was 8.4cm.
11:58 – 11:59	DB phoned her colleague and informed her of the findings. DB logged onto Microvet, the practice software, where she entered the procedures conducted upon the dog.	DB informed LM that if the kidneys had acute damage, like acute renal failure it would be a more positive outcome and she would be able to prescribe medication and specialised diets for the animal. However, if after the blood tests had come back and the dog had chronic renal failure, the options were both limited and expensive.
12:10 – 12:15	DB had her third consultation for the day, where she saw a small dog for its yearly vaccinations and a check up. DB took her stethoscope and placed it onto the dog, listened to its heart and then took the temperature. DB then prepared a vaccination for the dog. And was speaking to the clients about how dogs read one another's body language, however sometimes that one could have a dog which was oblivious to body language and then that was often when fights broke out between dogs. DB injected the dog and the dog who was	DB explained to the owners, that the dog could pick up on their tenseness and that in a situation like that it was best to stay calm.



	not expecting it let out a yelp, the owners who got a fright then rushed at the dog and therefore he, the dog became anxious for the next injection. The consultation then finished and DB went to call the Labrador's owners.	
12:30	The labrador's owners came to collect the dog. DB then spoke to them about the prognosis of the dog, who had since waking up from the sedative, become lively and pulled the owners out of the vet- eventually. DB informed the owners about Addison's disease and informed them of the small kidney. What DB said had further worried her was the lack of urine from the dog and the possibility of a secretion of cortisone or lack of secretion of cortisone into the bloodstream. The Labrador and his owners left shortly thereafter.	
12:32- 12:35	The owl began to move, so DB went to check up on the owl.	
12:32	A client came in to check about feral cats she was feeding and the spaying and or sterilisation of these animals.	
12:36	DB gave the owl more charcoal and cat food mixture. LM assisted with holding the owl. Then DB placed the owl back into the cat box.	
12:42	A Samoyed dog came in with its owners, it needed a deflea product. DB then assisted the owners with putting a deflea product on the dog.	
13:20	Interview continued. Interruption at 13:38- 13:42, Telephone call about the earlier Labrador patient. DB then went to consult with the assistant (Thea) about an animal patient. DB then showed LM an advert for a wildlife vet, that DB had obtained from the SAVA wildlife group.	FINISHED for day 17:46

**Appendix O: Excerpts from interview transcriptions: a) Mrs Joubert  
b) WOC610 Focus Group**

	Timespan	Content
1		<b>LM:</b> As I said, I am just going to ask a couple of questions to you, (um), can you let me know a little bit about yourself? As in, where you have studied, the background, your educational background, the course that you are doing, things like that?
2		<b>RJ:</b> Ok,(um), so I did an Undergrad at the University of Kwa Zulu Natal, in Environmental sciences, so I did a programme degree, it was called life sciences stream, so it was a mix of chemistry, geology and (er) geography subjects , (um) biological sciences, so more of a broad, quite general degree... and then.. am I going to fast? (laughs)
3		<b>LM:</b> Its cool, I am kind of typing along with you, as, as you are (um) you are speaking and then also just kind of making notes as well. Ya, sorry, carry on, ya?
4		<b>RJ:</b> (um) And then in honours I did, I sort of specialised more in the ecological side of things (um), so I did ecological sciences, and my honours project was in forest fragmentation, and the effects of that on tree species diversity, (um) so that was in Pietermaritzberg, but I still was based at UKZN in Howick college, and then I continued from there to do a Masters in, with Fred Ellery, in Wetland Geomorphology, so I studied a wetland called Wakkerstroomvlei in Mpumalanga province and just looked at the Geomorphological evolution of the wetland, so what are the geomorphological controls of the wetland, (um) and so that was sort of the emerging theme of the thesis and then I kind of moved to Rhodes (um) pretty much because of Fred (Ellery) and his influence.
5		<b>LM:</b> Alright..
6		<b>RJ:</b> So he, had moved here about two years before I had finished my Masters and he invited me to come here when I finished and go on a field trip and help him out with a student field trip to the Baviaanskloof catchment and I really enjoyed Rhodes and Grahamstown, and I thought that the catchment, just looking at the catchment and some of its issues and the beauty, also, the beauty of the catchment, I really wanted to stay and study further and (um) and I also had done a bit of lecturing at UKZN and I really enjoyed the whole teaching side of things and so I discussed that with Fred and he said, well if you want to get into teaching at University level, you need to have a PHD, so it was one of the reasons that drove me to want to study further, ya, so the current study is its also geomorphologically based it's studying or researching the drivers of erosion in the Baviaanskloof catchment and trying to evaluate the methods that are applied by the Working for Wetlands programme in wanting to restore the the former wetland, floodplain wetlands that once existed, so there once was a floodplain wetland, the river eroded it down cut through the wetland wetland became dried out and and spoiled the landscape, so, so I am quite interested in evaluating their techniques and whether they are appropriate for this technique for this system based on research of knowledge of how the system functions and how humans have impacted the system (um), and then hopefully that information, that critique could lead to further improvement of some of the techniques of the way in which they approach (um) restoration of degraded wetlands and eroding rivers in (um) South Africa.
7		<b>LM:</b> Ya, that is actually really interesting what you are saying, because (um), I used to work for Working on Fire, and although I did the media and awareness side of things, I was always very interested at the rehabilitation side, (um) post fires and things like that and where they got their information, because what you said there, or in that, was quite, quite a critical, quite a key area, in that each system is obviously different and each area is different and it's, it is dependant on what has

		been done to it before, that's then going to influence the plan after , (um), so, that's , that's really interesting what you have just said there! But ok, ya, tell me a little bit about sort of , yourself and your home and family, background, did anyone else go into the environmental side of things? Or was it you, that sort of took the lead?
8		<b>RJ:</b> (um), no, My Dad he worked initially for several years for the Department of Water Affairs (um) and He's now in mostly waste management and then he closer to his retirement he went into consulting, environmental consulting and he sort of , was basically just (um) writing EIAs (um) which he thoroughly hated , (um), but I think (um..) and my Mom, she didn't , she didn't study, my dad sort of went to Masters level in a BSC degree and he studied fish spp in Lake Kariba, I think that was a, one, one influence on me wanting to go into Environmental Science, but my folks are both very passionate about Nature and always had lots of holidays, growing up (um) in Game Reserves, Hiking, (um), being kind of in the wild, I grew up in the City, I mean I grew up in Durban and I lived in the city, but I always felt a connection to nature, really loved it and definately wanted to get into some kind of career that involved (um), either Conservation or (um) or just generally trying to help the environment and impacts on the environment and its kind of changed, that was kind of my initial , you know, dream and as I've, I mean i've been in the University system for a while now and I've done a bit of teaching stuff and I realised now that I really am passionate about the teaching side and getting students and young people passionate about learning about the environment, about current issues about how we manage and address those issues, possibly, maybe specialising in restoration management.... so it's kind of, it has changed over time, (um), and I think just the studying has helped me to realise that (um). Ya, so My Mom didn't study anything sort of ecologically related and she, she was a fund raiser, but she, she was always, she loved nature and (um) gardening and all that.. so ya..
9		<b>LM:</b> I was gonna say I also come from a family where it is also big into nature, not necessarily my parents having done nature related jobs, but I do find that it has fueled a lot of the passion, (um), that as I said, is actually quite interesting, you know that it's, it has brought you out and into nature and also the development of your passion, in teaching others, because essentially, I mena, there's the key in, in a lot of the environmental, (tsk), getting the environment right, is through teaching others... essentially. (um), ok, so you are currently doing your PHD and you did both Undergrads at UKZN.
10		<b>RJ:</b> Yes, that is correct.
11		<b>LM:</b> (Um) I am just filling this in slowly, but surely... I am trying to find a few wetland ecologists who have gone through UKZN, which is not a problem, but it has been a lengthly process trying to get into UKZN itself.
12		<b>RJ:</b> It has, with the whole merger of the two campuses, The Howard College Durban Campus and the Westville Campus, I think the whole University went through quite a difficult process, restructuring and a lot of, I mean I noticed, when I was based there, a lot of the good lecturers were lost, People like Fred (ellery) (um), left because there were, not a loss in standards in teaching and possibly research standards, quite a lot of politics involved in the whole merger.. am not sure... I think that is possibly why, why you are having difficulties....
13		<b>LM:</b> I need to interview staff and students who are there, in order to get a better feel for what the curriculum is and how they have been taught and things like that... (Explains how she has interviewed individuals from Stellenbosch and Rhodes, and how she found that there were difficulties trying to find individuals and then gain access to UKZN and UCT)
14		<b>RJ:</b> What is the problem with UCT?
15		<b>LM:</b> Their Fresh Water Department has seemingly fallen away... and so I thought, Ok , well let me try and get hold of a few of the people, who, were involved with it

		and I just keep coming up empty handed.. which is a little sad.. I mean this is all data, but at the same time, when one wants to find out the particulars ... ya... (um) alright, moving on, sorry. What motivated you to pursue this course and not another one, for instance?
16		<b>RJ:</b> (um), the PHD or the Undergrad, sort of general environmental science?
17		<b>LM:</b> Lets look at the PHD,since I am concentrating on you being at Rhodes.
18		<b>RJ:</b> Ok, er, it is a difficult one, I think quite a bit of it was, I was quite unsure of what to do after Masters, (um) I wasn't sure that I wanted to.. (um)... I mean I definately didn't want to do consulting and I had experienced the whole teaching at Masters level at University, and had enjoyed it alot, so I think alot of it was advice that Fred gave me, but also the excitement of studying, and something new, learning possibly a new topic and developing my knowledge and my skills further, as far as the key aspects that drove me to want to do the PHD (um), so I suppose it started out being that and now I really feel like I want to try improve the way, in which Working for Wetlands approaches restoration in South Africa, I think has become more of like a driver of why I am doing it now. Whereas, when I started, it was for alternative reasons, (um) and to be honest when I started I actually disliked it, and thought "Shjo, i shouldn't be doing this, I should possibly be working or doing something else, and I've already gotten into and started to enjoy the topic and, and so it has developed and changed and evolved over time"...
19		<b>LM:</b> Ok, (um) have you spoken to Christo Marais , at all? Coz he...
20		<b>RJ:</b> I haven't... but I know him (um), but ya, no I haven't , I haven't spoken to him...
21		<b>LM:</b> Coz it would be (um), I donno I guess, I used to work quite a lot with him, (um), and then with Guy Preston and them being some of the big head honchos to do with the "Working for..." Programmes , might be really good, after you are done with your research.
22		<b>RJ:</b> Great! Thanks, that's a great suggestion.
23		<b>LM:</b> Alright , I have already asked you if any of family members were involved in something similar , but have you had any other mentors, perhaps, besides Fred or your Dad, who have done anything, you know , similar to this, that you aspire to?
24		<b>RJ:</b> Do you mean when I was growing up and developing my interest for Nature and possibly environmental sciences or during my...
25		<b>LM:</b> Um, well essentially, what I'm, what I'm looking at is anyone else whose given you sort of inspiration, perhaps someone who you have worked with and as I said, you did mention Fred and your Dad, but anyone else who has done a similar course to what you have done or what you are doing now...
26		<b>RJ:</b> Off hand I can' really think of anyone (um), ya, I think definately my Dad and Fred has definately been very instrumental in my whole sort of... he taught me in my whole undergrad, my supervisor in Masters and he has definately influenced things... (um) ya I can't really think of anyone offhand. So...
27		<b>LM:</b> Ok, alright, (um) Ok, (er) am just going through a couple of the questions here which we have kind of dealt with, what was your initial feeling, or what IS your initial feeling about your transition or progression from University to workplace? Do you feel optimistic or pessimistic about, about the move?

## Appendices O: b) Excerpt from interview of WOC610.

15		<b>LM:</b> Thanks very much for signing the paper here (refers to the Consent form, thanks ZG). Usually I'd form a profile on all of you, so we will do this as a group. So what year are you all in?
16		<b>Class:</b> 6th year.
17		<b>ZG:</b> If you ask us a group question like that, do you want us to initial it... because there are alot of us who hold another degree...(Myself, Kobus, Tiaan, Wynand, Rob, Henrik, Nadia, Carien..)
18		<b>LJS:</b> Behalwe ek (Besides me!).
19		<b>ZG:</b> We all have degrees, we studied previously.
20		<b>LM:</b> Ok, what sort of degrees?
21		<b>ZG:</b> Everyone has a Bsc in Animal Science and on, two, three, four of us have honours in Animal Science.. (laughs).. and three Honours in Wildlife Management and one Agricultural Animal Science degree.
22		<b>LM:</b> And one Agric Animal Science degree.
23		<b>LM:</b> All through Onderstepoort?
24		<b>ZG:</b> No, All through University of Pretoria and University of Stellenbosch.
25		<b>LM:</b> My twin sister and both brothers went to Stellenbosch.. I didn't go. So the current course you are all doing is the WOC6 1?
26		<b>ZG and Class:</b> WO610.
27		<b>LM:</b> Excuse me, WOC610.
28		<b>ZG:</b> WOC (Wildlife, Ostriches and Crocodiles) , the 6 is 6th year, the 10 indicates it is a semester subject.
29		<b>LM:</b> You have all explained to me that you have all got different degrees, excuse me different undergrad degrees, all from University of Pretoria and One from Stellenbosch...
30		<b>LJS:</b> Onthou die een (Don't forget the one)- the one who came from school.
31		<b>LM:</b> Ok, generally what motivated you guys to pursue this specific course, direction?
32		<b>ZG:</b> What, WOC? Or to be a vet?
33		<b>LM:</b> That and to be a vet, I suppose we can do those two- in a couple of sentences.
34		<b>ZG:</b> I have always wanted to be a vet and ,ya, the wildlife, interest in it came in when I did my honours and after doing Animal Science [ her bsc degree] I decided I could not do another year of animal science and so got into Vet.. and it was obviously (obvious) to do the wildlife elective.. it was a choice between doing wildlife or exotics and caged birds.. and who wants to do exotics and caged birds?!(Laughs).. I'd rather do wildlife.
35		<b>LM:</b> So it is not necessarily based on marks whether you can get into this course..?
36		<b>ZG and Class:</b> No, it is an elective... so you choose between the two of them (electives) to get into this. But To get into Onderstepoort is based on marks...
37		<b>LM:</b> That one I know....
38		<b>ZG and Class:</b> That happens to be why most of us got honours degrees before getting in here! (laughs!) Except for this clever one over here points to LJS.... She just got in
39		<b>LM:</b> So she just strolled in... hmmm?
40		<b>LJS:</b> Want Ek issie stupid jong.. (Becuase I am not stupid) said in jest.

41		<b>LM:</b> Ok.... Alright..
42		<b>LJS:</b> Moet almal iets se? (Must each one of us sa something?)
43		<b>LM:</b> (Nods).
44		<b>LJS:</b> Studying vet.. well my Mom is a medical doctor, so I have always wanted to go into medicine, but I didn't .. I'm not very attracted to people so, animals was the next best thing. (laughs). (Um..) and I've been exposed to the wildlife, well mainly not in South Africa, In Botswana and it's just interested me from the get go.
45		<b>ZG:</b> I think the whole thing is quite swayed between caged birds and fish (exotics), because its like...
46		<b>LJS:</b> It's either or...
47		<b>ZG:</b> It would have been easier.. it's an easier subject.
48		<b>LJS:</b> The caged birds and fish...
49		<b>ZG:</b> But if you don't have an interest in it...
50		<b>LM:</b> Then whats the point?....
51		<b>ZG:</b> Ya... What's the point....
52		<b>LM:</b> Ok...
53		<b>ZG:</b> And I also think that is why the wildlife class is a lot smaller... We were 50 people in the wildlife class and the exotics class (Caged Birds and Exotics) was 80 odd...
54		<b>LM:</b> Wow! So that's quite a popular choice....
55		<b>LJS and ZG:</b> Ya.. becuase they know it's easier.. you're gonna get asked past papers and .... (Laughter from the class)
56		<b>JW:</b> (Um.) I also chose wildlife because I did my honours in Wildlife management ...
57		<b>LM:</b> Sorry you did your honours in....
58		<b>JW:</b> Wildlife management. Because I don't like domestic animals... (laughter from class). And I don't like monkeys and sh... so ya, that's .. that's why
59		<b>LM:</b> Ok...
60		<b>HJ:</b> KR...
61		<b>LM:</b> Say again?
62		<b>HJ:</b> HJ.. Wat moet ons se? (What must we say) hoekom het ons wildlife...
63		<b>ZG:</b> Hoekom jy het jy Wildlife gekies en veearts... (Why you chose wildlife and why vet)
64		<b>HJ:</b> I actually wanted to go and study Hoe se 'n mens Vingered (Viticulture) and then I wanted to do just animals so I changed over to the animal side of things and then I saw what the vets were work was in the Animal sciences and I just thought ya that's what I want to do. And the other reason I wanted to be a vet was it is so a diverse thing.. you can really do a lot of stuff with it.. it's not just... one thing, so you can spend less time...
65		<b>LM:</b> I'm quite enjoying your guys answers.. as there are none which are exactly the same...there's so many... there's obviously a treand of having a passion for wildlife, but there's definately different sort of areas and different places which people have come in from ..... Volgende (Next)
66		<b>RF:</b> (RCF): A bit generic, but veterinary has been a passion for as long as I remember.. discovering and playing with frogs and its.. I did animal science in order to get into veterinary and an honours to get in .. um wildlife.. I grew up in the Freestate and wildlife has always been a party of my life.. so hunting, shooting and fishing it has always been a part of my life... I've always had an interest in it (Wildlife)... So I reckon that's why I went into it.

67		<b>HK:</b> I've always had an interest in Animals.. but when I came to varsity I started in Actuarial Science.. and then I wasn't enjoying it at all and then I had friends who were doing veterinary science and so they were enjoying it and they let my interest peak.. and then I changed over to veterinary science and I'm enjoying it now.. and then the whole wildlife thing, (I) always had an interest in it.. I did a wildlife honours and wildlife management ..so really then, that's why I took wildlife elective here.
68		<b>LM:</b> OK.
69		<b>TC:</b> Growing up I've always had exposure to animals and so I developed a passion for it and (..um).. my Grandfather was to a certain extent involved in Wildlife so, that (uh..) made me (uh..) get an interest in wildlife.
70		<b>LM:</b> Was he a game ranger or did he run a...
71		<b>TC:</b> He just had a small patch of land he kept game on...
72		<b>LM:</b> Ok...
73		<b>ZG:</b> Did he have Nyala... because now they are selling for R35,000! (Class and ZG laugh)
74		Class banters..
75		<b>LM:</b> alright..... (um)...
76		<b>NJ:</b> I also when I was growing up had a passion for veterinary science.. wanting to be an animal doctor .. coming from the Eastern Cape, Conservation is always intrigued me, especially going to Addo alot.. (laughs..).
77		<b>LM:</b> Ok..
78		<b>NJ:</b> And since like school with the like the poaching (stuff) of elephants in the Eastern Cape and all the conservation stuff it has always given me an interest in wildlife.
79		<b>CL:</b> I am from Cape Town and Since before I can remember we went up to Kruger National Park every June Holiday, since I have been very small and every year just being there has really made me want to be especially wildlife vet , um, I would love to go and stay in Kruger when I am finished (Her degree)... so I think Kruger was one of the things that made me want to become a wildlife vet.
80		<b>LM:</b> Ok guys, (um..).. moving along.. so anyone who had a member of their family or a mentor who is in wildlife veterinary or who has gone into wildlife veterinary... waits for reply...
81		<b>Class:</b> Shakes heads in unison
82		<b>LM:</b> No.. ok.
83		<b>LJS:</b> Nee, ons is die Grondbreekers (No, we are the Groundbreakers/ pioneers).
84		<b>LM:</b> ok...
85		<b>LJS:</b> Pathfinders... dis wie ons is... (That is who we are)...
86		<b>LM:</b> Alright you guys have a supervisor? Or not specifically.. or do you just sort of like... how does it work?
87		<b>ZG:</b> Our course is supervised by Dr Burroughs who you saw earlier today... well that wildlife elective.. and he was our supervisor in our honours year as well... well for the BSC honours... so he was quite a big link between a BSC to coming here and like doing the wildlife stuff. He's been really good, like he organises pracs and stuff for us on weekends to go out and work with vets and ya..... go and stay on people's game farms on the weekend! (Laughs) .
88		<b>LM:</b> That's quite cool actually, we had we had a lecturer like that at C.P.U.T. who would organise for us to go hunting or fishing or whatever the case is.. or gun handling classes.. or...
89		<b>ZG:</b> Ya, Dr Burroughs is our person.. we do like darting pracs or like go to quarantine or ... go to the Zoo...

90		<b>LJS:</b> Gaan Zoo toe.. (We go to the Zoo).
91		<b>LM:</b> Ya, coz I understand that the Pretoria Zoo is quite influential in practicals and things like that...
92		<b>ZG and LJS:</b> Ya, they are, we do quite a lot of stuff through them.
93		<b>LM:</b> Ok.... What is your guys impression of how your transition is going to be?
94		<b>Class and LJS:</b> Scared.... I think it is going to take longer than we think... It is not going to be.. you walk out of here and you will be a Wildlife Vet.. it's gonna take some time.
95		<b>ZG:</b> Well there's a good indicator (I know we are not saying our initials- but, ZG), this past weekend we went to a Wildlife Auction in Vaalwater and we were there for the day with the vet and even he said himself, He's been in the wildlife industry for fifteen years that it took him almost five years in a normal mixed practice before he was able to work his way up before he was actually able to do wildlife work. Because you go into a practice like that and the vet that is already there obviously, chances are if he is in wildlife he wants to the wildlife work and you can't just come in there straight out of OP and be like "I'm going to all the wildlife work so you can now start doing cats and dogs..." you have to actually work your way and prove yourself.
96		<b>LM:</b> Ok
97		<b>ZG:</b> And alot of those game farmers , like those this weekend, those animals are being sold for like ludicrous amounts of money, they won't just let a recent graduate from OP come and dart their Sable Antelope, that cost a Million rand, they are going to want someone who has got a bit of a name behind them.. before they start letting people come and do what they want. You need to make a name for yourself and you need to find somebody who is going to give you the opportunity to also make a name for yourself. And if you talk to any qualified wildlife vet they will tell you that they didn't start out.. they didn't walk out of OP and then they were a wildlife vet.. they we and Wynand were talking about it today, a guy you are going to go to in Motsumi, tomorrow or wednesday...
98		<b>LM:</b> Wednesday
99		<b>ZG:</b> But Doctor Dawid Pretorius, he took a student that qualified at the... last year James, He is working with him, Dr James Roxburgh...
100		<b>LM:</b> Ja..
101		<b>ZG:</b> But the two of them are now doing wildlife and James is a new vet and he is still really good friends, but Dawid does all the big game like the Buffalo and the Rhino and stuff and James just has to take what he gets and they are friends and the work like for the same company, so that just goes to show that you can leave with all the connections in the world.. but you have to make a name for yourself.
102		<b>LM:</b> Oh ok.. I thought it was the other way around.. I thought James was Dawid's boss...
103		<b>ZG:</b> No, Dawid, Dawid is like the practice owner, and James is (has) just recently started working with him. James qualified Last year...
104		<b>LM:</b> And when did Dawid qualify?
105		<b>ZG and Class:</b> Oh a good few years back.... About ten years back... maybe more [ LM confirmed with Dawid that he actually only qualified in 2009, within the study's guidelines].. you'll have to ask him.
106		<b>LM:</b> Oh ok...
107		<b>ZG:</b> But James is Much older because he did his Master's in Wildlife Management. Before he got into OP.
108		<b>LJS:</b> En hy doen nogsteeds die donkie werk.. (laughs) (And he still does the dog/ donkey work).
109		<b>ZG:</b> Exactly and that is how it is!



## Appendices P : Excerpt from an Analytical Memo

### Supply of Freshwater Ecologists to the field

[<Internals\\Wetland Ecologists\\SUN Students Lect Indiv\\Alanna Rebelo\\A rebello>](#) - § 1 reference coded [100,00% Coverage]

Reference 1 - 100,00% Coverage

I don't know if I'd go back to South Africa straight away, but long term I definately want to be in South Africa. As I am really, really passionate about my country, and (um) if I did a post doc the research would be in South Africa. Unlike with my Phd, cause I'm really , really, I am an ecologist right so, I mean, so I know South Africa Ecosystems

[<Internals\\Wetland Ecologists\\SUN Students Lect Indiv\\JP Simaika Post Doc Researcher at SUN\\Dr Simaika part 1>](#) - § 3 references coded [100,00% Coverage]

Reference 1 - 100,00% Coverage

I actually think there is a sort of bottle neck and so I think there is a need for fresh water ecologists...

Reference 2 - 100,00% Coverage

Yes, I'd say yes , online and in newspapers and a good example being the Sunday Times... er sometimes you can find these sorts of things on in Magazine Science and alsorts of... sometimes you'll see Universities post for Fresh Water ecologists or aquatic ecologists and even recently I've seen posts come directly through the grape vine, you know on the list server, in our department.

Reference 3 - 100,00% Coverage

For example, at the moment the Water Research Commission is looking for a research Biologist, someone like one of their project managers in a climate change area, but still, all aquatic obviously, as it is the water research commission. They Posted it in the Sunday Times, but not online... Strange. But I do understand, as they don't want too many people applying and so they are looking for a particular type of person that would actually go out and look at the Sunday Times... So they are almost restricting the inflow...

[<Internals\\Wetland Ecologists\\SUN Students Lect Indiv\\Lect K Esler SUN\\Karen Esler 14 May 2014>](#) - § 1 reference coded [100,00% Coverage]

Reference 1 - 100,00% Coverage

But we have a kind of dual purpose, you know, although our undergraduate degree does prepare the UGs for PG work, it is quite a vocational thing, so they can with an UG 4 year degree go out and look for a job.

[<Internals\\Wetland Ecologists\\SUN Students Lect Indiv\\Linda Luvuno\\Linda Luvuno Inc Transcription2014 \(2\)>](#) - § 2 references coded [0,94% Coverage]