Social-ecological resilience for well-being: A Critical Realist case study of Boksburg Lake, South Africa

A thesis submitted in fulfilment of the requirements of the degree of

DOCTOR OF PHILOSOPHY

RHODES UNIVERSITY

Helen Elizabeth Fox

September 2014

Abstract

This thesis is based on a case study of the degraded Boksburg Lake social-ecological system and an environmental education initiative that aimed to support its transformation. This initiative aimed to involve local people in reclaiming the lake's social and ecological value, through a process of collectively reimagining possibilities, shaping identities, gaining knowledge and developing local human agency. The focus was on social learning processes in schools and churches to explore opportunities for co-engaged reflexivity that might produce transformation. Schools and Christian churches, two institutions that reflect modern, western social-ecological worldviews also have the potential to bring about change.

Critical Realism was chosen as my philosophical framework as it provided the tools to explore deeper mechanisms beyond empirical reality, both influencing the degrading trajectory as well as providing possibilities for transformation. It also legitimised case study research as a means to understand more generalised processes characterising modern social-ecological systems. The choice of Critical Realism informed the scope of my primary research question: What generative mechanisms constrain and enable the development of social-ecological resilience for well-being, in the modern social-ecological system of Boksburg Lake? The following three goals were formulated to address this primary question. Goal 1: Based on a multi-theoretical perspective of social-ecological literature, develop conceptual tools that have explanatory power to probe generative mechanisms operating in the Boksburg Lake social-ecological system. Goal 2: Identify generative mechanisms driving the current degradation of the Boksburg Lake social-ecological system. Goal 3: Identify learning mechanisms that support transformation for greater social-ecological resilience of the Boksburg Lake social-ecological system. By addressing the primary question and research goals I aimed to gain insights into modern global social-ecological systems, the mechanisms that drive high social-ecological risk and the requirements for and possibilities of global systemic change.

Drawing on a broad reading of social-ecological literature from different vantage points, tools with explanatory power were developed to probe for generative mechanisms in the Boksburg Lake social-ecological system (goal 1). The human capacity for symbolic representation is identified as an emergent property of co-evolving human-ecological systems. These symbolic representations become expressed in culture and worldviews, and influence patterns of identifying, types of knowledge and forms of agency. The nature of these will determine the degree that cultural systems are embedded within ecological reality and the extent of cultural-

ecological coupling. A cultural system closely coupled with ecological realities is likely to value ecological systems and manage them for their health, while less coupled cultural-ecological systems are likely to lead to the opposite. Because of their integrated nature, the extent of ecological health and value will affect the decline or sustainability of cultural-ecological systems. There are numerous examples of the learning that can take place when cultural-ecological systems are facing decline. This learning can enhance or reduce biophyllic instincts that become encoded in patterns of identifying, types of knowledge and forms of agency. This in turn affects the strength of cultural-ecological coupling and the extent that human societies co-evolve with ecological systems.

Normalising ideologies is a concept coined in the thesis to refer to symbolic representations of reality that have become integral to a social fabric and determine meaning, while maintaining the domination of the powerful. These ideologies determine patterns of identifying, knowledge and agency and are recognised as having a fundamental influence on the resilience of social-ecological systems. Four normalising ideologies are identified that promote apparent human progress at the expense of ecological integrity and social equality and thus alienation with each other and the ecological world. These are human-ecological dualism, anthropocentrism, nature is mechanised and nature is to be controlled. There are also a number of ideologies promoting connectedness with the ecological world that, if they became normalised, would support greater social-ecological resilience for well-being.

Generative mechanisms driving the current degradation of the Boksburg Lake social-ecological system were identified (goal 2). Drawing on critical methodology, the main method adopted was document analysis of the *Boksburg Advertiser* archives, Boksburg's local newspaper. Four generative mechanisms are recognised as most influential. Two of these have been named hegemonic symbolic systems. The primary symbolic system consists of the four normalising ideologies, mentioned above, that promote human progress at the expense of ecological health. The secondary, more explicit symbolic system, built on this, consists of the following normative ideologies: economic growth is imperative, unrestrained development is promoted, competition is the necessary means and consumerism is the good life. These two symbolic systems have had causal influence on the systematic erosion of ecological processes and biological diversity that has occurred in Boksburg, with the consequent undermining of social-ecological resilience for well-being. The third mechanism that constrains resilience is the power dynamics that have shaped Boksburg's economic history and social-ecological system. This has resulted in a society built on inequality and injustice with all its associated social and environmental ills, expressed as

externalities. The fourth mechanism resides in Boksburg's political and municipal dynamics. These structures are not designed to tackle complex social-ecological problems and they hold considerable agential power, yet seem dysfunctional at present.

Learning mechanisms that support transformation for greater social-ecological resilience of the Boksburg Lake social-ecological system were identified (goal 3). By adopting the role of a reflexive practitioner, supported by action research, case study and interpretivist methodologies, data on the empirical manifestations of the environmental educational initiative were collected. Methods included semi-structured interviews, focus groups, document analysis and participant observation. Findings indicate that schools and churches are important institutions that can positively influence patterns of identifying, knowledge about and agency for Boksburg Lake and can thus play a role in transforming hegemonic normalising ideologies. Important learning mechanisms identified included: Learning reflexively together within communities of practice that provide opportunities for active rather than passive learning; involving the youth as they are a group of people with notable enthusiasm, vision, energy and motivation; learning through information acquisition, investigation, action and deliberation; learning about abstract concepts and theoretical knowledge but embedding this in local realities; and learning that provides reference markers for how things can be different.

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Acknowledgements

It is with great pleasure that I write my acknowledgements! I have felt so supported, encouraged and loved through this process and feel deeply grateful to my incredible family, mentors and supervisors, community of friends and colleagues.

Professor Tally Palmer! Thank you for your remarkable generosity of spirit and endless care, support and guidance towards my spiritual, emotional and intellectual well-being. I have benefitted greatly from your considerable input (including the few fierce moments) and generous financial support and hope to do you proud through this thesis. What a privilege it has been to have you as my primary supervisor! Professor Rob O'Donoghue, it has truly been an honour to have an academic of your calibre as my co-supervisor. Thank you for being wild and genuine of spirit, caring of heart and incredibly generous with your creative and intellectual input. My thesis has benefited from your rich and deep intellectual insights. I hope to also make you proud!

Mum I've dedicated my thesis to you as an expression of how deeply I appreciate you! I can't thank you enough for being you! Thank you for being a source of invaluable kindness, patience, strength and support through this process! And then my Dad! My wise and generous Pappa Fox, I am very grateful for your financial support, encouragement and guidance. Thank you!

The community of people in Boksburg who participated in this process; you have been an inspiration! Thank you for your time, energy, commitment and passion for making a difference. I hope Boksburg Lake will soon be a place you can once again enjoy.

Thank you, Kim Ward for generously proofreading my work and being happy to work under pressure to get it done timeously, Margaret Wolf for so willingly and carefully helping me with my reference list, Helen Holleman for your refined input into my written work, Dr Andrew Gordon and Dr Neil Griffiths for kindly assisting with my biophysical section and Dr Leigh Price for being an invaluable source of knowledge and reading through some of my work.

A big thank you to Unilever, South Africa, for five years of generous funding that made the Schools for a Sustainable initiative possible and expressed their dedication to the transformation of Boksburg Lake. A generous scholarship was also provided

through Professor Palmer from the NRF: Global Change and Society programme. Thank you!

My dear friends, I have felt so encouraged and supported through you. I make special mention of Julia Smagorinsky, Shiloh Marsh, Treve Jenkins, Steve Ellis, Ruth Woudstra, Stephanie Penkler, Jane Tanner, Priya Vallabh, Imme Thom and Nina Rivers, my closest friend and PhD comrade with whom I've walked a remarkable journey.

And lastly to my God, in whom I live and move and have my being; what a joy it has been to do this knowing your grace and how passionately you love.

Chapter 1:
Thesis map

1.1 Contextual and philosophical overview

This dissertation emerged during an environmental education initiative called Schools for a Sustainable Environment (SSE) that focused on Boksburg Lake, a severely degraded urban lake. It is situated in the Central Business District of Boksburg, an industrialised city in the East Rand, Gauteng Province of South Africa, under the jurisdiction of the Ekurhuleni Metropolitan Municipality (EMM). Boksburg Lake was well known for its previous high societal value, outdoor recreational and aesthetic benefits; in addition the lake is closely associated with the city's identity. It is, however, currently notorious for serious water pollution, crime, deterioration of infrastructure and aesthetics and is little used. The lake's degradation mirrors more globalised modern social-ecological patterns and themes.

The SSE initiative aimed to involve local people in reclaiming the lake's social and ecological value, through a process of collectively reimagining possibilities, shaping identities, gaining knowledge and developing local human agency. An examination of this attempted change process and its consequences provided a means to better understand possibilities and requirements for global systemic social-ecological change. The focus was on social learning processes in schools and churches to explore opportunities for co-engaged reflexivity that might produce transformation. Schools and Christian churches, two institutions that reflect modern, western social-ecological worldviews also have the potential to bring about change (Weber 1930; Bourdieu & Passerson 1990; Clark 1993).

1.2 Primary research question and goals

This case study of the Boksburg Lake social-ecological system has provided the context to explore the primary research question and associated research goals (see box 1.1).

I initially adopted the position of a reflexive practitioner and collated a wide range of empirical data on the effects of the SSE initiative, but with a particular focus on identifying participants' emergent knowledge, roles, identities and agency. My initial research journey had a strong empirical focus with the intention of describing the

Boksburg Lake SSE case study in detail. My introduction to Critical Realism (examined in detail in chapter 2, section 2.3), a meta-philosophical framework that is increasingly influential in both social and natural sciences and interdisciplinary endeavours, increased the scope and theoretical aspect of my thesis, and informed the scope of my primary research question and associated goals.

Box 1.1: Primary research question with associated research goals

Primary research question: What generative mechanisms constrain and enable the development of social-ecological resilience for well-being, in the modern social-ecological system of Boksburg Lake?

- **Goal 1:** Based on a multi-theoretical perspective of social-ecological literature, develop conceptual tools that have explanatory power to probe generative mechanisms operating in the Boksburg Lake social-ecological system.
- **Goal 2:** Identify generative mechanisms driving the current degradation of the Boksburg Lake social-ecological system.
- **Goal 3:** Identify learning mechanisms that support transformation for greater social-ecological resilience of the Boksburg Lake social-ecological system.

By addressing the primary question and research goals I aimed to gain insights into modern global social-ecological systems, the mechanisms that drive high social-ecological risk and the requirements for and possibilities of global systemic change. The question is serious because it is examining the real world at risk. The question in turn required a meta-philosophical framework that is reality congruent. Critical Realism provided three points of purchase to answer the primary question.

- Firstly, Critical Realism provides an ontology that includes a real world, beyond our human perception of it, which is structured and complex, where generative mechanisms (which may not be empirically manifest) have causal effects on the world, and are a fruitful focus for research (Bhaskar 1998; Danermark *et al.* 2002). Generative mechanisms is a term used in Critical Realism that is useful for exploring the underlying causes determining observed empirical data. A Critical Realist discourse encourages researchers to identify and understand the underlying generative mechanisms operating in a particular context (Bhaskar 1998; Danermark *et al.* 2002; Mingers 2011). However, these generative mechanisms tend to be more generalised in scope than their unique manifestations in each case study (Price 2007). It therefore becomes possible to examine the Boksburg Lake social-ecological system case study as a means to explore broader modern social-ecological generative mechanisms.

- Secondly, Critical Realism provides an epistemology to examine Boksburg Lake as an integrated social-ecological system and combined a variety of research methods and perspectives from different disciplinary traditions (Bhaskar 2010). This meta-philosophy is theoretically and empirically inclusive, while also providing conceptual tools to discern plausible, compelling lines of argument (Archer *et al.* 2004).
- Thirdly, Critical Realism provides an in-depth critique of prevailing western philosophies that have held sway since the time of Plato (Norrie 2010). This critique provides insight into the role that dominant philosophical thought has played in western social-ecological relations. In turn, Critical Realism presents a philosophy of science that I believe can help address some of the fundamental knowledge problems in western social-ecological relations.

The thesis therefore has a strong philosophical base, with the aim of developing new theoretical insights into modern social-ecological systems and current crises. It is also empirical, being grounded in a particular case study. The study therefore moves between data and theory in an iterative process.

1.3 The primary assumption supported by key concepts

Social-ecological coupling, identity, knowledge and agency

A foundational assumption in this thesis is that the more closely human systems are coupled to ecosystems, the healthier and more valued by local people they will be. This in turn improves social-ecological resilience for well-being. The premise explored is that individual and collective patterns of identifying with, types of knowledge about and forms of agency in social-ecological systems, have fundamental effects on coupling processes and the consequent level of resilience. The concept of coupling is explored in section 5.2. This assumption is supported by three key concepts used in this thesis and summarised below, namely social-ecological systems, resilience and modernity. Together these concepts highlight firstly, how interconnected humans are with ecological systems (social-ecological systems), that the health of this relationship is not guaranteed (resilience) and that modern systems are increasing the vulnerability of human-ecological systems (modernity).

Social-ecological systems

Social-ecological systems is a relatively new concept that emerged out of a combination of theoretical spaces, including systems ecology and complexity theory and incorporates ideas about resilience, robustness, vulnerability and sustainability.

Authors who have developed and worked with the concept of social-ecological systems include Berkes and Folke 1998; Woodgate and Redclift 1998; Posey 1999; Berkes and Folke 2002; Folke *et al.* 2003; Plummer 2010, Folke and Gunderson 2012 and the Stockholm Resilience Centre. Through this concept recognition is expressed that human and ecological systems are interdependent, interconnected, constantly co-evolving and make up an integral system; that ecological processes have been fundamentally affected by cultural patterns of human use; that economic and social development are dependent on a biophysical foundation; and human actions directly or indirectly affect the capacity of ecosystems to sustain human societies. Complexity is inherent in these systems where they are characterised by non-linearity, emergence, uncertainty, adaptability and self organisation.

Resilience

Resilience emerged in the 1970s in ecological discourse as a challenge to stability thinking (Holling 1973). In social-ecological discourse resilience is defined as the amount of change the system can undergo and still retain its function and structure; the degree to which the system is capable of self-organisation; and the ability to build and increase the capacity for learning, adapting and where necessary transforming (Armitage *et al.* 2012). Resilience is a neutral term, which does not specify whether a particular system being resilient is good or bad. However, this neutrality also has normative implications because of the need to decide which resilient systems to protect and which to change (Armitage *et al.* 2012). There are examples of resilient ecological systems that provide highly valued ecological services and others, also resilient, which provide little value to people. There are also examples of resilient socio-economic systems that benefit some while producing harm to others (including both humans and other living creatures).

In this thesis desirable resilience is that which has implications of well-being, both for people (with particular consideration of the poor and marginalised) and the planet as a whole. Armitage *et al.* (2012: 3) defined social well-being as "A state of being with others and the natural environment that arises when human needs are met, where individuals and groups can act meaningfully to pursue their goals, and where they are satisfied with their way of life". This definition covers a multi-dimensional perspective that has material, relational and subjective aspects. Planetary well-being includes high biological and landscape diversity and productivity, and stable slow variables and feedback loops (Biggs *et al.* 2012).

Modernity

Modernity originated in Europe during the time of colonial expansionism (Giddens 1990), emerged from the Scientific Revolution (fifteenth to sixteenth centuries) and the Enlightenment project (eighteenth century) (Swilling & Annecke 2012) and is now worldwide in scope (Giddens 1990). It is built on experience that the world can be transformed by humans; is characterised by a separation between time and space, as elaborated in section 5.3.6 (Giddens 1990); has a number of defining economic structures, namely capitalism and industrialisation; is future-oriented; supports the nation state and mass democracy; has a particular suite of ideologies and values that influence the dominant worldview (as discussed in section 5.3.4); has globalising forces in its foundation and is discontinuous from traditional forms of life (Giddens & Pierson 1998). According to Swilling and Annecke (2012: 7) additional key characteristics defining the "culture of modernity" include a "belief in progress, the power of reason, the primacy of the individual, the sanctity of empiricism, the unlimited universalism of scientific knowledge, and the virtues of secularism" that all contribute to building the Enlightenment promise of the 'good society'. Modernity is also characterised by global social-ecological risks and Beck (1992) has coined the term "risk society" to characterise this time in history. The extent of these social-ecological risks has necessitated that modern society reflects on itself and Beck, Giddens and Lash (1994) describe this era as reflexive modernisation. It can be assumed that these risks result from the seventh characteristic identified by Swilling and Annecke (2012: 20), namely "the separation of nature and eco-systems from the logic of socio-economic development, with nature and ecosystems regarded as sources of unlimited resources which will always be extractable by modern technologies derived from scientific advances".

1.4 Motivation for thesis

> … at a deep level of our being we find it hard to suppress the cry of anguish, the scream of horror – the wild words required to express wild realities. We human beings are being led to a dead end – all too literally. We are living by an ideology of death and accordingly we are destroying our own humanity and killing the planet. (Daly & Cobb 1994: 21)

Over the past two millennia many writers from diverse and different perspectives have alerted humanity to the dangers and latent crises that can result from discordant patterns of being that damage our relationship with nature. The following quotations, beginning in ancient Judeo-Christian literature and ending with views on the recent

realisation of imminent collapse in the twenty-first century, highlight how critical thinkers have presented their fears of social-ecological collapse.

Over 2000 years ago the dangers of a barren world through ecological exploitation and a void of morality were expressed in religious texts. For example,

> Woe to you who add house to house and join field to field till no space is left and you live alone in the land. (Isaiah 5: 8, New International Version)

> There is no faithfulness, no kindness, no knowledge of God in your land. You curse and lie and kill and steal and commit adultery. There is violence everywhere, with one murder after another. That is why your land is not producing. It is filled with sadness, and all living things are becoming sick and dying. Even the animals, birds, and fish have begun to disappear. (Hosea 4: 1-3, New Living Translation)

Numerous historical case studies of local social-ecological collapse, due to ecological exploitation (discussed in more detail in section 5.3.2), indicate that human communities can cause severe ecological harm, destroying life support systems (Weiskel 1989; Janssen & Scheffer 2004; Anderson 2010). However, the modern western track record for the scale of social-ecological destruction is unprecedented (Jensen 2004). The globalised and profoundly interconnected nature of modern social-ecological systems as well as the highly unrealistic economic trajectory, based on the assumption of unlimited economic growth on a finite earth is an extremely serious, risk infused situation (Beck 1992), expanded further in chapter 5. Daly and Cobb (1994: 390) express some of the devastation incurred from the beginning of modern western expansionism:

> All the ancient cultures of the world felt the power of the Enlightenment critique. For the enormous accomplishments of their communities rooted in great traditions they heard no support. Then there fell upon them the power of an economic system, rooted in this way of thinking. To succeed in this new system, the ancient cultures required modernization or rationalization, which meant the destruction of the power of tradition and community. Land and labour – that is the earth and human beings – had to become commodities. The result has been a holocaust, and this process of rationalization and commodification threatens to destroy yet more.

This holocaust includes the severe diminution of ecological integrity and abundance. The Millennium Ecosystem estimates present extinction rates to be 100 to 1000 times above the background (United Nations 2005), which if continued unabated will

account for the loss of 30-50% of all current species by the mid 21st century (Wilson 1988).

To provide some perspective, early European accounts of the North American continent provide a picture of bountifulness unthinkable in today's world:

> Early Europeans describe towering forests of cedars, with an understory of grapes and berries that stained the legs and bellies of their horses. They describe rivers so thick with fish that they 'could be taken not only with a net but in baskets let down (and weighted with) a stone'. They describe birds in flocks so large they darkened the sky for days at a time and so dense that 'a single shot from an old muzzle-loader into a flock of these curlews (Eskimo curlews made extinct by our culture) brought down 28 birds'. [There are descriptions of rivers so full of salmon that] at night one is unable to sleep, so great is the noise they make [and lobsters] in such plenty that they are used for bait to catch the Codd fish. (Jensen 2004: 85, 86)

Future social-ecological scenarios are terrifying and are being driven by modern, western hegemonic and increasingly global patterns of being. For example, the Living Beyond Our Means statement (from the Millennium Ecosystem Assessment's Board) explains that, "Human activity is putting such strain on the natural foundations of the Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted" (quoted in Glasser 2007: 42). Rockstrom *et al.* (2009) have discussed planetary boundaries and highlighted that critical thresholds are being crossed in the high rate of biodiversity loss, climate change and the disruption of the global nitrogen cycle. The Millennium Ecosystem Assessment states that 15 of the 24 (60%) ecosystem services humans depend on are degraded and already detrimentally affect human well-being (United Nations 2005). The current ecological overshoot has been calculated as 1.33 times the earth's available resources and it is estimated that by 2050 humanity will require two times the earth's available resources to be sustained (Massey 2013).

Badke (1991) has described the earth as a mirror, reflecting the collective emotional and spiritual condition of a culture on the land. Gottlieb (2009: 6) supported this by stating that when we look to nature and "find broken beer bottles on mountaintops or birds choking on plastic bags; we will find, that is, only ourselves". The present ecological degradation is therefore a mirror of the condition of modern hegemonic culture.

According to Jickling (2013) modern society has come to normalise catastrophe. This is largely because of a TINA complex, a term used in Critical Realism to refer to ideologies (particularly economic) so entrenched that people believe that 'There Is No Alternative' (TINA) (Norrie 2010). Sachs (1996: 245), for example, has stated that politicians, industrialists and scientists repeatedly give the following message: "Nothing should be done (the dogmatic version) or can be done (fatalistic version) to change the direction the world's economies are taking… alternatives to development are blackballed, but alternatives within development are welcome". However, many authors believe that alternatives are possible. Frank (2010: 101, 102), for example, called for "life-affirming, emergent social imaginaries" instead of the death imaginaries that presently have effect: "A world that is sustainable and health-enhancing must become more of a real socially emergent imaginary". This thesis explores possible life-affirming social imaginaries that challenge the hegemonic order.

My intention in this study has been to contribute to social-ecological discourse by providing a broad rather than in-depth conceptual analysis of the relationship between humans and ecological systems in the modern world, and possibilities for transformation, that are rooted in a particular case study. In light of the profoundly complex nature of human-ecological systems and the many nuances that characterise modernity, this broad approach has meant some areas touched on in this thesis necessarily lack an in-depth examination (both empirically and theoretically).

Although this thesis has been researched under the auspices of a science faculty, the first person has been adopted to express that a subjective person (me), in relationship and partnership with the world and people, undertook the study. This expresses my ontological and epistemological assumptions that challenge the dominant scientific idea that I am a detached observer, examining an external reality that can be objectified.

1.5 Thesis structure

The thesis is presented in eight chapters. See figure 1.1 for a conceptual overview of the relationships between chapters and the three research goals that support the primary question.

The **thesis map (chapter 1)** has introduced the study, stated the primary question and its three supporting goals and explained the philosophical and contextual context underpinning these. The motivation for the study is also provided.

The **philosophical framework (chapter 2**) provides a philosophical framework for the thesis. Critical Realism is the chosen meta-philosophy and is described in detail. This includes both Basic Critical Realism, which deeply informed the ontology and epistemology underpinning the thesis and guided the development of the primary question and associated three goals; and Dialectical Critical Realism, which critiques western philosophy and provided the conceptual tools to examine possibilities for change.

The **contextual orientation (chapter 3)** introduces the social-ecological system of Boksburg Lake and the SSE initiative that focused on the reclamation of this socially and ecologically degraded system. The chapter describes the geographical, biophysical, historical and educational context of the Boksburg Lake case study. The SSE initiative that attempted to bring about change to this degraded system is then described in some detail, including its underpinning philosophies and design. The chapter concludes with a list of ideas and plans that were identified but not subsequently implemented due to various constraints.

The **methodological framework (chapter 4)** discusses the methodological and analytical process adopted in this thesis. As a reflexive practitioner I undertook an action research project on a particular case study, which was explored from both a critical perspective, to identify and critique processes of social-ecological degradation, and an interpretivist perspective, to explore people's subjective experiences. An adapted version of the inductive, grounded approach was used to allow the data to emerge without a preconceived hypothetical lens. The RRREIC (Bhaskar 2010) schema was then employed as a tool to identify key generative mechanisms operating in the Boksburg Lake social-ecological system.

The **synthesis of social-ecological theory to develop conceptual tools with explanatory power** (chapter 5) provides a synthesis of current social-ecological literature from a multi-theoretical perspective. From this synthesis conceptual tools with explanatory power have been developed to probe generative mechanisms operating in the Boksburg Lake social-ecological system (**research goal 1**). The chapter thus orientates the reader to the main conceptual tools used in this thesis to identify key generative mechanisms enabling or constraining social-ecological resilience of the Boksburg Lake modern social-ecological system. An important aspect of the chapter is an exploration of western historical factors influencing modern social-ecological systems. A conceptual map indicates how these factors have reinforced each other to make the hegemonic socio-economic system highly resilient to change.

The **historical-contextual analysis of the Boksburg Lake social-ecological system (chapter 6)** explores the history of the Boksburg municipal social-ecological system from the early 1900s until 2008, from when the SSE initiative was implemented. It is a case study of a modern social-ecological system that is currently experiencing high social and biophysical risk after decades of economic growth and expansion (Beck 1992). The exploration of generative mechanisms driving the degradation of the Boksburg Lake social-ecological system (**research goal 2**) contributes to an understanding of degrading processes in modern, industrialised social-ecological systems.

Learning and change in the Boksburg Lake social-ecological system (chapter 7) explores the patterns of identifying, types of knowledge and forms of agency that have emerged through the SSE initiative, with a particular focus on schools, although the broader community of practice, including the role of churches, is also examined. The chapter explores learning and change in the Boksburg Lake social-ecological system to identify learning mechanisms that support transformation for greater resilience of the Boksburg Lake social-ecological system (**research goal 3**).

In the **concluding discussion (chapter 8)** the analysis of the Boksburg Lake social-ecological system is re-examined. A summary of the main findings of applicable chapters to address each research goal is provided and then used to answer the primary research question. This reflexive assessment seeks to better understand more generalised modern social-ecological systems and to identify requirements and possibilities for global systemic change. The chapter also provides a self-critical reflection of the processes undertaken in the thesis. The thesis ends with my vision of a transformed social-ecological reality.

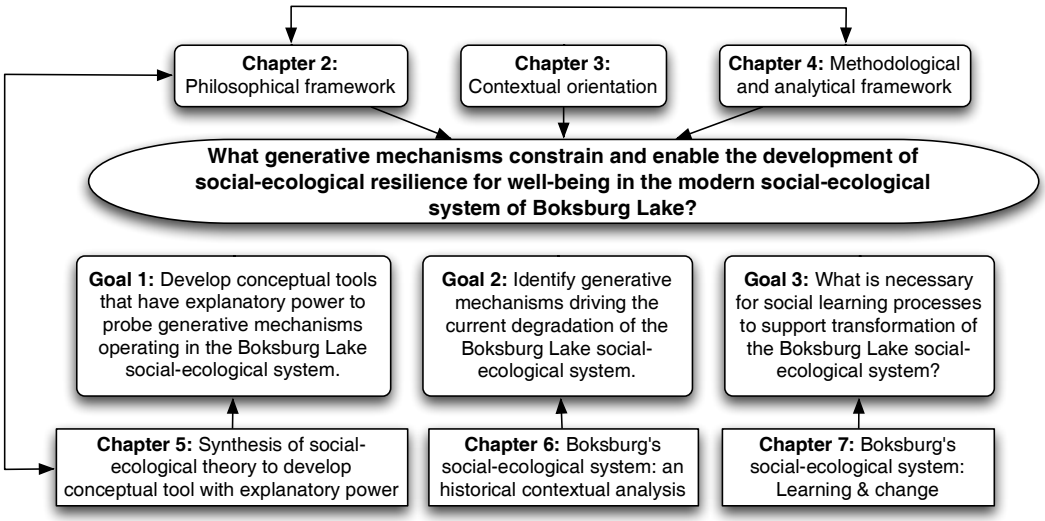


Figure 1.1: A conceptual overview of the relationships between chapters and the three research goals that support the primary question (highlighted in bold). Chapters 2, 3 and 4 provide context to the primary research question that is addressed in terms of the three research goals examined in chapters 5, 6 and 7. Arrows indicate relationships between chapters and linkages between chapters and the research goals and key question.

Chapter 2:
Philosophical framework

> God help us. With great skill and energy we have ignored the state of the human heart. With politics and economics we have denied the heart's needs. With eloquence, wit and reason, we have belittled the heart's wisdom. With sophistication and style, with science and technology, we have drowned out the voice of the soul. The primitive voice, the innocent voice. The truth. We cannot hear our heart's truth and thus we have betrayed and belittled ourselves and pledged madness to our children. With skill and pride we have made for ourselves an unhappy society. God be with us. Amen. (Leunig 2006)

2.1 Introduction

This chapter introduces the meta-philosophical framework of my thesis, namely Critical Realism. The chapter has four main sections. Firstly, conventional western philosophical approaches to knowledge acquisition are critically examined, including their impact on western social-ecological relations. This is based on Bhaskar's (1977) critique of western philosophy that influenced his development of Critical Realism. While recognising the many nuances within the traditions, I have adopted his broad generalisation of the three main philosophical approaches, namely empiricism, transcendental idealism and transcendental realism (Bhaskar 1977). Secondly, the main tenets of Basic Critical Realism are provided, including ontological realism, epistemological relativism and judgmental rationality. Thirdly, Dialectical Critical Realism is introduced with a focus on the MELD schema. Fourthly, a critique of Critical Realism is presented.

2.2 Typology of western philosophical approaches

Bhaskar (1998:122) has stated that philosophy "is a causal agent in society", the dominant philosophies are historically conditioned and there is often a link between a contradiction, inconsistency and point of difficulty in a dominant philosophy and a wider socio-political or socio-historical problem (Norrie 2010). Drawing on Bhaskar's (1993) work, Norrie (2010: 158) explained that, by critiquing a philosophical approach, a bridge is created "between the theory or practice under scrutiny and the wider world of structured power relations which the theory reflects on, participates in and embodies". Bhaskar (in Norrie 2010: 112) argued that in spite of some differences, there is an underlying unity that holds western philosophy together where it can "be understood as continuously committed to forms of alienation". This alienation is

supported by a pervasive anthropocentrism where people are viewed as knowers of complete reality, a consequence of conflating epistemology (the theory of knowledge) with ontology (the theory of reality). Bhaskar calls this the 'epistemic fallacy', which he argues is one of the primary failings of western philosophy (elaborated further in section 2.3.3). This misleading notion has undermined the possibility of western scientific philosophical approaches being fully cognisant of reality and the chance of developing cultural systems that embed us in the ecological world.

Bhaskar (1977) identified three main western philosophical positions of science, namely, empiricism, transcendental idealism and transcendental realism. He stated that these three positions do not provide a complete typology, but by highlighting them, the current issues and limits in the philosophy of science surface (Bhaskar 1975). Bhaskar (1977) developed transcendental realism (a philosophical approach that provided the ontological and epistemological foundations of Critical Realism) to address the inherent weaknesses in the above two mentioned approaches. These three philosophical approaches will be discussed in turn. I then go on to discuss critical naturalism, which explores the implications of transcendental realism for the social sciences by examining the ontological and epistemological differences between natural and social research objects. The section concludes with an outline of critical realism that emerged from the combination of transcendental realism and critical naturalism.

Empiricism advocates that all knowledge is derived from sense experience and has had an important influence on our image of science (Bhaskar 1975). This philosophy is aligned with a rigorous quantitative methodology, which uses experimentation and sophisticated statistics to develop and test hypotheses based on deductive and inductive inferences. Positioning oneself as an objective researcher is important in an attempt to reduce subjective bias and provide a true representation of reality (Malone 2006). This reflects the view that the natural world is an object that is separate from scientists and something that can be examined from a detached position (Connole 1998). The goal is to understand, predict, and ultimately control these systems (Connole 1998; Hindmarsh 2008) through technological development (Janse van Rensburg 2001). It is a perspective that validates observation, measurement and replication in the advancement of knowledge and views an event as meaningful only if it can be demonstrated by empirical evidence (Connole 1998; Janse van Rensburg 2001).

Bhaskar (1975) identified Hume as a central figure in empiricist philosophy where the "impoverished" (Mingers 2011: 4) and reductionist Humean theory of causal laws as a "constant conjunction of events" has held sway and discovering empirically based correlations between different elements is the aim (Bhaskar 1975; Norrie 2010). It is

therefore a philosophy that "adopt[s] a perceptibility criterion for existence" and ignores the unobservable and immeasurable (Mingers 2011: 9). This approach was a reaction to blind faith in religious authorities that characterised the Middle Ages and was seen as a way of offsetting the dangers of superstition, hearsay, rumours, doctrine, imagination and intuition (Janse van Rensburg 2001). Emotions, intuitions and spiritual revelations have consequently been de-legitimised as adequate means of obtaining true knowledge. From the perspective of Critical Realism this philosophy is viewed as seriously flawed (Benton & Craib 2001) and based on its limited ontology, has been described as naïve realism (Janse van Rensburg 2001) that supports the epistemic fallacy (section 2.3.3).

Mingers (2011) argued that Empiricism does not reflect the actual practice of scientists who hypothesise about the existence of unobservable laws and then look for their evidence. This frequently occurs in mathematics and physics where scientists move from the theoretical in search of evidence. In practice therefore not all modern science is limited to the perceivable.

Empiricism has proved successful in some important respects, where the emphasis on rigorous and controlled observation of the world has resulted in valuable scientific discoveries, technological advancements and the seemingly increased control of natural systems. These gains justified the dominant position of this philosophical approach, despite its serious flaws (Bhaskar 1975).

Social science initially adopted the empiricist philosophy, collecting observable, measurable data and conducting statistical tests to determine correlations. This universal approach to studying both natural and social research objects was termed the 'naturalist view' (Mingers 2006). An opposing view argued that the characteristics of social objects are fundamentally different from natural objects and that empiricism alone was untenable (Cohen *et al.* 2000). A different suite of philosophical approaches, which included post-modernist and post-structuralist approaches, emerged to better understand social research objects (Dickens & Fontana 1994). There has consequently been a swing away from the empiricist philosophy, to a position where reality is viewed as highly subjective and the possibility of making valid generalisations problematic. The emphasis shifted to qualitative, interpretivist research that had a post-modern alignment and there were paradigmatic conflicts on the validity of quantitative versus qualitative research (Erzberger & Kelle 2003).

Bhaskar (1975) coined the term 'transcendental idealism' to express some fundamental tenets of this philosophical backlash to empiricism. He identified Kant, who believed

that language and social constructs are critical in defining scientific interpretations of reality, as its formative philosopher. Bhaskar argued that transcendental idealism lacks an adequately developed ontology with the result that "the natural world becomes a construction of the human mind or, in its modern versions, of the scientific community" (Bhaskar 1975: 25). This is a type of epistemic fallacy, discussed in detail in section 2.3.3.

To summarise this section thus far, scientists influenced by empiricism adhere to a flat ontology that inadequately allows for structures and mechanisms beyond the empirical; what "cannot be experienced cannot be" (Mingers 2006: 21), while those influenced by transcendental idealism emphasise that knowledge and access to the world is mediated through language. In its more extreme form, this perspective questions whether reality exists beyond human language. As Mingers (2006: 26) stated "limitations of knowledge of being are taken to be limitations of being itself". Empiricism, which was designed to examine natural objects of enquiry, and transcendental idealism, which developed in the context of social objects of enquiry, are two apparently opposed philosophical approaches. This tension points to the significant challenge of authentically combining social and natural research objects in a thesis examining a social-ecological system.

Transcendental realism, a philosophical approach developed by Bhaskar (1975), provides a "philosophical ontology" for the natural sciences that addresses some of the important weaknesses of both empiricism and transcendental idealism (Harvey 2002: 164). Compared to empiricism's flat ontology that focuses only on the empirical, Bhaskar (1975) advances an ontology that is structured and layered, where the empirical constitutes only a small part of reality. Transcendental realism engages in model building to uncover what is behind the empirical, a similar approach to transcendental idealism. However, a fundamental difference is that transcendental realism argues that there is a real world, which the model reflects to varying degrees of accuracy (Bhaskar 1975). Because of this understanding of a real world, it becomes possible to judge between the reality congruence of different models (Bhaskar 1975).

Critical naturalism, also developed by Bhaskar (1989), explored the methodological and philosophical implications of transcendental realism for the social sciences. He argued that in spite of some fundamental differences (as explained below), society and nature can be studied in an integrated way. This is because of a stratified ontology in which physical, social and conceptual entities have causal power in the world (Mingers 2006). In contrast with empiricists, who aim to discover universal laws determining

empirical reality, Bhaskar spoke of universal laws as generative mechanisms that have tendencies for causal effects. According to Carter and New (2005: 1):

> The complexities of human ambition, desire, interests and relationships are such that social relations could never be reduced to a set of generalisations. This does not mean that human behaviour is inexplicable or chaotic. The many interwoven dimensions of social life are roughly patterned rather than law-determined. However, the contrast with the natural world has been overdrawn. Many causal 'laws' in the natural sciences are not invariant successions of events but express tendencies, the likelihood of certain things occurring, given certain sorts of conditions.

In this perspective both social and natural objects can be subject to a scientific inquiry that integrates both systems.

Bhaskar (1998) identified important ontological and epistemological differences between natural and social research objects that limit a universal scientific approach.

Ontological differences

Firstly, social (unlike natural) structures and mechanisms only manifest through activities that they affect (Bhaskar 1998; Mingers 2011). As Mingers (2006: 25) explained, "Social structures enable social activities and through that activity are themselves reproduced or transformed. Thus, they are themselves the result of social activity. In contrast, the laws of the natural world are not affected by their own operation". A consequence is that social structures can only be empirically identified through their activities, i.e. they exist in their effects, and they do not exist apart from human agents (Bhaskar 1998). Secondly, social (unlike natural) structures and mechanisms are dependent on agents' conceptions of their activity and are thus concept dependent (Bhaskar 1998). Thirdly, social (unlike natural) structures and mechanisms, rather than being universal, are only relatively enduring, being connected to particular cultures in space and time and are therefore more variable and changeable (Bhaskar 1998; Mingers 2011). Realistic explanations in the social sciences are thus activity dependent, concept dependent, and spatio-temporally dependent (Bhaskar 1998).

Epistemological differences

Most orthodox natural science relies on creating 'closed' systems for experimental purposes to test their theories (Bhaskar 1998: 45). This experimental technique cannot be applied to social systems and it is therefore more difficult to test theories by seeing the operation of an isolated mechanism (Bhaskar 1998; Danermark *et al.* 2002;

Mingers 2006). Researchers are left to postulate possible mechanisms from their effects on a particular context. These effects can be highly variable and are fundamentally connected to context as socially mediated mechanisms may reinforce or negate each other (Bhaskar 2012a). The purpose of theory in social science is therefore explanation rather than prediction (Bhaskar 1998; Mingers 2006).

In addition, social systems are largely constructed through meaning (Hornborg 1996). This undermines the possibility of accurate measurement, counting and comparison, as is often used for increasing our knowledge of natural systems. It is rather qualitative descriptions and understanding of meanings that are emphasised (Bhaskar 1998; Mingers 2006).

Critical Realism

Through the addition of critical naturalism, Bhaskar (1998) developed a philosophical framework for the sciences that became known as Critical Realism. It has addressed the dichotomy between natural and social research by ontologically and epistemologically combining social and natural research objects into an integrated totality. Critical Realism will now be examined in more detail.

Bhaskar described his work as 'philosophically under-labouring' for the natural and social sciences, a metaphor taken from John Locke, meaning to address the obstacles to true knowledge production contained in the various scientific and philosophical traditions (Collier 1994). Critical Realism thereby "clears the ground" for quality natural and social science (Bhaskar 2012a) and is proving to be an influential research philosophy as it has negotiated a path between the two extremes of empiricism and transcendental idealism (Harvey 2002). As Danermark *et al.* (2002: 2) have explained, Critical Realism has created "something new out of a number of different – sometimes irreconcilable – perspectives. This new perspective preserves the knowledge and insights from previous positions, but offers a distinct alternative". Critical Realism is also described as 'depth realism' due to its focus on penetrating the surface appearance of things to reveal deeper structures and mechanisms in operation (Benton & Craib 2001).

Bhaskar developed three stages of Critical Realism: Basic Critical Realism, Dialectical Critical Realism and Meta Reality. Basic Critical Realism consists of an ontology and epistemology made of ontological realism, epistemological relativism and judgmental rationality and it encourages interdisciplinary work. Dialectical Critical Realism deepens the ontological perspective by including the causal efficacy of absences and develops a theory of change, freedom and emancipation. Meta Reality reflects

Bhaskar's spiritual turn and focuses on ethical questions that allow difference to flourish creatively in the context of unity. The goal is to practise empathy by becoming one with the other (Bhaskar 2012). Basic and Dialectical Critical Realism have informed this thesis and are described in detail below.

2.3 Basic Critical Realism

2.3.1 Introduction

Basic Critical Realism is the first stage of Critical Realism and develops Critical Realism's ontological and epistemological assumptions. It has three main concepts, namely ontological realism, epistemological relativity and judgmental rationality. These three are each discussed in turn. Ontological realism is examined in depth and includes a discussion of the stratified ontology; generative mechanisms; emergence, the non-tenability of reductionism, and the laminated system.

2.3.2 Ontological realism

Bhaskar (1975) has developed a three-tiered ontology that depicts a stratified reality and reflects scientific processes better than the assumptions of traditional research approaches such as empiricism and transcendental idealism (Mingers 2011). It consists of three tiers, namely the empirical, the actual and the real, where:

- The **empirical**, the first tier, is only a small part of reality and exists for humans at the level of the senses. It is the level of reality experienced directly, provides data based on observation and has been the focus of empiricist research (Danermark *et al.* 2002). As this level is at the surface appearance of things, data can be misleading as underlying causalities may not be apparent and correlations may be attributed incorrectly.
- The **actual** is the second ontological tier and comprises events and experiences whether they've been observed or not: "what happens in the world is not the same as that which is observed" (Danermark *et al.* 2002: 20). These events have a causal effect (Mingers 2011) and will partially express themselves in empirical data that can be collected.
- The **real** is the third and most fundamental tier. It encompasses both the actual and empirical, and is thus total reality whether perceived or not. It consists of enduring social and natural structures and generative mechanisms (often unobservable) that we can experience indirectly through their causal effect (Danermark *et al.* 2002; Carter & New 2005; Mingers 2011). Bhaskar (1977)

> referred to them as generative mechanisms, which operate independently of the events and empirical data that they generate. He explained: "through their interactions, mechanisms generate the actual occurrences and events of the world, only some of which are observed or noted empirically" (1979: 170).

I have represented this ontology in figure 2.1. Scientists have the highest degree of confidence in knowledge gained from the empirical level that is dependent on direct observation and data collection. However, as figure 2.1 depicts, this is only a small part of reality. There is an increasing reliance on abstract theories based on metaphor and allegory, as scientific explanations are drawn from historical events, at the level of the actual, and even more so when probing unseen generative mechanisms and structures at the level of the real.

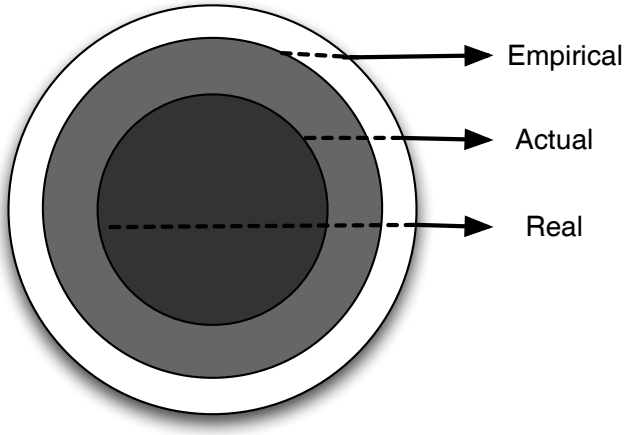


Figure 2.1: The three tiers of ontological realism: the empirical, actual and real. The empirical is a small part of reality, namely what can be observed, the actual lies at the level of events and encompasses the empirical while the real is all of reality, including unseen structures and generative mechanisms and encompasses both the actual and the empirical.

Bhaskar (1975) developed ontological realism based on the approach and success of the natural sciences that used experiments as a method for revealing and understanding "ever deeper and more basic strata of a reality" that was often not empirically manifest (Plant 2011). As Bhaskar (1975: 13) stated:

> Real structures exist independently of and are often out of phase with the actual patterns of events. Indeed it is only because of the latter that we need to perform experiments and only because of the former that we can make sense of our performance of them. Similarly it can be shown to be a condition of the intelligibility of perception that events occur independently of experiences.

A constant conjunction of events where the particular generative mechanism aligns with the actual and empirical levels in a linear fashion is therefore rare (Benton & Craib 2001; Harvey 2002). Experimentation creates a 'closed' system that operates under the specific variable/s being explored. A constant conjunction of events is produced where the empirical, actual and real levels align, making the generative mechanism much more transparent (Mingers 2011). For example, scientists examine gravity by creating a 'closed' system where an object is dropped in a vacuum. By preventing the actualisation of other mechanisms, such as air friction, the empirical effects of gravity can be clearly seen.

In naturally occurring open systems, many generative mechanisms operate. Some of these mechanisms may counteract or reinforce each other's effects so that a generative mechanism, although real, may be unexpressed in a specific instance (Collier 1994; Danermark *et al.* 2002). In critical realist understanding, this means that the particular generative mechanism is actually present, but other factors have caused it to be absent. Bhaskar (1975) thus refers to generative mechanisms as tendencies rather than laws.

Mingers (2011) summarised the important characteristics of generative mechanisms as defined by Critical Realism: they can be social, physical or conceptual; they exist independently from how they are known or described; they can be either observable or unobservable; their existence is judged by their causal rather than perceptible properties; these causal powers may not always be triggered; they are relatively enduring, but with highly varied timescales; social structures and mechanisms have different properties from natural ones, and they have emergent properties.

Emergence is an important concept used in Critical Realism. It is a process that happens when two entities with certain properties and powers interact to form a whole with properties and powers (generative mechanisms) not present in the individual entities (Goodenough & Deacon 2006; Elder-Vass 2005). Bhaskar (2010) identified three essential properties of emergence:

1. The emergent level is unilaterally dependent on the lower one;
2. The emergent level has new and different properties that cannot be predicted from the lower level;
3. The emergent level is causally irreducible to it, i.e. it can affect back on the lower level but in unpredictable and complex ways.

The concept of emergence helps one understand how layers of increasingly complex reality have evolved; mechanisms existing at higher emergent levels have causal powers irreducible to lower levels (Benton & Craib 2001: 126), while the higher the

level of emergence, the more open, complex and unpredictable the system, as more mechanisms are in effect (Danermark *et al.* 2002). This challenges the reductionist position, which argues that all of reality can be described by the base level, namely physics, thus reducing complex reality to a few quantifiable basic elements (Swilling & Annecke 2012).

Polkinghorn (1986: 86) distinguished between structural and conceptual reductionism. Structural reductionism understands that the elementary particles studied by physics make up the physical world. This Polkinghorn accepted, while denying conceptual reductionism, which has had two main influences:

1. It has attempted to understand the whole exclusively by studying the properties that make it up (Polkinghorn 1986).
2. It has encouraged denial of the reality of higher levels, which are often highly complex and immeasurable (Polkinghorn 1986; Collier 1994). If these higher levels are recognised, it is assumed that they can be understood from theories and concepts appropriate to lower levels. For example, that one can explain psychological effects in terms of neurophysiology.

Peacocke (1983) encouraged disciplines, which explore reality at different levels of emergence, to develop concepts appropriate to the behaviours, relationships and properties that have emerged at their specific level. He also stated that a non-reductionist scientific approach makes it untenable to discriminate between levels of reality: one cannot say that an atom is "graded as more real" than a bacterial cell or human person or values.

The concept of a laminated system, coined by Bhaskar and Danermark (2006), provides a non-reductionist conceptual framework to better understand the complexity of reality. While doing research on disabilities they were struck by how previous researchers predominantly focused on one aspect (e.g. it is a physical condition), while ignoring others (such as the social-economic and cultural factors that affect the experience of being disabled). They identified seven applicable levels of reality that emerged from each other. Each level had its own generative mechanisms that could not be explained by examining lower levels. These were (i) physical, (ii) biological, iii) psychological iv) psycho-social, v) socio-economic, vi) cultural and vii) normative. These levels of reality can usefully be transferred to understand levels of reality in social-ecological systems and will be adapted when grappling with the complexity of the Boksburg Lake social-ecological system in the concluding discussion, chapter 8.

In the critical realist philosophy, the multiplicity of operating mechanisms and structures are located at different levels of the laminated totality. These mechanisms could lie, for example, in the material, social and/or conceptual domains. Reality is therefore stratified according to these generative mechanisms where the higher mechanism is rooted in but emergent from the mechanism/s below (Collier 1994; Mingers 2006). The laminated system has been further developed to map out the relationships between different academic disciplines. Bhaskar and Danermark (2006) explained that disciplines understand reality at different scales and have been ordered to identify generative mechanisms that operate at these emergent strata.

This points to the value of interdisciplinary research, which draws on a range of methodological and conceptual frameworks (Collier 1994; Mingers 2006). This moves us onto the second important characteristic of Basic Critical Realism, namely epistemological relativism, which provides a particular theory on the nature of knowledge.

2.3.3 Epistemological relativism

Critical Realism argues that reality has an objective existence beyond our knowledge and experience. This is because stratified reality is "transparent to reason" (Collier 1994: 23) due to invisible generative mechanisms and the fact that knowledge is socially produced, historically situated and concept dependent (Danermark *et al.* 2002; Bhaskar 2010). Consequently, our knowledge of reality is always incomplete, fallible and dependent on culture (Collier 1994) and is therefore epistemically relative (Mingers 2011). Bhaskar (2010: 1) defined the object or mechanism being scientifically examined as the intransitive dimension and "established facts and theories, paradigms and models, methods and techniques of inquiry available in a particular scientific school or worker" as the transitive dimension (Bhaskar 1975: 21). An important point is that the intransitive dimension exists independently from our knowledge of it (Mingers 2011) where there is always "an ontological gap … between science and its intransitive object" (Danermark *et al.* 2002: 22).

Without this distinction between the transitive and intransitive dimension, there is the danger of making the epistemic fallacy, i.e. reducing what there really is (ontology) to what we can know of this reality (epistemology). This has been one of the fundamental failings of western philosophy and has characterised both empiricism (what we see is what there is) and transcendental idealism (reality as constructed through language). The epistemic fallacy is particularly dangerous as it places human beings at the centre

and extent of everything and has been described as the "strong anthropocentric current" characterising western philosophy (Bhaskar 1977: 45). Collier (1994: 77) has summarised the different forms this fallacy can take:

> 1) the question whether something exists gets reduced to the question whether we can know that it exists; 2) the question what sort of thing something is gets reduced to the question how we know about it; 3) the question whether A has causal/ontological primacy over B gets reduced to the question whether knowledge of A is presupposed by knowledge of B; 4) the question whether A is identical to B gets reduced to the question whether our way of knowing A is identical to our way of knowing B.

A proposition I suggest is that the epistemic fallacy is possible because of our human propensity to symbolically represent the world and therefore be able to detach from it (as explained in section 5.3.1). This detachment allows us to gain representational knowledge of the world. However, this representation is never an adequate reflection of the world's complexity. This is because of the limitations of human knowledge (as explained above), and the stratified nature of reality where so many mechanisms remain unseen. The epistemic fallacy occurs when we conflate and thereby reduce the world to our symbolic representation of it. This is dangerous as this reduced reality congruence can lead to weak coupling with ecological processes and their consequent undervaluing and degradation, with the threat of social-ecological decline, as explored in detail in section 5.3.2. The epistemic fallacy also supports anthropocentrism, where human interests and human realities are perceived to be of utmost importance. Critical Realism is therefore used in this thesis to make possible "a much greater respect for the integrity of things independent of us" (Collier 1994: 149).

2.3.4 Judgmental rationality

Critical Realism makes a distinction between epistemological relativism, as described above, and judgmental rationality based on the idea that all knowledge is fallible, but not equally so (Mingers 2011). This is because the different theories or truth claims refer to a real world, i.e. the intransitive object of science, and the researcher can therefore choose the theory that is able to encompass the most coherent available knowledge (Collier 1994; Danermark *et al.* 2002). The approach therefore asserts that we can make judgments between different truth claims based on their reality cognisance. Archer *et al.* (2004: 2) explained:

> We can publically discuss our claims about reality, as we think it is, and marshal better or worse arguments on behalf of these claims. By comparatively evaluating the existing

arguments, we can arrive at reasoned, though provisional, judgments about what reality is objectively like: about what belongs to that reality and what does not.

This section has presented the three key aspects of Basic Critical Realism, namely that:

- A real, stratified and complex world exists consisting of often invisible structures and generative mechanisms (ontological realism);
- Knowledge of this world is concept dependent and will always be limited (epistemological relativism); and
- In spite of the limited and fallible nature of knowledge one is able to judge between truth claims due to the fact that knowledge relates to a real world (judgmental rationality).

A discussion of Dialectical Critical Realism follows that builds on the foundations laid by Basic Critical Realism.

2.4 Dialectical Critical Realism

2.4.1 The MELD schema

Dialectical Critical Realism presents Bhaskar's second wave where the ontology developed in Basic Critical Realism is deepened and enriched through a focus on absence. As Norrie (2010) explained, an examination of non-being and negativity can deepen our understanding and conceptualisation of being.

The MELD schema provides the framework of Dialectical Critical Realism (Bhaskar 1993) and is a useful conceptualisation of transformation and change (Schudel 2012). It consists of the following four levels: the first 'moment' (1M) examines non-identity, the second 'edge' (2E) examines negativity, the third 'level' (3L) examines open totality, and the fourth 'dimension' (4D) examines agency/ praxis (Bhaskar 2010). Each level is elaborated below.

The first moment (non-identity)

The first moment, **non-identity**, builds on the ontological perspective developed in Basic Critical Realism. Non-identity is the hidden difference and differentiation that exists in the world. It includes the idea of a structured world, made up of both natural and social objects, where emergent generative mechanisms, that may not be empirically manifest, exert causal power irrespective of our understanding of them (Mingers 2006; Norrie 2010). Emergence is an important concept in non-identity

because it suggests how things are connected but have real differences, where a structure or mechanism is not reducible to the thing from which it emerged (Mingers 2011).

The second edge (negativity)

The second edge, **negativity**, explores the role of absence in change and temporality. Bhaskar (1993) argued that absence/non-being has ontological priority and is of greater consequence than presence/being (Norrie 2010). This is because the presence of something is powerfully shaped by what is lacking: "Absence always exercises its hidden power through shaping what is, and making it move on, (to) become what it is not" (Norrie 2010: 38).

Absence is a useful concept in understanding change because in a completely compacted space, nothing can move and hence change (Bhaskar 1993). Absence, where a thing becomes something else ("becoming") and in the process negates what it was before ("begoing") (Norrie 2010), is therefore strongly linked to causality and lies "at the heart of causal mechanisms" (Mingers 2011: 15). Mingers (2011) named four categories of absence: i) absence as a noun where something not existing has causal effect on what is present e.g. an unpaid bill; ii) absence as a verb, including absenting a presence (e.g. removing dirt on clothes) or absenting an absence (e.g. putting in recycling bins where there has been nothing); iii) 'process-in-product', where a process (e.g. erosion) leads to an absence (e.g. loss of fertile soil), and iv) 'product-in-process' where a structure (e.g. an industry) has causal effect in producing an absence (e.g. a lack of a healthy river). When attempting to effect change, it is useful to identify and absent the structures and mechanisms that prevent desirable things from becoming (e.g. economic structures that prevent eco-justice) as well as identify what is absent (e.g. the lack of effective legislation to bring the culpable to account) (Bhaskar 1993; Norrie 2010). In these cases, processes of absenting are important in bringing about emancipation, which Bhaskar (1989: 6) describes as the move from "unneeded, unwanted, and oppressive to needed, wanted and empowering" purposes.

However, a "primordial failing of western philosophy" has been a denial of absence, which Bhaskar called 'ontological monovalence' (Bhaskar 1993). Plato, Parmenides (a pre-Socratic philosopher) and Aristotle promoted this denial and the consequent philosophical tradition embedded "in structured power relations", which Bhaskar called $power_2$ or "generalised master-slave relations" (Norrie 2010: 46). These are power relations where one gets what one wants to the detriment of others, and which result from "structures of exploitation, domination, subjugation and control" (Bhaskar 1993: 402). This compares to $power_1$ relations where a person affects change according

to his/her needs and/or desires without intentionally harming others. To deny absence is to entrench the status quo because it denies the possibility for real change in a world dominated by power$_2$ relations (Bhaskar 1993).

The third level (open-totality)

The third level, **open totality**, deepens the understanding of how things are distinct, different and stratified, while also connected to form a totality: it "is the place where different things are seen in their connection, and are viewed as a whole" (Norrie 2010: 86). The aim is to build a more comprehensive totality where being is "bound together" in an internally related, "real, open, unfinished whole" (Bhaskar 2002: 249). Because of the absenting processes of becoming and begoing, reality is a totality in motion (Norrie 2010). This points to Bhaskar's nuanced use of totality as open totality, partial totality and sub-totality, which Norrie (2010: 90) explained in some depth:

> Sub-totality is the term he uses to denote the splitting, fracturing and broken nature of the whole... Partial totality is the broader term…and includes sub-totality. It indicates both the necessity of thinking totality, and the impossibility of thinking its completeness in an open, diffracted world. In such a world, change and the emergence of the new is always possible, so the totality is incomplete. This means that while we need to think in terms of totality, there is a sense in which we cannot, and the idea of partial totality fills the resulting gap.

Constellationality is an important concept that refers to how distinct things are embedded with and relate to each other on the same or different levels to constitute a totality (Norrie 2010). Emergence helps understand how this embeddedness comes about where in this totality the whole both produces and enables its parts and is only able to operate through its parts (Norrie 2010: 16). Totality is therefore about examining both the parts and how they relate to form a whole, articulates duals in terms of their difference and connection, and shows "how both sides intra-act" in embedded relationships (Norrie 2010: 101). For example, ontology and epistemology are different, yet related where they are two distinctive parts of the same whole: "knowing is at the same time a subset of being, and the study or theory of being (ontology) is already epistemically committed. So, there is a complex, co-embedded, constellational relationship between the terms, not a clear analytical distinction between epistemology and ontology" (Norrie 2010: 17). This compares to dualisms that are typically presented in philosophical thought as one-sided contradictions that are displaced from their overall context and therefore "detract…from wholeness" (Norrie 2010: 105). Bhaskar (1993) associated these dualisms with different kinds of exploitative social relations, summarised as power$_2$, or generalised master-slave-type

relations (Norrie 2010). It is these kinds of power$_2$ relations that Bhaskar argued underpin traditional philosophical dichotomies (Norrie 2010).

The fourth dimension (agency)

The fourth dimension explores how people act within the totality and examines the role of **agency** in bringing about transformation (Norrie 2010). Questions asked are whether transformative praxis can lead to emancipation and if it is possible to achieve an envisaged totality in particular space/time contexts. Agency is viewed as ethical practice and it is argued that knowledge about the world can lead to deeper understanding of moral truth within it (Norrie 2010). It therefore challenges the prevailing view (termed the naturalistic fallacy) that there is an unbridgeable gap between fact and value, and theory and practice (Norrie 2010).

Bhaskar identified three foundational aspects of ethical agency required to transform the world, namely freedom, trust, and relations of solidarity (Norrie 2010). He developed an elaborate, logical argument as to why these are foundational. In simplified form, the argument is as follows: Humans by nature desire the freedom to meet their basic needs. This freedom is the basis for human flourishing. Attainment of this freedom ("self-orientated desire") is dependent on trust and solidarity with others ("other-orientated solidarity") as we live in an interdependent world (Norrie 2010: 140). These three ethical foundations of freedom, trust, and solidarity with others, when fully realised through their universalisation (where there is a progression from wanting one's individual needs met to wanting all people's needs met) will lead to the 'eudaimonic society' (Bhaskar 1993). This is a society expressing the "best of moral worlds" (Norrie 2010: 17) in "a state of fully achieved freedom" (Norrie 2010:138) where "the freedom of each is achieved by the freedom of all" (Norrie 2010: 17) and "the freedom of each is a condition for the freedom of all" (Norrie 2010: 141).

It is clear that this is an ideal world and raises the question of whether the gap between the actual and the ideal is too huge (Norrie 2010). Bhaskar explored the dialectical relationship between the eudaimonistic society based on an ideal, universalised ethical practice (where we could be), and the reality we experience where power$_2$ relations are entrenched (what we currently are). In this kind of society, the flourishing of the powerful/master often depends on the subjection of the powerless/slave through dominant structures that lead to absences with negative impact, which in turn sustain the dominant structures (Norrie 2010). Ethical agency is therefore aimed at removing absences so as to disrupt power$_2$ relations and enable a society in which the flourishing of each will lead to the flourishing of all in a continually emerging open totality.

2.4.2 The three key failings of western philosophy

Bhaskar (1993) has provided a persuasive critique of traditional western philosophies. He identified their three key failings as ontological monovalence (that refers to a denial of absence), the epistemic fallacy (as described in section 2.3.3) and ontological actualism, a limited ontological perspective, advanced by empirical realism, that what you see is what you get (Norrie 2010). These three failings are closely connected. The link between ontological monovalence and actualism is that "a world that is complete, self-sufficient and self-present, at one with itself, will be one that simply exists in its actuality. All that there is is there, so that 'what you see is what you get', that and no more" (Norrie 2010: 177). Once ontological actualism is entrenched, it in turn reinforces ontological monovalence because this view has no place for absence. The link between the epistemic fallacy and ontological actualism is that the conflation of knowledge about reality with reality itself (the epistemic fallacy) depends on a limited view of reality that only consists of the empirical (ontological actualism). In turn the epistemic fallacy reinforces a limited view of reality (ontological actualism) by equating reality with what people can know about it. The three failings have negated the kind of emancipatory philosophy advocated by Critical Realism: that deepened knowledge of the real, stratified world containing generative mechanisms and absences, with causal effect, can have emancipatory power (Norrie 2010).

This section has examined Dialectical Critical Realism and its MELD schema. The first moment describes a structured world made up of emergent social and natural generative mechanisms. The second edge explores the role of absence and change. The third level examines how distinct things are related to form an open totality while the fourth dimension highlights the role of agency in bringing about transformation of this open totality. Freedom, trust and relations of solidarity provide the foundation for ethical agency to achieve the vision of a eudaimonic society where freedom of each person is dependent on the freedom of all. Western society's three key failings were then discussed, namely ontological monovalence, ontological actualism and the epistemic fallacy. These three failings reinforce each other to entrench the status quo and support disconnection from the real world as human construction of reality becomes viewed as reality itself.

The discussion moves on to a critique of Critical Realism, much of which is a reaction to the ambitiousness of its project.

2.4.3 Critique of Critical Realism

Mingers (2006) identified five areas of debate that challenge certain aspects of Critical Realism. The first area relates to Bhaskar's transcendental argument that an independent, stratified reality exists independent of observer's conceptions. Bhaskar's argument is that one can infer the existence of this independent, stratified reality from the "intelligibility" of scientific experimental activity (Bhaskar *et al.* 1998). Mingers (2006: 27) critiqued the use of the word intelligibility: "Does it really imply the existence of an external world, or does it just imply that scientists have that belief, whether or not it is actually true? We could similarly argue that the intelligibility of religious activity implies the existence of God but presumably we would only wish to argue that it implies a belief in God on the part of religious people". My sense is that this is a misreading of Bhaskar where his argument for an independent reality is based on the success of experimental activity, irrespective of how scientists perceive that success.

The second area of debate focuses on Bhaskar's analytical sequence, which he terms DREIC (still to be discussed in section 4.4.4). D stands for describing a state of affairs, R for retroducing possible generative mechanisms in operation, E for eliminating those least feasible, and I for identifying the most likely ones. According to Mingers (2006) this sequence has several weaknesses. Firstly, because conceptual and theoretical lenses influence the transitive domain, objective descriptions of a particular phenomenon are unlikely. "This will clearly condition the forms of generative mechanisms that are postulated to explain the phenomenon and make any sort of comparison or contrast very difficult" (Mingers 2006: 28). In turn, it becomes difficult to test the credibility of postulated generative mechanisms, especially when many are unobservable and their powers are not actualised (Mingers 2006).

The third area of debate concerns how Bhaskar postulates the nature of truth. He argued that knowledge in the transitive domain corresponds to objects in the intransitive domain, but the degree of correspondence is always limited (referred to as epistemic relativity): "We are…left with a problem of precisely what criteria we can use to judge between competing explanations" (Mingers 2006).

The fourth area of debate centres on the fundamental differences between social and natural objects of science, and the limitations those differences place on the scientific approaches developed for applying natural science methods to social science. The question asked is whether these limitations are "in fact so great that CR-type science is not possible? If social "structures" are unobservable, and indeed only exist through

people's activity; if social systems are open and not amenable to experiment; and social activities always rely to some extent on prior common sense or theoretical conceptualisation, then to what extent is it really possible to test competing explanations and identify "true" ones?" (Mingers 2006: 29).

The fifth area of debate relates to Critical Realism's claim of being critical, i.e. bringing emancipatory change to society (Mingers 2006). The challenge of this is correctly identifying both oppressive structures and the means to bring about effective change in a social world characterised by high complexity, interdependence, diversity of values and non-linearity (Sayer 1997). Attempts at emancipation will often have unintentional and sometimes undesirable consequences (Sayer 1997).

An area of concern that I have identified is the language used by prominent critical realists, such as Bhaskar, to describe the non-human or ecological. The language depicts the ecological as a material dimension that lacks sociability and capacity for personal experience and perpetuates discourses of a mechanised ecological world, examined in detail in section 5.3.4. For example, when Bhaskar (1975: 6, my emphasis) argued that an intransitive dimension exists independently of humans, he stated that generative mechanisms "would act in a world without men, where there would be **no experiences** and few, if any constant conjunctions of events". Intentionally or not, the language used implies that experience lies in the sole domain of humans, thus negating the possibility of other living creatures having sentient experience of reality.

Another example is based on the 'four-planer being', a model Bhaskar develops to depict four levels of human existence. In this model, human relations with the ecological world are described as "material transactions". The language used here depicts a limited view of what is possible regarding human-ecological relations and silences the many ways humans relate to the ecological world, beyond it being a resource. In many societies (for example, the Raramuri tribe of North Western Mexico), particular animals are described as kin and are seen as part of their living community (Salmon 2000). In the examples given above Bhaskar used language that perpetuates a metaphor of nature as mechanised. It is explained in chapter 5 that this metaphor influences modern western social-ecological relations and, along with anthropocentrism, human-ecological dualism and nature is to be controlled, underpins ideologies and practices that promote human progress at the expense of ecological health and value.

Another critique is that although Bhaskar makes useful distinctions between some forms of natural sciences and social sciences, he does not account for ecological sciences that explore the living world as a system. This form of science is similar to social science in that experimentation cannot be done in a closed system, largely because of high complexity. Bhaskar's use of language, as highlighted above, indicates that he has not factored in the living world. Words such as "material transactions" with nature are much more appropriate for the inanimate rather than animate living world. Because of this gap, Critical Realism, as presented by authors such as Bhaskar, has not adequately conceptualised social-ecological systems, which is a key concept that underpins this thesis.

2.5 Conclusion

Critical Realism is a meta philosophy that is proving useful in circumventing the limitations of conventional philosophical approaches, particularly empiricism (that views scientists as objective, external observers of a flat, empirical reality) and transcendental idealism (that views reality as only constituted through people's experiences).

Bhaskar, the leading proponent of Critical Realism has developed its three stages, namely Basic Critical Realism, Dialectical Critical Realism and Meta Reality. Basic Critical Realism that provides the philosophy's ontology and epistemology and Dialectical Critical Realism that deepens its ontology by examining the causal efficacy of absence and develops a theory of change, freedom and emancipation, have been discussed at length in this chapter.

Basic Critical Realism develops ontological realism that views reality as stratified, consisting of what can be seen (the empirical level), phenomena that have occurred (level of events) and structures and mechanisms, often unobserved, with causal effect (the level of the real). In this ontology, generative mechanisms, emergence and the laminated system are important concepts.

Basic Critical Realism's epistemology accommodates the social aspect of knowledge that is subjective and reliant on concepts, models and theories of a real world. Knowledge is therefore never a full and true reflection of reality (epistemological relativism). However, because knowledge is of a real world that exists beyond our perception of it, one can judge between truth claims depending on their alignment with reality (judgmental rationality).

Dialectical Critical Realism, framed by the MELD schema, deepens the ontological perspective by including the causal efficacy of absences and develops a theory of change, freedom and emancipation. A valuable contribution is the identification of the three key failings of western philosophy, namely ontological monovalence (a denial of absence), ontological actualism (a limited view of reality that consists only of the empirical) and the epistemic fallacy (that conflates one's knowledge of reality with reality). These three failings reinforce each other to entrench the status quo and support disconnection from the real world as human construction of reality becomes viewed as reality itself.

Chapter 3:
Contextual orientation

3.1 Introduction

Boksburg Lake is a shallow, manmade, urban lake situated in the city centre of Boksburg, south of Johannesburg. Boksburg City falls within the Ekurhuleni Metropolitan Municipality (EMM) that includes much of the East Rand. Figure 3.1 locates Boksburg within South Africa and Gauteng Province. Boksburg Lake was once the city's recreational centre and had high value to people. Over the last two decades, however, it has developed a notorious reputation for social and ecological ills. My role in the process of remediating this situation is explained below.

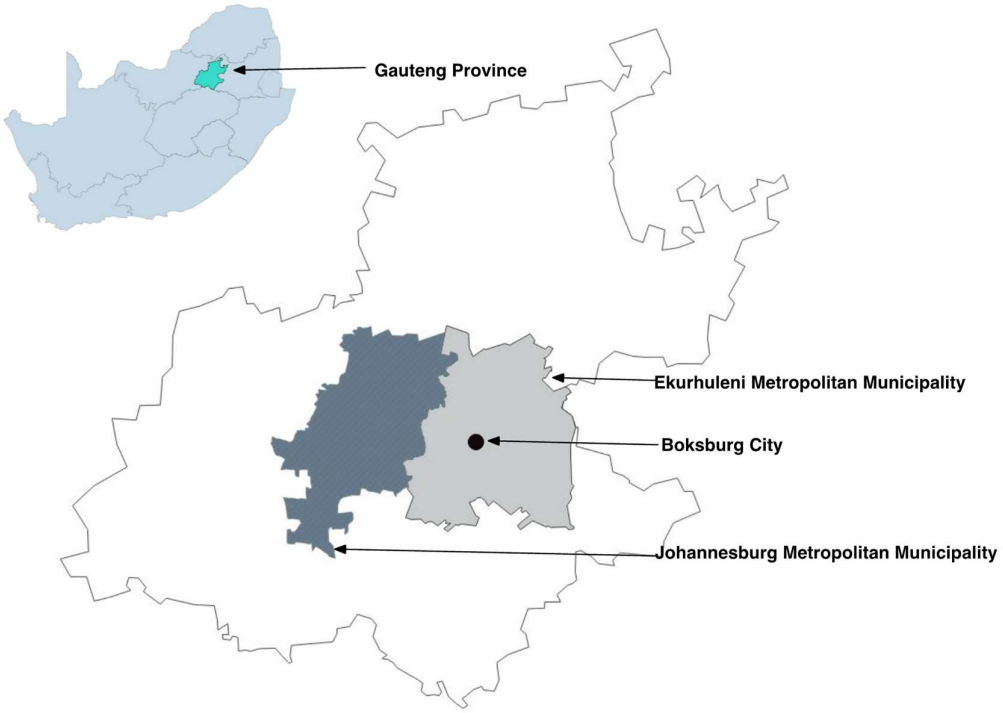


Figure 3.1: A map that locates Gauteng Province within South Africa and locates Ekurhuleni Metropolitan Municipality and Johannesburg Metropolitan within Gauteng Province

From 2008 to 2012 I was employed by the Unilever Centre for Environmental Water Quality (UCEWQ), Rhodes University and funded by Unilever South Africa, to design an environmental education initiative as a means of reclaiming Boksburg Lake. It became known as the Schools for a Sustainable Environment (SSE) initiative and was built on a previous intervention called the Boksburg Lake and Wetland Project, also

funded by Unilever South Africa. During the same year, the Environmental Learning Research Centre (ELRC) at Rhodes University employed me to develop twelve books on sustainability practices to be used within the South African school curriculum. They became known as the Handprint series. I also took part in the Goldfields Environmental Education part-time course. This was designed for environmental education practitioners and provided theoretical and practical input to inform their environmental educational initiatives. Guidance I received on the Goldfields course and experience gained developing the Handprint booklets, informed the design of the SSE initiative.

One of the first assignments of the Goldfields course was to undertake a contextual profile of the area of intervention to inform the design of a contextually appropriate environmental education project. The particular objectives for my contextual profile were to:

- Identify the main social-ecological problems and their causes affecting Boksburg Lake from social, economic, political and biophysical perspectives. This was informed by O'Donoghue (1986) who foregrounded social, economic, political and biophysical aspects to guide a holistic exploration of the causes of a particular social-ecological problem.
- Identify and develop a profile of relevant stakeholders.
- Document the local vision for Boksburg Lake and challenges to realising this.
- Map out possibilities and resources available for a school-based environmental educational initiative focusing on the Boksburg Lake social-ecological system.

The contextual profile consisted of a desktop study and a five-day field trip to Boksburg. During this field trip three relevant meetings were attended: the Klipriver Catchment Management Forum (CMF); a Gauteng Department of Agriculture, Conservation and Environment (GDACE) MEC Stakeholder Engagement meeting; and the Gauteng Wetland Forum. Sixteen stakeholders were interviewed, including users of Boksburg Lake and local residents, a municipal water quality manager, a local activist and member of WESSA (the Wildlife and Environment Society of South Africa), the regional director of WESSA, and a leader of a local Christian church located next to the lake. Contacts with local councillors, officials, developers, managers and researchers were established and followed up telephonically and via email. Data obtained from this profile informed the design of the SSE initiative.

This chapter, which draws on data from the contextual profile developed through the Goldfields course, introduces the degraded social-ecological system of Boksburg Lake

and describes in detail the SSE initiative that focused on the reclamation of this system. Identifying generative mechanisms influencing the social-ecological resilience for well-being of the Boksburg Lake social-ecological system later became the focus of my doctoral research.

The chapter is structured as follows: Firstly, an examination of the Boksburg Lake social-ecological system's past and present characteristics is presented, with a focus on its biophysical condition. Secondly, the Boksburg Lake and Wetland project (an earlier UCEWQ intervention) is outlined. Thirdly, the South African educational context is briefly described. This sets the scene for the fourth section, namely a thorough discussion of the design and implementation of the SSE initiative, which built on the Boksburg Lake and Wetland project. A list of ideas and plans that were not implemented due to various constraining factors is included.

3.2 Boksburg Lake's urban water catchment

3.2.1 Past system characteristics

Boksburg has been characterised as an industrial giant (*Boksburg Advertiser*, April 19, 1971) and is located in the economic heartland of South Africa. It was founded as a coal and gold mining town in 1886 and soon became the administrative centre of the East Rand. For the first thirty years Boksburg was predominantly a mining town surrounded by agricultural activities, with the East Rand Proprietary Mines (ERPM) gold mine, once one of the largest gold mines in the world (*Boksburg Advertiser* 1970; BHA 2004), becoming the backbone of Boksburg's economy. World War I brought industrialisation, which was consolidated during World War II, as imports from England were scarce. This encouraged local economic activity and industrial growth. Boksburg and neighbouring Benoni were the main foci and Boksburg grew into one of South Africa's biggest industrial centres.

In 1888, the government mining commissioner, Montague White, was contracted to build Boksburg Lake as a means to address water scarcity in the area and provide a watering hole for cattle. However, his vision was bigger than the small dam initially planned. With the assistance of convicts from Johannesburg's overcrowded prisons he built the 150 000 square metre Boksburg Lake and planted 40 000 surrounding trees (BHA 2005). In 1895 recreational use began and in a few years Boksburg Lake "had developed into an inland pleasure resort, with over 100 rowing boats for hire, a paved promenade lit by electric lights at night, a rose garden with thousands of plants, a

spring garden, a swamp garden, an autumn garden, a refreshment kiosk and a bandstand. Hotels, restaurants, cinemas and other entertainment venues sprung up in the streets nearby" and attracted 5 000 – 10 000 visitors over weekends (BHA 2009: 1). Many amenities developed (for example, a mini-train, boat club, putt-putt course, restaurant, Christmas lights, a swimming pool) and it was used for recreation, picnicking and open-air activities. From its early years until the late 1980s, Boksburg Lake was the social centre for Boksburg and "an esteemed landmark of the Boksburg CBD" (van Eden & Barlow 2008).

3.2.2 Present system characteristics

Over the last two decades the Boksburg Lake social-ecological system has undergone notable social and ecological degradation: "This once pristine holiday destination has become one of the most infamous historical landmarks" (BHA July 2005). Boksburg Lake has lost its ecological integrity and function; is currently threatened by serious water pollution (Van Eden & Barlow 2008), which includes +300 000 tons of toxic sludge (Gordon 2008); extensive fish kills are not uncommon; there has been significant deterioration of infrastructure and aesthetics, and the area suffers from social ills such as vandalism, rape and murder (Van Eden & Barlow 2008). Figure 3.2 provides a visual representation of some of the challenges facing Boksburg Lake. The following section provides a detailed discussion of the biophysical characteristics of Boksburg Lake between 2001 and 2008.

Figure 3.2: A visual representation of the challenges facing Boksburg Lake

3.2.3 Summary of biophysical characteristics 2001-2008

The condition of water bodies reflects human activities in a catchment (Davies & Day 1998) and as a result can be considerably altered from their base condition. Water quality, water quantity and the geomorphological characteristics can all be impacted. The particular focus of this section is the quality of Boksburg Lake's water. Figure 3.3 is a Google Earth image of Boksburg Lake and its catchment. It indicates the mining, commercial and industrial activities that take place close to Boksburg Lake and that the

lake's two main drainage lines flow past Cason mine dump and Anderbolt Industrial Park.

Figure 3.3: A Google Earth image of Boksburg Lake and its catchment (indicated by the black line), including drainage lines. It shows the Cason mine dump, the East Rand Mall, the central business district, the industrial areas of Anderbolt Park and Boksburg East Industrial Park and Boksburg North and Plantation residential areas, as well as the sampling points used by Ekurhuleni Metropolitan Municipality are indicated in black text for the canal, lake inflow and lake outflow.

Dallas and Day (2004) explained that acceptable water quality is specific to a particular user (such as naturally occurring aquatic species, recreational users, agricultural users, industrial users) and is determined by the physical properties of a sample of water. This includes physical constituents (turbidity, suspended solids and temperature) and chemical constituents (including non-toxic: Total Dissolved Solids, conductivity, pH, nutrients, organic enrichment, dissolved oxygen and salinity; and toxic: trace metals and biocides). These variables may have favourable or detrimental results on aquatic organisms, which can be heightened if variables counteract or reinforce each other's effects (Dallas & Day 2004). Pollution occurs when physical and/or chemical constituents of the water have been altered to the detriment of aquatic organisms and/ or users (Davies & Day 1998).

Trace metals, including mercury, aluminium, cadmium, lead, nickel, copper, chromium, selenium and zinc (Davies & Day 1998) are classified as toxic because under natural conditions they typically occur in very low concentrations (Dallas & Day 2004); they cannot be broken down and are therefore persistent, becoming more concentrated higher up the food chain (Davies & Day 1998). Any increase thus exposes aquatic organisms to concentrations they are not adapted to and leads to a reduction in species richness and diversity and change in species composition (Dallas & Day 2004). Contamination of water bodies by trace metals therefore requires proper management and careful monitoring (Dallas & Day 2004). This is important to note, when considering the intensive mining and industrial activity that occurs in Boksburg, which are two common sources of trace metals (Davies & Day 1998; Dallas & Day 2004).

Ekurhuleni Metropolitan Municipality regularly tested the water quality of Boksburg Lake, at the lake's inlet, outlet and a point in the canal feeding Boksburg Lake, from 2001. See figure 3.2 for the location of these sampling points. The following water quality variables were monitored: pH, chemical oxygen demand (COD), electrical conductivity, faecal coliforms, nitrite nitrogen, phosphates, ammonia, aluminium, copper, iron, nickel, manganese, magnesium and zinc. Gordon (2008) analysed this water quality data to establish trends over time for each water quality variable. Gordon's (2008) analysis has been used as an initial summary of the biophysical condition of Boksburg Lake between 2001 and 2008. Gordon (2008) compared concentrations and values at the lake inflow, lake outflow and canal points with the Klipriver catchment management forum (CMF) water quality guidelines (Klipriver Forum 2003) that indicated an ideal and unacceptable range. Guidelines for inland aquatic ecosystems (DWAF 1996) were used in cases where the Klipriver CMF water quality guidelines were not available for a particular water quality variable (figures 3.9, 3.10, 3.11, 3.12, 3.13, 3.14). The DWAF (1996) guidelines for the protection of aquatic ecosystems indicate quantitative chronic and acute effect toxicity values for different variables. A chronic effect value refers to situations when the target water quality range (TWQR) has been exceeded and where non-lethal effects of aquatic organism exposure to lake water are measurable. The TWQR specifies the desired concentration range for a particular constituent (DWAF 1996). An acute effect value indicates that lethal effects in aquatic biota are measurable, ecosystem health is threatened if the situation persists, even for a short period, and urgent management attention is required (DWAF 1996). The identification of the chronic and acute toxicity range for each constituent provide broadly protective ecosystem goals but this does not adequately account for the complexity of ecosystem interactions, where interacting water quality

variables may have additive, synergistic or counteractive effects (DWAF 1996; Dallas & Day 2004).

Variables that exceeded to varying degrees the Klipriver CMF guidelines and, where applicable DWAF guidelines, included faecal coliform counts, COD, copper, nickel, zinc, aluminium and iron. The analysis of these variables is presented below. pH is also included as its value influences the toxicity of other variables. Data was collected intermittently and gaps in the data set are evident in each graph.

Data from Ekurhuleni Metropolitan Municipality, as made available by Gordon (2008), was re-analysed to determine the percentage time that a given value was exceeded for the different water quality variables (faecal coliform counts, COD, copper, nickel, zinc, aluminium and iron) at the lake inflow, lake outflow and canal.

Results

pH

pH is an important water quality variable as it determines the availability and potential toxicity of a variety of substances, particularly many heavy metals. Heavy metals most likely to have toxic effects under acidic conditions include aluminium, copper, manganese, nickel and zinc (Davies & Day 1998; Dallas & Day 2004). Under natural conditions, most freshwaters in South Africa have pH ranges between 6 and 8 (DWAF 1996). Human induced acidification generally results from acid precipitation, industrial effluents and mining activities (DWAF 1996; Dallas & Day 2004).

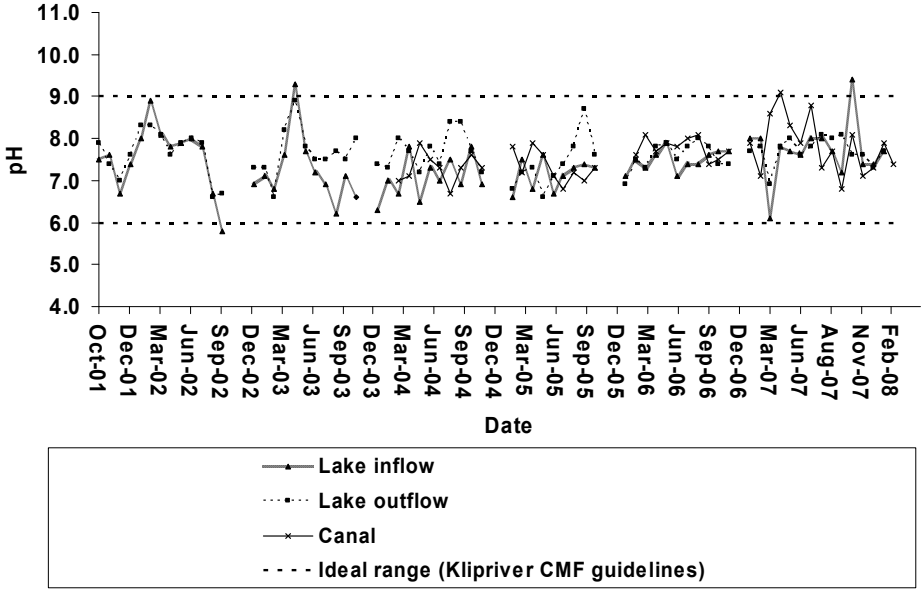


Figure 3.4: pH measured at the Boksburg Lake inlet, outlet, and canal feeding the lake (October 2001 – February 2008). The ideal range based on the Klipriver catchment management forum (CMF) guidelines is plotted; gaps in the graphs indicate missing values (Gordon 2008).

The pH values at all sampling points from 2001 to 2008 have fallen within the ideal range (Klipriver CMF guidelines), except three times (figure 3.4), which is surprising considering the amount of industrial and mining activity in the catchment. In September 2002 the lake inflow sampling point dropped below 6 and in May 2003 and November 2007 it went above 9. The pH range of Boksburg Lake will therefore buffer the toxicity of aluminium, nickel, zinc, manganese and copper that occurs in the lake.

Faecal coliforms

The most common source of pollution of water bodies is organic enrichment through sewage, measured by the number of faecal coliforms present (DWAF 1996; Dallas & Day 2004). This pollution changes species composition with an increase in those tolerant to such enrichment and a decrease or elimination of those that are sensitive, as well as an overall reduction in species diversity (Dallas & Day 2004). Humans may also be affected as faecal coliforms indicate the possible presence of pathogens in a water body, which can transmit infectious diseases such as cholera, typhoid fever and dysentery, to name a few (DWAF 1996).

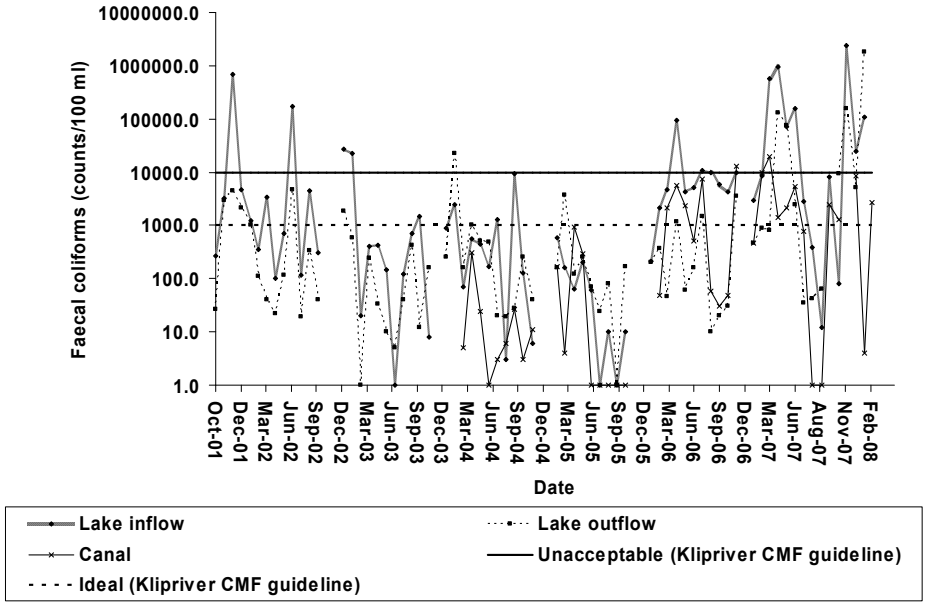


Figure 3.5: Faecal coliform counts measured at the Boksburg Lake inlet, outlet, and canal feeding the lake (October 2001 – February 2008). The ideal and unacceptable ranges based on the Klipriver catchment management forum (CMF) guidelines are plotted; gaps in the graphs indicate missing values (Gordon 2008).

It is locally known that Boksburg suffers from sewage leakages and spills, probably attributable to deteriorating sewage infrastructure. This has contributed to the highly variable monthly faecal coliform counts over the eight years sampled at Boksburg Lake that often exceeded the Klipriver CMF guidelines for unacceptable amounts, as figure 3.5 indicates. DWAF's guidelines for full contact (swimming) and intermediate (boating and fishing) are more stringent, being 100 counts per 100ml and 1000 counts per 100ml respectively. Between late 2002 and early 2006 the coliform counts rarely exceeded the unacceptable range. However, from mid 2006 to 2008 faecal coliform concentrations exceeded the unacceptable level on a regular basis. Seven times levels were close to 100 000 counts per 100ml and nearer 1 million counts per 100ml five times.

Figure 3.6 shows the percentage exceeding given values of coliforms. Data indicates that the lake inflow is the largest source of faecal coliforms and one can infer that faecal contamination comes from sewage leaks occurring in the Boksburg Lake catchment as a whole. At the lake inflow, the unacceptable Klipriver CMF guidelines were exceeded 20% of the time, levels were as high as 100 000 counts per 100ml for 10% of the time and exceeded 1 000 000 counts per 100ml for about 2% of the time. Data from the canal exceeds the unacceptable limit of 10 000 per 100ml for 10% of the

time, but at much lower levels than either the lake inflow or outflow, indicating that the canal is not a major contributor of faecal coliforms.

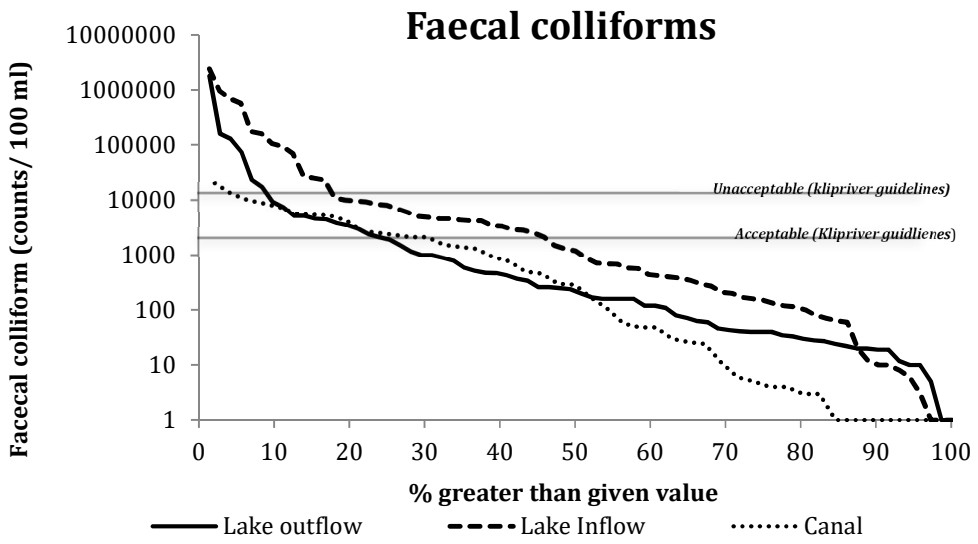


Figure 3.6: Percentage exceedance of faecal concentrations in the lake inflow, lake outflow and canal (October 2001 to February 2008). Data sourced from Ekurhuleni Metropolitan Municipality.

Organic enrichment, for example through sewage, can have important impacts on a number of other water quality variables including a change in pH, reduction in dissolved oxygen (DO) and an increase in turbidity and suspended solids, temperature and bacterial contamination (Dallas & Day 2004).

A reduction in DO, caused by organic enrichment, can have severe impacts. As Davies & Day (1998: 190) stated, "The concentration of dissolved oxygen is probably one of the most important abiotic determinants of the survival of most aquatic organisms". This is because DO is necessary for aerobic respiration while many toxic elements, such as ammonia, cadmium, cyanide and zinc become increasingly toxic under reduced levels of DO (Dallas & Day 2004). The degree of turbidity determines light penetration, with far reaching effects on the aquatic biota as photosynthesis and vision both depend on light (Dallas & Day 2004). Suspended solids, causing turbidity also smother surfaces, such as habitats and gills, absorb toxins and can change community composition to those species most able to adapt to such conditions (Dallas & Day 2004).

In 2008 there was an extensive fish kill due to the anaerobic conditions resulting from leaking sewage. An informant described the lake (at that time) as a sewage farm, which parallels the data of counts at 1 million per 100ml.

Chemical Oxygen Demand (COD)

Chemical oxygen demand (COD) measures the capacity of water to consume oxygen in chemical oxidation reactions and is therefore a useful surrogate of chemical pollution (Dallas & Day 2004).

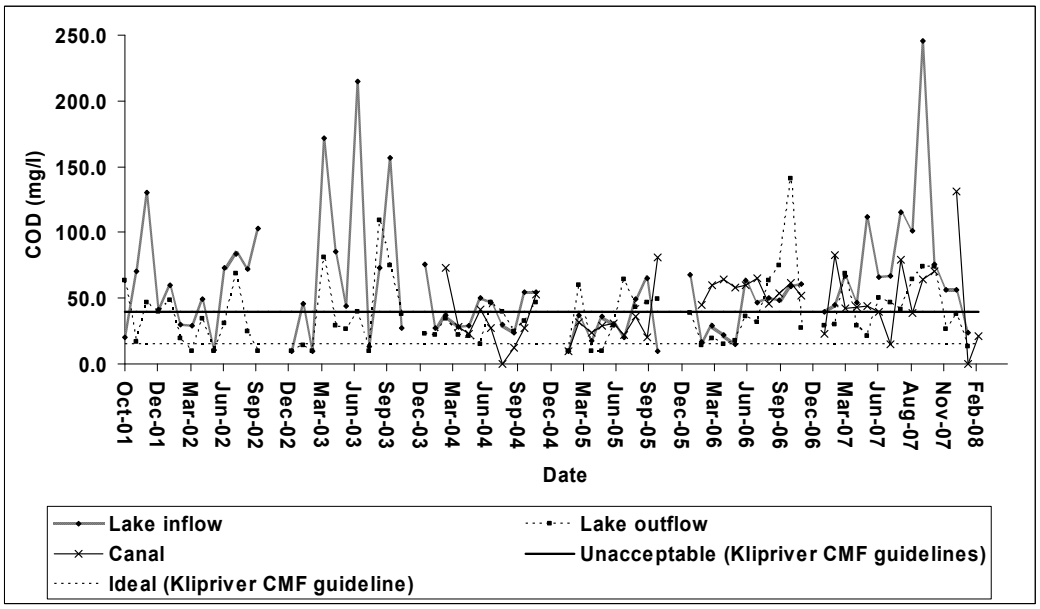


Figure 3.7: Chemical oxygen demand at the Boksburg Lake inlet, outlet, and canal feeding the lake (October 2001 – February 2008). The ideal and unacceptable ranges based on the Klipriver catchment management forum (CMF) guidelines are plotted; gaps in the graphs indicate missing values (Gordon 2008).

Water samples were analysed for COD from October 2001 to February 2008, as shown in figure 3.7. This data indicates a degree of temporal variation in COD but also a trend of increasing levels, which signifies a growing chemical pollution problem. There are two periods with particularly high COD levels, namely March 2003 to December 2003 and June 2007 to February 2008. During both these periods levels exceeded 100mg/l on a consistent basis and peaked above 200mg/l.

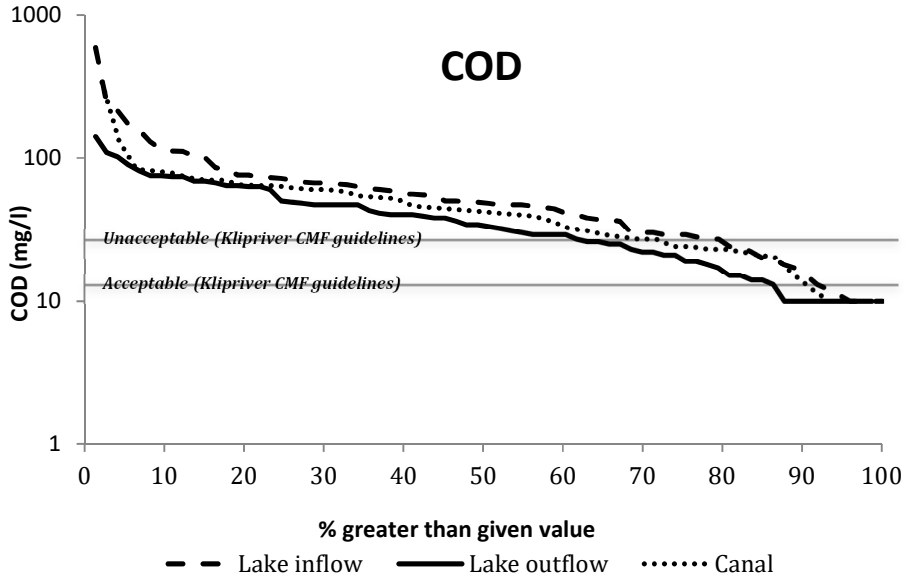


Figure 3.8: Percentage exceedance of chemical oxygen demand in the lake inflow, lake outflow and canal (October 2001 to February 2008). Data sourced from Ekurhuleni Metropolitan Municipality.

Figure 3.8 indicates that both the lake inflow and canal are significant contributors of COD. At both these sampling points levels exceeded the unacceptable Klipriver CMF guidelines 70% of the time. For 10% of the time the levels increase dramatically to exceed the unacceptable guidelines by considerable amounts, especially when one considers that a logarithmic scale has been used.

Copper

Copper, although a micronutrient, is toxic at low doses and has been known to cause brain damage in mammals and to change the species richness and composition of invertebrate communities (DWAF 1996; Dallas & Day 2006). The DWAF guidelines recommend that values of copper levels should be below the chronic effect level if ecosystems are to remain healthy. The toxicity of copper increases with a decrease in water hardness and dissolved oxygen and when combined with other metals, while it decreases with higher alkalinity and chelating agents (DWAF 1996). Applicable anthropogenic sources of copper include mining and industrial activities (DWAF 1996).

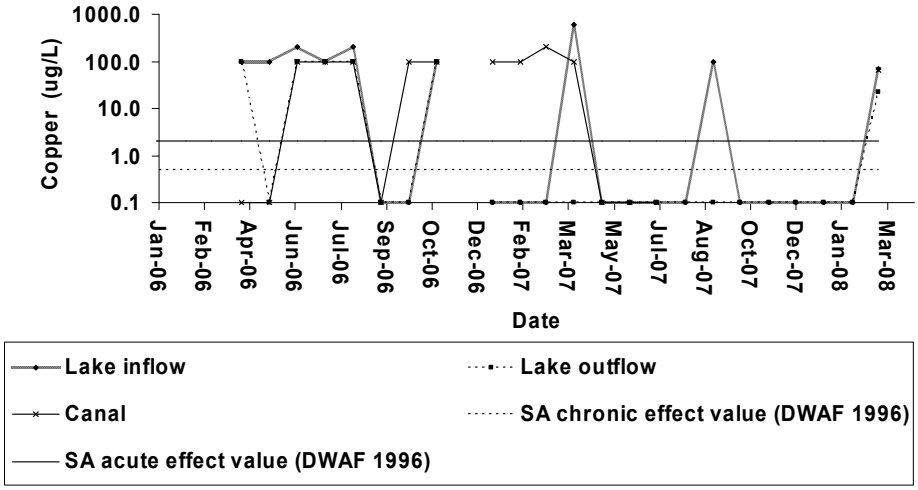


Figure 3.9: Copper concentrations at the Boksburg Lake inlet, outlet, and canal feeding the lake (January 2006 – March 2008). The SA chronic and acute effect values are plotted; gaps in the graphs indicate missing values (Gordon 2008).

Water samples were analysed for copper between January 2006 and March 2008, as shown in figure 3.9. The levels of copper fluctuated dramatically throughout this period, varying from 0 to over 100ug/L, which is almost 100 times the SA acute effect value. This could point to the temporal discharge of copper into the environment from a variety of point sources.

Figure 3.10 indicates that the canal is the largest contributor of copper, with levels exceeding the SA acute effect value over 60% of the time. The lake inflow is also an important contributor, with levels exceeding the SA acute effect value about 40% of the time. What is of note is the extent to which these levels are exceeded, varying between 100 to 200 times the acute effect value. For 26% of the time the lake inflow exceeds the SA acute effect value, meaning that 14% of copper levels are remaining in the lake. Boksburg Lake, therefore acts as a sink for copper, which will be accumulating in the sludge. These values indicate that copper constitutes a noteworthy risk to the Boksburg Lake aquatic ecosystem.

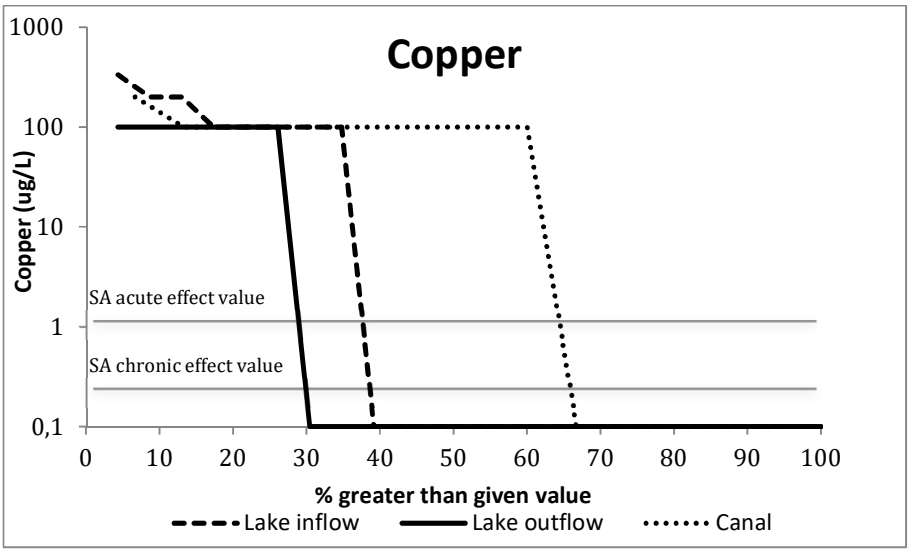


Figure 3.10: Percentage exceedance of copper concentrations in the lake inflow, lake outflow and canal (January 2006 to March 2008). Data sourced from Ekurhuleni Metropolitan Municipality.

Nickel

Nickel is toxic even in small quantities where it damages the lungs of mammals, can lead to mortality of amphibians, fish and insects and has carcinogenic effects (Davies & Day 1998; Dallas & Day 2004). It is five times as toxic when combined with zinc due to synergistic effects (Dallas & Day 2004). Industrial wastewater can be a source of nickel.

Water samples were analysed for nickel concentrations during 2006 (figure 3.11). During this year nickel concentrations exceeded the SA acute effect value by 5x or more on a regular basis. Figure 3.12 indicates that the lake inflow is an important source of nickel which exceeds the SA acute effect value 100% of the time. For 22% of the time it exceeds the SA acute effect value 10 times. From this one can infer that the Boksburg Lake catchment as a whole is a significant source of nickel. Nickel from the canal also poses a risk, with levels exceeding the SA acute effect value 55% of the time, leveling off at 100 ug/l, which is five times the SA acute effect value. Interestingly the lake outflow has high levels of nickel that exceed both the lake inflow and canal, being at 200 mg/l 44% of the time (20% more often than the lake inflow). When one considers that only a year of data was sampled, this could indicate that the concentrations of nickel in the lake inflow and canal were higher in the previous year. These values point to nickel constituting a notable risk to the Boksburg Lake aquatic ecosystem. This is especially so when one considers the high levels of zinc in Boksburg Lake, as discussed below, and its synergistic toxic effects with nickel.

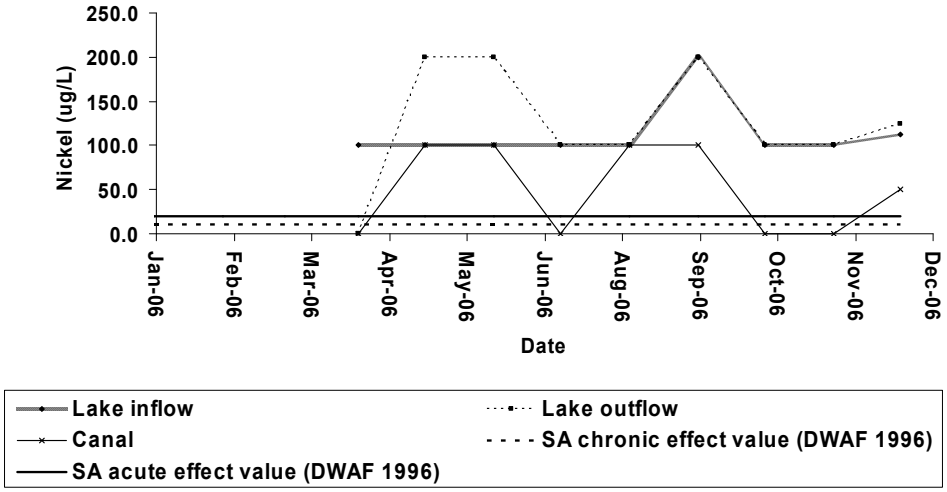


Figure 3.11: Nickel concentrations at the Boksburg Lake inlet, outlet, and canal feeding the lake (January 2006 – December 2006). The SA chronic and acute effect values are plotted; gaps in the graphs indicate missing values (Gordon 2008).

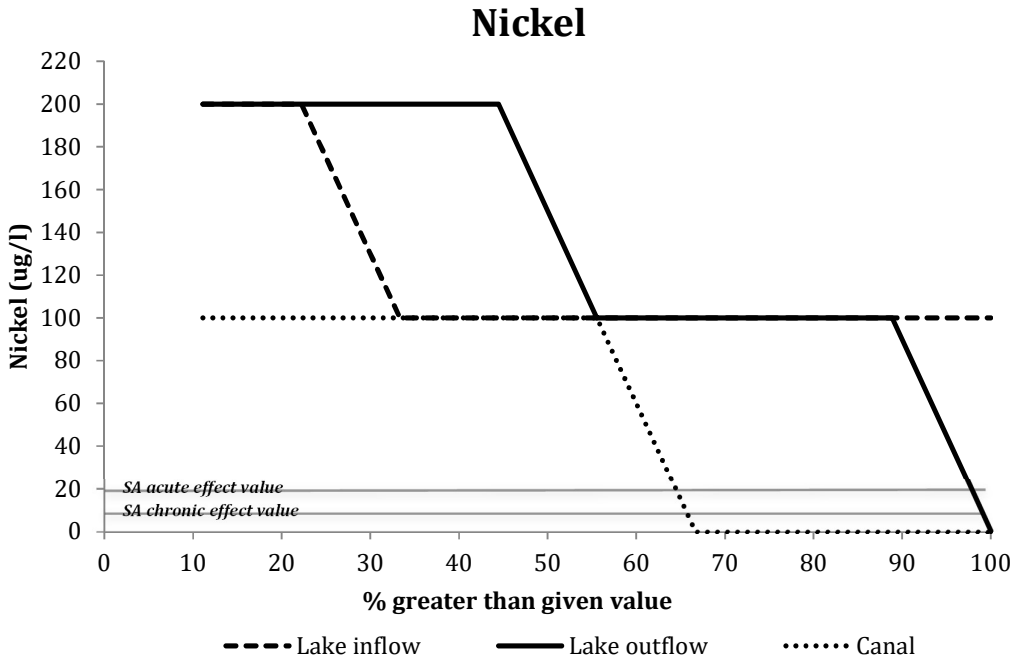


Figure 3.12: Percentage exceedance of nickel concentrations in the lake inflow, lake outflow and canal (January 2006 to December 2006). Data sourced from Ekurhuleni Metropolitan Municipality.

Zinc

Zinc is an essential micronutrient (Dallas & Day 2004). It occurs in two oxidation states, namely in metal form and as zinc(II). In the zinc(II) form, it is toxic to fish and other aquatic organisms at relatively low concentrations, leading to death or reduced fitness (DWAF 2006). Zinc toxicity increases in the presence of copper, in soft waters

and low dissolved oxygen concentrations (Dallas & Day 2004; DWAF 2006). Both natural (weathering and erosion) and human (industrial activity) processes can cause zinc to enter aquatic ecosystems (DWAF 2006).

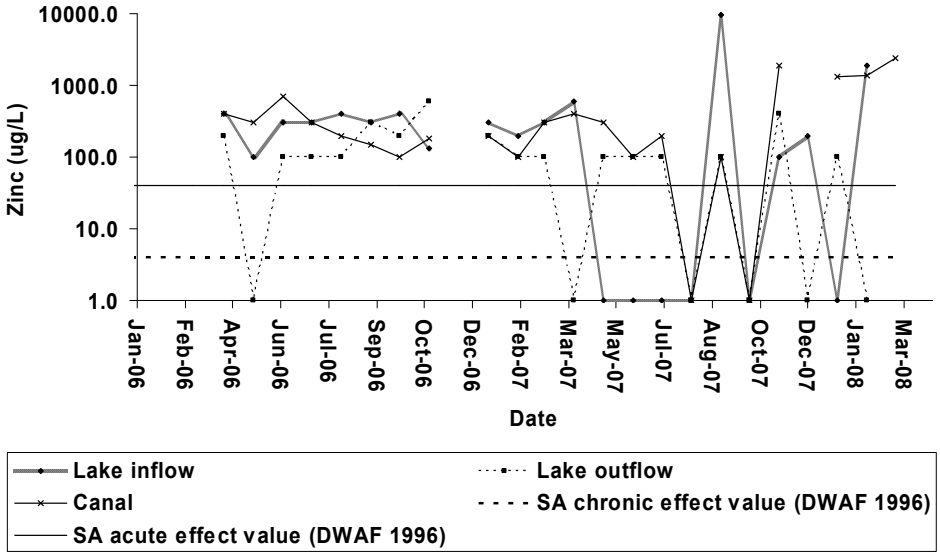


Figure 3.13: Zinc concentrations at the Boksburg Lake inlet, outlet, and canal feeding the lake (January 2006 – March 2008). The SA chronic and acute effect values are plotted; gaps in the graphs indicate missing values (Gordon 2008).

Water samples were analysed for zinc from January 2006 to March 2008, as shown in figure 3.13. Throughout the two years zinc regularly exceeded the SA acute effect value of 40 ug/L, for the canal, inflow and outflow with a possible increasing temporal trend.

Figure 3.14 indicates that the canal is the largest source of zinc and can be attributed to the industrial effluents discharged into the canal. For over 92% of the time zinc levels in the canal exceeded the SA acute effect value while for 30% of the time this was over 1 000 times. For about 7% of the time levels reach 5 000 ug/L in both the canal and lake inflow. The lake inflow is also a notable source of zinc. It exceeds the SA acute value over 70% of the time and exceeds it by 1 000 times for about 20%. The lake outflow is consistently lower than both the lake inflow and canal pointing to the accumulation of zinc in Boksburg Lake. These values indicate that zinc is another heavy metal that poses a risk to the health of the Boksburg Lake aquatic ecosystem and will have synergistic effects through its combination with the high levels of copper in Boksburg Lake.

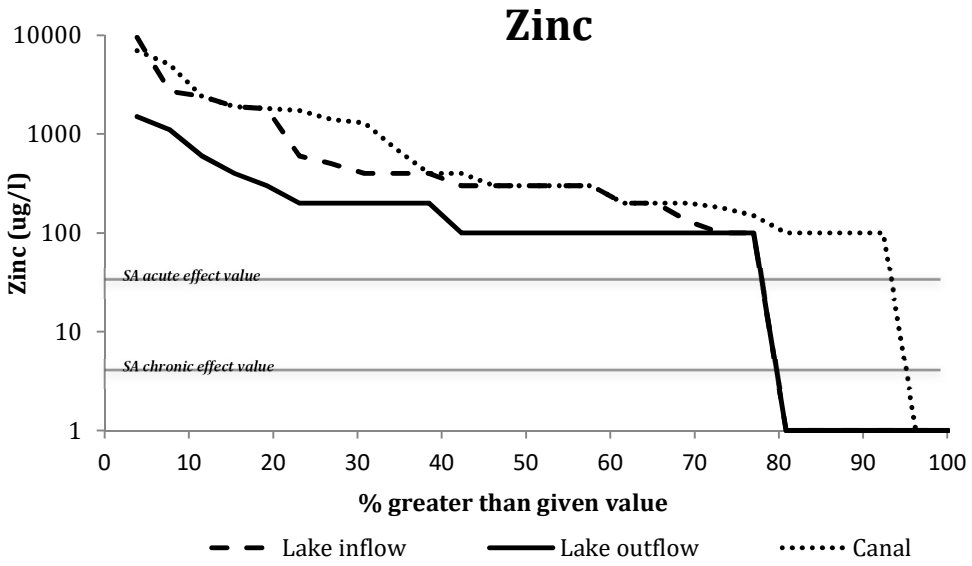


Figure 3.14: Percentage exceedance of zinc concentrations in the lake inflow, lake outflow and canal (January 2006 to March 2008). Data sourced from Ekurhuleni Metropolitan Municipality.

Aluminium

Aluminium is not an essential nutrient for any organism and is considered to be one of the more toxic trace metals with deleterious effects on a wide variety of organisms (Dallas & Day 2004; DWAF 1996). It becomes particularly toxic under acidic conditions where the unavailable and non-soluble aluminium ion is converted to the bioavailable and extremely toxic aquo-Al 3+ ion (Davies & Day 1998). Coal mining and industrial activities are sources of aluminium.

Water samples were analysed for aluminium concentrations samples between January 2005 and December 2006, as shown in figure 3.15. Over these two years the concentration of aluminum was generally below the unacceptable level with a few periodic spikes.

Figure 3.16 indicates that the canal is the main source of aluminium and it can be inferred that industrial effluent is an important contributing factor. Aluminum concentrations exceed the unacceptable level 15% of the time at the canal. However, when considering the SA acute effect value this increases to 50%. It peaks at 1.4mg/L for more than 10% of the time, which is more than double the unacceptable level. The lake inflow barely exceeds the unacceptable levels 10% of the time, which increases to 30% when the SA acute effect value is considered. This analysis indicates that aluminum sometimes poses a risk to the Boksburg Lake aquatic ecosystem, which

could increase through acid mine drainage (a potential future threat in the area) and industrial activity, a likely source of aluminium.

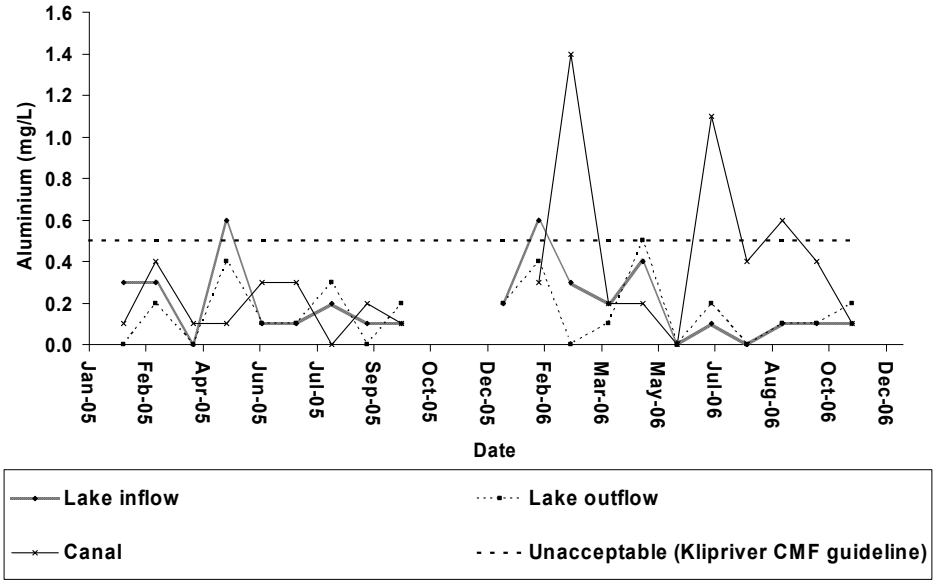


Figure 3.15: Aluminium concentrations at the Boksburg Lake inlet, outlet, and canal feeding the lake (January 2005 – December 2006). The unacceptable range based on the Klipriver catchment management forum (CMF) guidelines is plotted; gaps in the graphs indicate missing values (Gordon 2008).

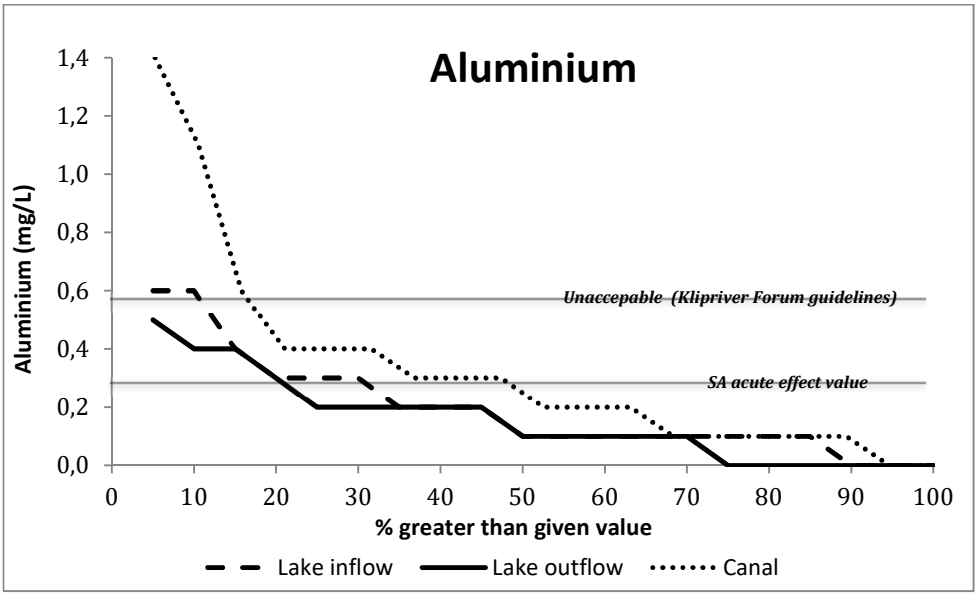


Figure 3.16: Percentage exceedance of aluminium concentrations in the lake inflow, lake outflow and canal (January 2005 to December 2006). Data sourced from Ekurhuleni Metropolitan Municipality.

Iron

Iron is an essential micronutrient for all organisms but can become toxic at high concentrations (above 1 mg/L as derived by the USA Environmental Protection Agency) (Gordon 2006) where it inhibits enzymes and is easily oxidised so can result in reduced oxygen levels (Dallas & Day 2004). However, this toxicity is limited because it is not easily absorbed though the gastro-intestinal tract of vertebrates and it has been classified as a non-critical element (DWAF 1996; Dallas & Day 2004). Iron naturally occurs in water bodies due to the weathering of rocks (DWAF 2006). Anthropocentric sources of iron include coal, gold and uranium mines, acid mine drainage, sewage and mineral processing (DWAF 1996).

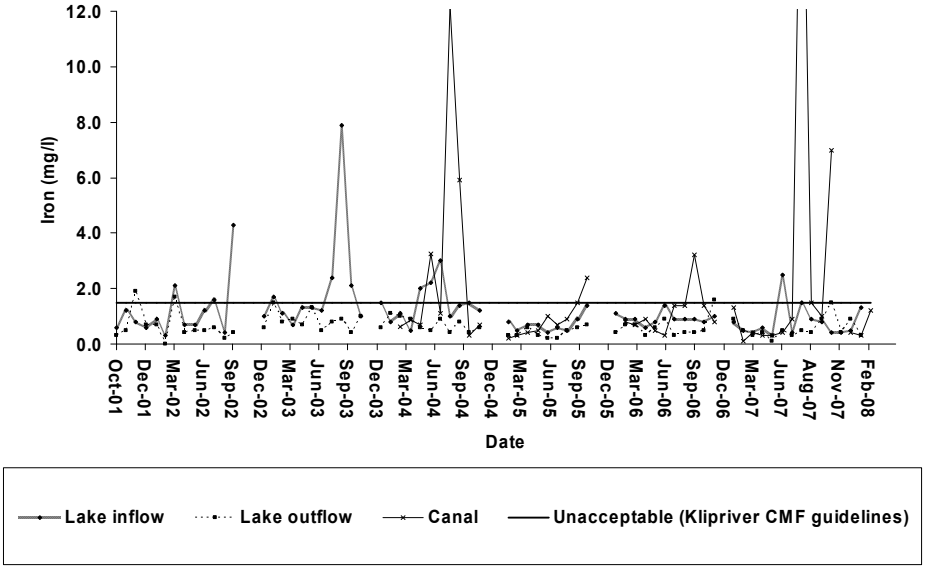


Figure 3.17: Iron concentrations at the Boksburg Lake inlet, outlet, and canal feeding the lake (October 2001 – February 2008). The unacceptable range based on the Klipriver catchment management forum (CMF) guidelines is plotted; gaps in the graphs indicate missing values in Boksburg Lake (Gordon 2008).

Water samples were analysed for iron from October 2001 to February 2008, as shown in figure 3.17. Iron concentrations were generally below the unacceptable level, but with a few sporadic periods of elevated levels. In some cases these exceeded the unacceptable level by four times or more. Figure 3.18 indicates that the canal is the main source of iron, pointing to the impact of local industries. It exceeded the unacceptable level 15% of the time and peaked at 22mg/L. This compares to the lake inflow, which exceeded the unacceptable level 10% of the time with a high of 8 mg/L. The lake outflow never exceeded the unacceptable levels, indicating that iron was either absorbed by plants and/or was deposited in the lake sludge.

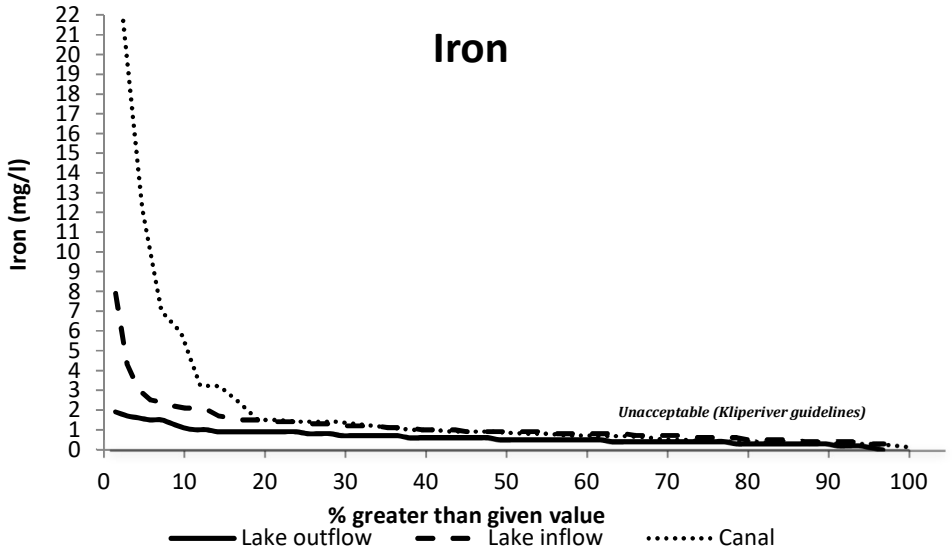


Figure 3.18: Percentage exceedance of nickel concentrations in the lake inflow, lake outflow and canal (October 2001 to February 2008). Data sourced from Ekurhuleni Metropolitan Municipality.

In summary, the six most critical water quality variables impacting the ecological integrity of Boksburg Lake are faecal coliforms, COD, copper, zinc, nickel and aluminium. Iron also exceeded unacceptable levels but at relatively low levels and it is also classed as a non-critical element. A slight trend was the increase in the level of these variables over time. Davies and Day (1998) have pointed out the negative impact on aquatic ecosystems of trace metal contamination that leads to a reduction of biological species richness and diversity, and change in species composition to those more tolerant of such contamination. Recognised sources of these water quality variables indicate that industrial and mining activities, as well as sewage leaks, are significant pollution sources of Boksburg Lake. Surface runoff in urban areas is also known to carry many of these pollutants (Dallas & Day 2004). The fact that the main source of each water quality variable varied between the canal and the lake inflow demonstrates that both industrial discharges as well as general catchment activities are sources of pollutants. Apart from nickel, there were consistently lower values at the lake outflow indicating that Boksburg Lake is acting as a sink for a variety of heavy metals and faecal coliforms.

The next section describes the initial intervention that aimed to improve the situation at Boksburg Lake.

3.3 Boksburg Lake and Wetland Project

Unilever South Africa has two factories in Boksburg and a vested interest in the health of Boksburg Lake. In 2005, they provided seed funding through the Unilever Centre for Environmental Water Quality (UCEWQ), Rhodes University, to lead a community-driven project to help improve Boksburg Lake. This was in collaboration with Ekurhuleni municipal staff, local residents, local industry, water quality scientists and other stakeholders. It was called the Boksburg Lake and Wetland project and aimed to restore the lake to its former beauty, recreational value and ecological function, thus reclaiming it as a valuable community asset (Gordon 2008). An Integrated Water Quality Management Plan (IWQMP) was developed that identified problems affecting Boksburg Lake and its connected wetland as well as suggesting solutions (Gordon 2006) and was submitted to Unilever SA as an unpublished report. This IWQMP structured the Boksburg Lake and Wetland project and guided the municipality in its implementation plans (see Table 3.1).

Objectives for the Boksburg Lake and Wetland project, as recorded in the 2008 annual report (Gordon 2008), were to:

- Assist EMM with their rehabilitation actions.
- Seek funding for lake rehabilitation actions not undertaken by EMM.
- Collaborate with EMM, Working for Wetlands, Provincial Government and interested stakeholders in the nearby wetland's rehabilitation.
- Undertake regular water quality tests and biological monitoring to build up baseline information for Boksburg Lake and the nearby wetland.
- Encourage scholars' involvement in the project through Delta Environmental, an environmental education, training and consultation network.

The project had been reasonably successful and the municipality began showing signs of buy-in to improve Boksburg Lake; in 2007 the project was listed as an EMM Mayoral project and some of the recommended solutions were implemented to varying degrees, as table 3.1 indicates.

Table 3.1: Rehabilitation actions for Boksburg Lake adopted by Ekurhuleni Metropolitan Municipality (Gordon 2008)

Purpose	Action	Budget allocated	Progress
Safety	Security patrols	R52 000	2 guards patrolling the lake
Safety	Install lighting around lake margins	R382 000	Completed
Water quality	Improve aeration by making cascades functional	R400 000	Completed
Water quality	Improve aeration through installation of aerators	R76 000	Completed
Aesthetics	Litter removal	R63 000	Being undertaken
Improve lake grounds	Fence children's play area and repair facilities	R250 000	In progress
Water quality and aesthetics	Environmental Impact Assessment for litter and sediment traps at inputs to Boksburg Lake	R200 000	Being undertaken

In spite of these successes there was a lack of groundswell support from local people. Unilever consequently funded the development and management (again through the UCEWQ) of an environmental education initiative, over a five-year period. The purpose, approach and design of this initiative, which became known as the Schools for a Sustainable Environment initiative (SSE), are discussed in section 3.5. First, a brief overview of South Africa's educational context is provided.

3.4 South Africa's educational context

South Africa's national curriculum has had four recent historical phases: the pre-1994 Apartheid curriculum, the 1997 Curriculum, the 2002 RNCS (Revised National Curriculum Statements) and the 2012 CAPS (Curriculum Assessment Policy Statements) (Schudel 2012). The pre- and post-1994 curricula had different agendas. The Apartheid curriculum was partly designed to perpetuate unequal racial relations by "prepar[ing] different groups for dominant and subordinate positions in social, political and economic life" (Harley & Wedekind 2004: 195), while the new curriculum mission aims "to unite all citizens as equals in a democratic and prosperous South Africa" (Harley & Wedekind 2004: 195). In spite of this ideological change, the Apartheid curriculum continues to have effect in schools negatively impacted by the Apartheid system (Schudel 2012), where for example, classrooms are still ill equipped and over-populated and many of the learners come from impoverished backgrounds (Nelson Mandela Foundation 2005). Parents, if the household is not child-headed, often lack the necessary reading, writing and conceptual skills to assist learners with homework. The learners therefore do not grow up in a supportive educational culture. A number of schools that participated in the SSE initiative come from this context. Tackling the

problems of Boksburg Lake from an educational position thus presents many challenges, including the structural, intellectual and economic inequalities that continued to persist after Apartheid.

There were also opportunities presented in the South African educational context. The RNCS curriculum was in operation at the time (2004-2011). It was based on outcomes-based education principles, which supported flexibility and learning within a local context (Department of Education 2002). The design of the SSE initiative, based on the active learning framework, (O'Donoghue 2001), as explained in section 3.6.2, was well suited to such a curriculum. The new CAPS curriculum no longer includes outcomes-based principles, which reduces flexibility and the ability of teachers to adapt the curriculum to local context and outside interventions. The adaptability of the SSE initiative to the CAPS curriculum is therefore reduced.

With the educational context provided, the chapter moves on to discuss in detail the SSE environmental education initiative.

3.5 Schools for a Sustainable Environment Initiative

3.5.1 Introduction

The initial contextual profile revealed a complex mix of economic, political, social and biophysical causes of the Boksburg Lake social-ecological degradation and identified a wide variety of stakeholders. This profile indicated the significant challenge of adequately addressing the problems at Boksburg Lake. It would require the emergence of champions within and collective action and partnerships between schools, media, faith communities, municipality, non government organisations and the business sector. It would also need a change in local practices such as littering, and deeper systemic and ideological changes to effect more fundamental transformation.

The constraints of time, capacity and resources limited the scope of intervention to between ten and fourteen local schools each year but with plans to extend over time. The initiative became known as Schools for a Sustainable Environment (SSE) and had two main aims:

1. Inspire Boksburg's youth to have a high value of, care for and connection with the natural environment.
2. Generate a groundswell of support and action around the improvement of Boksburg Lake.

These two aims were to be achieved through developing a school-based educational initiative for local schools with plans to extend to other role players, such as local churches. The initiative was designed for youth to impact the broader community by providing systemic knowledge of the Boksburg Lake social-ecological complexities and creating opportunities to become agents for change.

3.5.2 Approach

Two main approaches guided the development of the SSE initiative namely Integrated Water Resources Management (IWRM) and the Handprint Series, underpinned by the active learning framework.

Integrated Water Resources Management

Integrated Water Resource Management (IWRM) has been defined as a philosophy, process and implementation approach promoting the coordinated, efficient and integrated management of water, land and related resources for equitable economic and social benefits without compromising the sustainability of important ecosystems (Rogers & Luton 2011). It is participatory, decentralised and trans-disciplinary management that values multi-stakeholder collaboration and decision-making and appreciates the systemic nature of water management issues that are impacted by multiple practices (Rogers & Luton 2011). All stakeholders are thus regarded as having a responsibility in maintaining the integrity of the water resources (Pollard & du Toit 2005; Haigh, Fox & Davies-Coleman 2010).

IWRM is supported in South Africa's National Water Act (NWA) and Catchment Management Agencies (CMA) are seen as the implementing bodies at the catchment level (Pollard & du Toit 2005; Rogers & Luton 2011). In spite of its positive ideals and principles, the implementation of IWRM in South Africa has had limited success. This is partly due to the lack of progress in developing CMAs, the lack of institutional capacity and the dramatic escalation of service delivery needs that place a large financial and capacity burden on local municipalities (Siddle & Koelble 2012).

IWRM principles of stakeholder collaboration, participation and responsibility for water resource health as well as the systemic nature of water resources informed the design of the SSE initiative, which was developed through a community/ municipal driven partnership and aimed to foster a local culture of responsible water stewardship practices. A resource pack on urban water catchments, specifically tailored to the Boksburg Lake social-ecological system (appendix A), provided the initial structure to the SSE initiative. Its purpose was to represent the Boksburg Lake's social-ecological

system and degradation, alert users to linking action to consequence (increase a sense of responsibility) and facilitate agency for meaningful sustainable action.

The content of the resource pack reflected the integrated and systemic nature of water resources with the intention that learners gain a better grasp of the system as a whole and the connections within it. The initial contextual profile provided an understanding of aspects of the system dynamics influencing Boksburg Lake. This formed the basis of the draft content of the resource pack on urban water catchments, focusing on Boksburg Lake.

Stakeholder collaboration underpinned the development and continual refinement of the initiative and content of the resource pack. On 5 February 2009, a workshop was held with teachers and representatives from the Boksburg Historical Association and Rand Water. The aim was to establish networks, receive input into the general initiative and content of the resource pack, encourage a sense of local responsibility to see Boksburg Lake reclaimed, and facilitate community understanding and ownership of the initiative. Useful local and expert input was given and it was an important step in stakeholders beginning to own the initiative. Another stakeholder meeting was held on 9 February to present the initiative to local stakeholders, provide a platform for a municipal representative to share Ekurhuleni's intentions and discuss the way forward. A wider range of role players was invited and there was good attendance, including eight teachers, three Ekurhuleni representatives, two environmental representatives, two WESSA representatives, a representative from GDACE, a local activist, a columnist for the Advertiser and a businessman.

In addition, an evaluation and reporting process was conducted from 2009 and 2012, with learners, teachers and role players who participated in the Boksburg Lake Day (particularly Unilever, EMM, WESSA and Rand Water), to continually improve the initiative and provide feedback to these role players.

The Handprint series

The design of the resource pack was adapted from the Handprint: Action Towards Sustainability Series developed by O' Donoghue and Fox (2009). The Handprint series consisted of a suite of resource books designed to inspire sustainability practices. The series was informed by three core concepts: the active learning framework, the ecological handprint and the power of stories to provide "authentic cases of environmental learning and change" (O' Donoghue and Fox 2009: 1). These three core concepts will be discussed in turn.

Active learning has been described as:

> learning by doing, discovery learning, hands-on experiential learning … the learner becomes socially, culturally, and cognitively involved in a reflexive learning process [and] … is encouraged to investigate the world, find out about it with others, and engage in collaborative reflections and change-oriented actions. (United Nations Environment Programme 2006: 28)

O'Donoghue (2001) developed the active learning framework to deepen active learning theory. It synthesised approaches in environmental education that had developed from having a purely information-sharing and experience emphasis to include more participatory, hands-on, enquiry-based and practice-centered learning opportunities around local environmental concerns (O' Donoghue & Lotz-Sisitka 2006; O'Donoghue 2007). The active learning framework is flexible so that environmental learning can be structured around a local environmental issue (Schudel 2012). It includes informative, investigative, action and reflection aspects and promotes situated and action-orientated environmental education.

Environmental education's primary focus has been on human beings' negative environmental impact, which can be measured by the ecological footprint. Consequently there has been a need to provide learners with opportunities to engage in positive action rather than confront them only with negativity (O'Donoghue pers.com 2008). The ecological handprint logo, depicted in figure 3.19, is a symbol for positive action (O'Donoghue & Fox 2009) and emphasises that humans can adopt practices with positive effects on social-ecological systems.

Figure 3.19: Handprint series logo

Authentic stories are a meaningful way to share locally relevant knowledge that learners can identity with. This was the rationale for developing inspirational stories of sustainability practices that the reader could identify with. Connelly and Clandinin (1990: 2) have expressed the value of this approach: "Humans are storytelling organisms, who individually and socially, lead storied lives".

Figure 3.20 represents a revised version of the active learning framework underpinning the Handprint series. This framework structured the design of the resource pack on Urban Water Catchments, which included:

1. A **start-up authentic story** on a sustainability practice with linked, locally relevant **knowledge support materials** to facilitate deepened understanding of the

topic. These knowledge resources were developed to be used within the different learning areas in the RNCS curriculum.

2. Questions to guide discussion on local concerns and possibilities.
3. Investigative activities to **find out** about local issues and practices.
4. Ideas to **try out** sustainability practices.
5. **Deliberation** activities to reflect on the chosen sustainability practice in relation to risk-infused social-ecological systems.

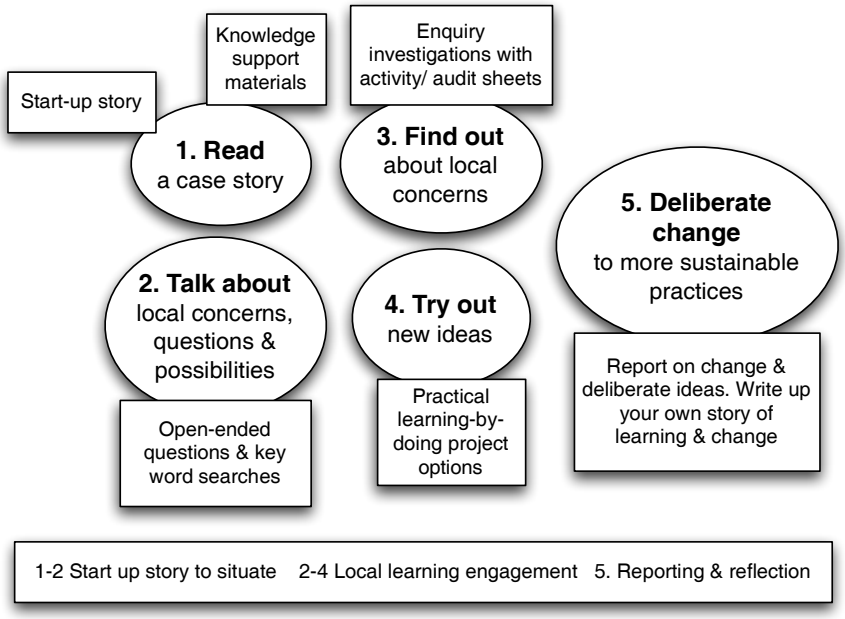


Figure 3.20: Revised active learning framework underpinning the Handprint series (developed by O' Donoghue 2009) that indicates the value of reading, talking about, finding out, trying out and deliberating change for effective learning

3.5.3 Design of the initiative

The final resource pack on urban water catchments was handed out to participating schools in April 2009, with a revised version in 2010 (appendix A). It consisted of the following:

- A story about environmental learning and action for Boksburg Lake that mirrored the possibilities of learning contained in the initiative and included themes on:
    - Urban water catchments and their characteristics;
    - The value of healthy rivers;
    - The lake's history;
    - Its value to local people;
    - The current problems of Boksburg Lake and their economic, social, political and biophysical causes;

    - Solutions;
    - Importance of being responsible citizens; and
    - Youth being positive agents of change.
- Knowledge resources that explained and expanded themes raised in the story and were linked to relevant learning areas of the RNCS curriculum. (See appendix B for a list of these knowledge resources.)
- Investigation activities, including auditing water sources, historical investigation and water quality testing.
- A Boksburg catchment activity to facilitate 1) a better comprehension of the Boksburg Lake sub-catchment, 2) the spatial relationships of the different factors influencing the lake, and 3) creative solutions that could inform a school action project. It consisted of an A1 map of the Boksburg Lake sub-catchment; photographs depicting different issues to be geographically located on the map; a model of Boksburg's sub-catchment made from a coke bottle; cards depicting the main factors (sewage leaks, industrial effluent, mine dumps, littering and wetland dumping) negatively impacting Boksburg Lake, to be inserted on this model of Boksburg's catchment; and knowledge resources to deepen understanding of the different issues and their possible solutions.
- Guidance for learners to engage in an action project and critically reflexive activities.

Another central event of the SSE initiative was the annual Boksburg Lake Day that complemented the resource pack in terms of design and aims. The concept behind this day grew collaboratively. The initial plan was to coordinate a range of investigative activities about Boksburg Lake that would be guided by the resource pack and led by teachers. The idea expanded to having a Boksburg Lake Week during which participating schools would take part in activities and media coverage would be organised. It was then envisaged to organise one high-impact, interactive day for all participating schools, hence the Boksburg Lake Day. The organisation and implementation was a considerable team effort involving much sponsorship, organisation and participation from Unilever, EMM, participating schools and NGOs such as WESSA, Randwater, the Boksburg Historical Association, Wildlands Trust, Green Office and the UCEWQ. The aims of the day were to: 1) increase applicable social-ecological systems knowledge, 2) encourage learners to become positive agents of change, and 3) generate public awareness and action to support the work the municipality was doing to rehabilitate the lake. Once a year, from 2009 till 2012, about 250 learners from the ten participating schools would spend a day at Boksburg Lake engaging in a variety of informative (e.g. Boksburg Lake's history), investigative (e.g.

water quality testing) and action (e.g. making banners, clean-ups, tree planting) activities. These were based on the structure of the active learning framework and were designed to equip learners with the systems knowledge and passion to make a positive difference to Boksburg Lake and their local community. On the day, learners would also give a presentation that reflected their passion for Boksburg Lake; hand out statements to the municipality expressing their commitment to see the lake restored; plant indigenous trees at the lake grounds and make banners that they waved during a march around the lake. During this march, they had the opportunity to pick up litter. The event would be given high profile by the attendance of, for example, Miss Earth South Africa (2009), municipal representatives and the media. Figure 3.21 provides a visual representation of the day's activities.

To sustain and broaden the impact of the Boksburg Lake Day an essay competition with participating learners on the problems and solutions for the lake was organised during 2009 and 2010; learners were encouraged to communicate their learning experience at school through, for example, a presentation (2009-2011); certificates of attendance were formally handed out to learners in 2010 and 2011, and participating schools were supported to become Eco-Schools (2010-2011). See text box 3.1 for a brief description of the Eco-Schools programme.

Box 3.1: A description of the Eco-Schools Programme

Eco-Schools is an international programme, led by the Foundation for Environmental Education, which works with schools to increase environmental sustainability, both through increasing an environmental focus within the curriculum as well as encouraging action. In South Africa, the Eco-Schools programme was initiated in 2003. WESSA is the implementing agent and there are now over 1 200 schools registered in the Eco-Schools programme (www.wessa.org.za). The South African programme is influenced by O'Donoghue's active learning framework (Schudel 2012) that encourages knowledge acquisition, investigation, action and deliberation. It is designed around five themes to be incorporated into lesson planning, namely nature and biodiversity, resource use, culture and heritage, healthy living, and local and global issues (Eco-Schools Programme South Africa, 2009).

From 2010 the initiative expanded to a broader community focus by including faith communities as additional local institutions for mobilising and effecting positive change. Faith communities were chosen as they represent a broad spectrum of society, including industry, business, and teachers; play an important role in encouraging values and morals (Hitzhusen 2007); and can potentially draw local people back to Boksburg Lake through, for example, Sunday picnics, jumble sales and special services such as Easter. I engaged with faith communities by holding informative

meetings with their leadership, handing out eco-theology knowledge resources to be used for sermon development and organising an Eco-Congregation workshop led by Kate Davies from the Southern African Faith Communities' Environment Institute (SAFCEI).

Figure 3.21: Visual representation of activities at the Boksburg Lake Days (2009 - 2012)

3.5.4 Plans unrealised

Numerous ideas, intentions and plans to strengthen the initiative's impact were not fulfilled. These are listed below, in chronological order, and will be referred to in the concluding chapter 8, that explores possibilities and avenues for change in Boksburg's social-ecological system.

- Use local media channels to promote an environmental citizenry. The local newspaper, the *Boksburg Advertiser*, was to play an important role and in 2008 they pledged their full co-operation. The newspaper would publically launch the initiative in late 2008; run historical features about Boksburg Lake; publish the involvement of Unilever South Africa and their commitment to the rehabilitation process; write articles on projects undertaken by participating schools; publish the winning essay from the essay competition; and once a month highlight any positive individual, business or industrial action for Boksburg Lake's reclamation.
- In partnership with WESSA, establish school environmental clubs and an environmental club forum including additional clubs such as boy scouts and girl guides.
- Establish a memorandum of agreement with EMM, linking the SSE initiative to their EYE (Ekurhuleni Youth for Environment) programme. The EYE programme's vision was to conserve, protect and care for the environment and encourage local communities to develop environmental pride and responsibility through environmental education and partnership formation (Pilani 2009 pers.com). This vision supported one of the primary aims of the SSE initiative, namely to inspire a high value, care for and connection with the natural environment amongst Boksburg's youth.
- Produce three/five of the most effective school action projects as Handprint booklets that would be distributed to participating schools to inspire and guide the adoption of various sustainability practices and action projects.
- Expand the use of the urban water catchment resource book to other catchments in the East Rand.
- Develop two additional resource packs (greening playgrounds and wetlands) similar in structure to the one on Boksburg's urban water catchment.
- Hold quarterly local community forum meetings that share information and best practice around Boksburg Lake's reclamation.
- Participating schools lead a community forum consisting of a dinner to which key role players (municipality, industries, businesses, rotary, *Boksburg Advertiser* and local churches) are invited. Schools present their environmental action projects and role players would have had the opportunity to adopt a local school and provide either resource support for their environmental projects or sponsor initiatives at the lake.

These unrealised plans focused on developing an environmental citizenry and community of practice, supporting social learning processes and strengthening school involvement in environment practices.

3.6 Conclusion

This chapter has provided the geographical, biophysical and educational context to my doctoral thesis. The following chapter discusses my methodological and analytical framework that was used to generate data to answer the primary question: What generative mechanisms constrain and enable the development of social-ecological resilience for well-being, in the modern social-ecological system of Boksburg Lake?

Chapter 4:
Methodological and analytical framework

4.1 Introduction

This chapter provides the methodological and analytical framework that underpinned this thesis and includes a broad description of the methodologies, methods and analytical process adopted. Figure 4.1 depicts this framework that also includes Critical Realism as my meta philosophy. In chapters 6 and 7, which represent data respectively on 1) generative mechanisms driving the degradation of the Boksburg Lake social-ecological system, and 2) transformative possibilities, a more detailed and specific description of the process of generating data is provided.

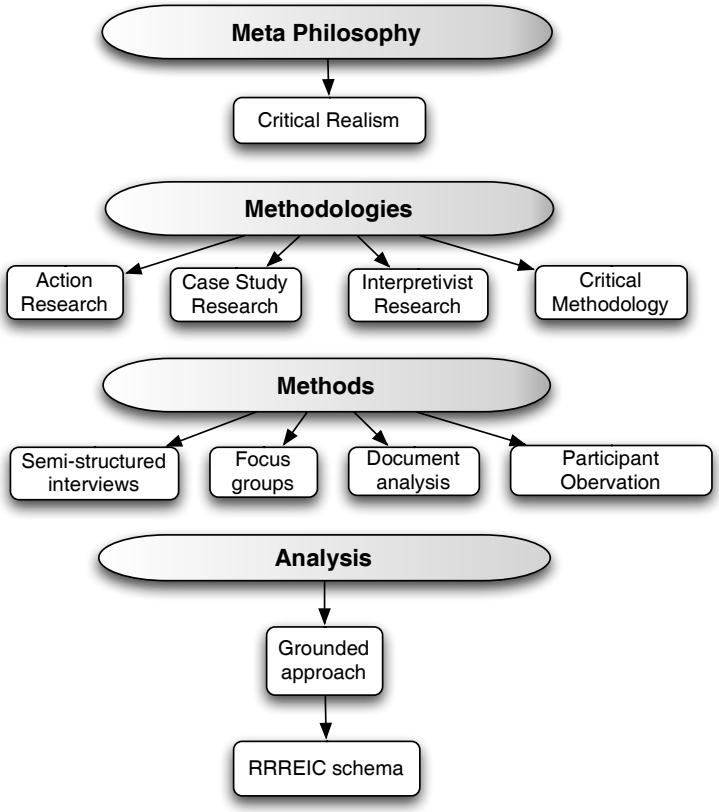


Figure 4.1: Philosophical, methodological and analytical framework. Critical Realism as the meta-philosophy allowed for a multiplicity of methodologies (action research, case study research, interpretivist research and critical methodology) and methods (semi-structured interviews, focus groups document analysis and participant observation). Meaningful data emerged through the grounded approach emerge, which was further analysed using the RRREIC (resolution, redescription, retrodiction, eliminate, identify, correct) schema to probe for generative mechanisms (Bhaskar 2010).

Critical Realism, as my overarching philosophical framework (described in chapter 2), provides space for a multiplicity of methodologies. This was well suited to my research approach, which was characterised by methodological pluralism (Norgaard 1989). From the onset I adopted various research roles, each of which encouraged different methodological approaches. I undertook an action research project on a particular case study, which was explored from both a critical and interpretivist perspective, as indicated in figure 4.2.

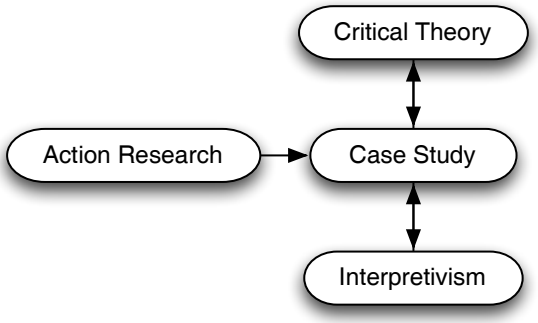


Figure 4.2: Relationships between different methodologies adopted. Action research was undertaken on the Boksburg Lake social-ecological system case study, which was examined using both interpretivist and critical methodologies.

Each of these four methodologies is now discussed in detail.

4.2 Methodologies

4.2.1 Action research

Action research is defined by Carr and Kemmis (1986: 162) as "a form of self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own practices, their understanding of these practices, and the situations in which the practices are carried out". It is research that participates in solving real world, locally relevant problems and aims at transformation through improved choices and action (McKernan 2008). The researcher, who takes up the position of an involved participant, adopts both action and research roles (Malone 2006). Importantly research is not done 'on' or 'for' people but rather 'with' people and addresses locally relevant issues, questions and concerns (Reason & Bradbury 2008). In many cases, local people are invited to become co-researchers in a process of collective inquiry (Reason & Bradbury 2007). It is thus a reflexive form of practice that aims at developing contextual knowledge and understanding to guide action and choices for positive transformation (McKernan 2008).

The action research methodology addresses some of the perceived weaknesses of traditional western science approaches, which include the elitist position of scientists, the extractive nature of research, the often inadequate sharing of accessible results with local people (Fals-Borda & Rahman 1991), the 'objective' representation of the world (McKernan 2008), and the detached and objective position adopted by the researcher, which can easily dehumanise people (Malone 2006).

From the outset of the research process, my responsibility was to initiate and manage an environmental education process that would contribute to transformation of the Boksburg Lake system for increased social-ecological resilience. I consequently adopted the role of a reflexive practitioner, as is customary in action research. My aim was to reflect on the environmental education initiative so that it could improve on an ongoing basis. Research was designed to understand the situation better and obtain feedback for improved practice. Rather than a detached research position, this was a particular role that I adopted within the community, of which I became a part. The action research process was a collaborative one, where I worked closely with local people to realise locally desired actions.

4.2.2 Case study research

Case study research is conducted in a real situation that is based on an entity of interest, be it an educational activity, an institution, child, community or social-ecological system (Bassey 1999). According to Cohen *et al.* (2000: 181) "contexts are unique and dynamic, hence case studies investigate and report the complex dynamic and unfolding interactions of events, human relationships and other factors in a unique instance". Their value is that the research issue is studied in its complex, embedded and real-life context (Gillham 2000).

A case study is of a bounded system with designated localised spatial and temporal boundaries (Bassey 1999). There were two temporal aspects to the Boksburg Lake case study. Firstly, the time frame of the environmental education intervention provided a bounded unit where an interpretivist methodology (see section 4.2.3) was used to explore local people's experiences of this attempted change process. Secondly, an historical vantage point was adopted, where a content analysis of the local newspaper archives was undertaken to identify generative mechanisms causing the unsustainability of the Boksburg Lake social-ecological system.

There are different kinds of case study approaches, depending on the underlying philosophical framework and the purpose of research (Schudel 2012). A case study may be for evaluative purposes (Bassey 1999); for improvement of action within the case, i.e. action research case studies (Stenhouse 1979); for testing or developing a theory (Sake 1998; Bassey 1999); or for providing rich descriptions of a particular context (Bassey 1999). It may also be of a collective nature where one works across a number of cases to make generalisations (Stake 1998; Stark & Torrance 2005) or nested, where a number of smaller cases are situated within a bigger case (Lotz-Sisitka & Raven 2004).

The Boksburg Lake case study was conducted for three main reasons, namely 1) evaluation of the environmental education strategy; 2) improving action to transform the Boksburg Lake system; and 3) developing theory on social-ecological systems.

The Boksburg Lake case study examined specific and detailed empirical outcomes that emerged through the environmental education process. However, the aim was to then identify the underlying generative mechanisms, and to provide insights on generative mechanisms operating in more generalised modern social-ecological systems. The identification of these generative mechanisms can further develop applicable theory and thus supported my third main reason for conducting case study research. Price (2007) has argued for the more generalised applicability of findings from case study research by drawing on the metaphor of a hologram. In a hologram, each part is a reflection of the whole (Bohm 1985). Price (2007: 100) stated that this

> metaphor could significantly imply that no matter how small the piece of the world we analyse, it contains the image of the whole, although as the pieces get smaller, the picture gets hazier. This is not the same as saying that what one finds out in a small case study is easily and directly applicable to other situations, but rather that the case in point could only be as it is because of the whole, and therefore it is also a reflection of the whole … this means that instead of seeing my research as limited to its specific context, it can, through its integral process of explanation, offer insights into a broader world.

4.2.3 Interpretivist methodology

An interpretivist methodology was adopted in exploring the case study of the Boksburg Lake social-ecological system. According to Neuman (2003: 76) it allows for the systematic exploration "of socially meaningful action through the direct detailed observation of people in natural settings in order to arrive at understandings and interpretations of how people create and maintain their social worlds". An important

aspect of an interpretivist methodology is that is an in-depth exploration of individual and social situations and searches for the meanings that people create (Bhaskar 1998; Carter & New 2004; Davies 2007). The focus is on description rather than explanation, and the aim is to understand participants' reality, their personal feelings and experience "through an empathetic identification with the other, a grasping of their subjective experience" (Connole 1998: 13). Data collection is therefore not for measurement "for meanings cannot be measured, only understood" (Bhaskar 1998: 46), but rather for understanding. Understanding the context, making connections and seeing relationships are important (Neuman 2003; Madsen & Adriansen 2004). Qualitative methods are generally used to collect data, often in the form of words, pictures, objects and direct quotations (Madsen & Adriansen 2004). These methods are better suited to obtaining detailed descriptions of situations, people and places (Patton 1980; Ervin 2000; Neuman 2003), and the meanings people attach to their world (Sullivan & Brockington 2004).

The interpretivist methodology creates a space of engagement as the researcher is encouraged to listen, observe, discuss and learn from the people within the research case study (Assmo 1999; Neuman 2003). The researcher can thus be described as a well-informed outsider in a position to gain a fuller understanding of the social reality of participants and the cultural meanings they create (Berg 1998; Assmo 1999; Neuman 2003). The research process is more cyclical than linear, and the means of data analysis is rarely known at the beginning of the research process (Neuman 2003).

In the Boksburg Lake case study, data was collected to understand local people's subjective experience of the Boksburg Lake social-ecological system and the process of attempting to transform it through the SSE initiative and the meanings they attached to it.

4.2.4 Critical methodology

A methodology rooted in critical theory was used to explore the case study of the Boksburg Lake social-ecological system. Critical theory argues that global society is built on social structures that privilege a few to the detriment of the majority (Malone 2006). The aim is to use research as social critique to "disrupt and challenge the status quo" (Kincheloe & McLaren 2008: 260) and address social injustice (Horkheimer 1972). Critical research does not shy away from a political agenda and is "unafraid to consummate a relationship with an emancipatory consciousness" (Kincheloe & McLaren 2008: 264). Knowledge becomes emancipatory when it exposes distortions in

human actions and structures (Connole 1998) and "the contradictions of [a] world of appearances accepted by the dominant culture as natural and inviolable" (Kincheloe & McLaren 2008: 265).

Critical methodology has clear links to Critical Realism, because of its emphasis on understanding underlying oppressive factors and "ideological binds" (Malone 2006). My research, based on a concrete case study, aimed to bring to the surface the structures and mechanisms that were supporting the degradation of the Boksburg Lake social-ecological system and explore possibilities for transformation. This formed the basis of a critique of more generalised western social-ecological relations, which has clear links to a critical methodology.

4.3 Data collection methods

A range of data collection methods were adopted to provide different vantage points for understanding the complexity of the Boksburg Lake social-ecological system. Gillham (2000) has called this a multi-method approach. Methods included semi-structured interviews, focus groups, participant observation and document analysis. These are the classic methods available to researchers examining complex social realities because they enable one to probe and gain understanding of people's meanings and experience. See appendix C for the raw data collected using these methods.

The methods adopted were selected to align with the different methodologies. Figure 4.3 depicts the relationships between the methodologies and their associated methods.

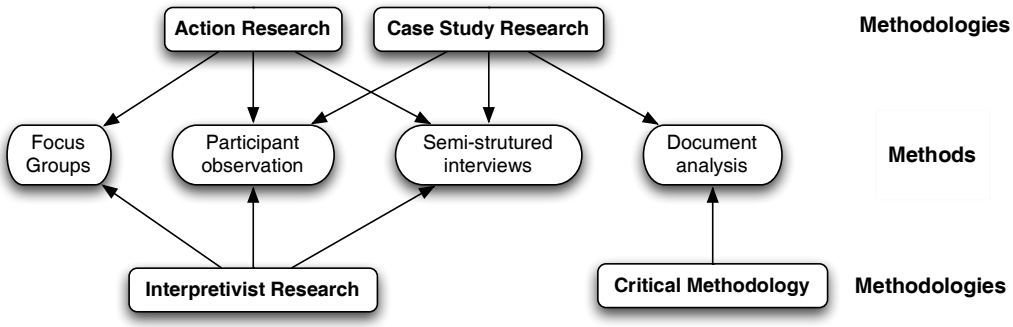


Figure 4.3: Adopted methodologies and their associated methods. Action research and interpretivist research were both undertaken through focus groups, semi-structured interviews and participant observation; case study research was undertaken through semi-structured interviews, participant observation and document analysis; and critical methodology was undertaken through document analysis.

4.3.1 Participant observation

Three main types of participant observation have been identified (Atkinson & Hammersley 1998). These are: complete participation, where the researcher's role as observer is hidden; participant-as-observer, where the researcher adopts one or two roles in the social setting being observed and actively participates in social activities; and complete observer, where the researcher observes the situation without any contact with the researched.

My means of observation was participant-as-observer, which was a natural outcome of undertaking action research in the Boksburg community. I adopted the role of a researcher and practitioner of the environmental education initiative and participated in a variety of social activities. This included staying with the chairperson of the Boksburg Historical Association, regular attendance at the monthly Boksburg Lake Forum meetings, active participation in the annual Boksburg Lake Day, observation of three lessons at Witdeep Primary when the resource pack, designed as part of the initiative, was being used, and attendance of church services. Through the relationships established with local people I was able to experience and record meaningful events that occurred, as advised by Lindlof (1995). Throughout the process, a field journal was kept, and photographs and video recordings were taken.

4.3.2 Semi-structured interviews

Interviews are indispensible in case study research (Gillham 2000) and provide a space to deepen understanding of the social subject's perspective and experience on a matter (Lindlof 1995). Three interview categories have been identified, namely the structured interview, the informal interview and the semi-structured interview (Berg 1998). The semi-structured approach is most commonly used in case study research (Gillham 2000) and was the main interview method adopted in this study.

Themes were prepared in advance, but each informant was not necessarily asked the same set of questions in a particular order as questions were adapted to suit each respondent and varied according to how the interview was progressing. Most of the interviews were recorded on a tape recorder and a word-for-word transcription of each interview was produced as soon after the interview as possible. This proved helpful in the transcription process as it was easier to decipher muffled words from memory recall.

In total, thirty-eight semi-structured interviews were conducted, typically lasting between forty minutes to an hour, to gain a better understanding of local people's experience of the Boksburg Lake social-ecological system, and the SSE initiative, from various vantage points. Interviews included twenty-two interviews with participating teachers between 2009 and 2013; two interviews with role players involved in the initiative in 2009; eight interviews with local faith leaders in 2010; two interviews with participants of an Eco-Congregation workshop in 2010; three interviews with Boksburg Forum members in 2012; and one interview with a municipal employee in 2012. Appendix D provides an example of the semi-structured interview schedules (2009-2010) used when interviewing teachers.

4.3.3 Focus groups

The focus group is a method used in qualitative research, which can be described as a structured, semi-structured or informal group interview (Fontana & Frey 1998) consisting of a relatively homogenous group of between six to twelve people with certain experiences in common (Lindlof 1995). The benefits of focus groups include the following: they increase the number of people interviewed at a time; they can be stimulating to respondents (Fontana & Frey 1998); the group discussions aid memory recall (Fontana & Frey 1998) and document a range of opinions and experiences on an issue (Lindlof 1995: 174).

In total, nineteen semi-structured focus groups were conducted with learners who participated in the environmental education initiative. The purpose was to examine learners' experience of the initiative, receive feedback on positive and negative aspects of the initiative, and document patterns of identifying, knowledge and agency and their drivers. See appendix E for the semi-structured interview schedule for focus groups conducted with learners (2009 to 2011).

A group typically consisted of between five to ten learners from a particular school. In a few cases a whole class participated. The selection of learners was generally left to the teachers involved. Some groups were made up of the top students; some were based on learner representation and others on those who were available. The focus groups lasted about an hour each, and were recorded and transcribed word for word. Emphasis was placed on creating a relaxed atmosphere and developing rapport with the participating learners. This was done using humour, treating the learners with respect and adopting an approachable, easy-going stance. Photos of the environmental education initiative were used as a stimulus (Lindlof 1995) and for memory recall.

In 2009, six focus groups were conducted in five schools, namely, Boksburg High, Diakomea School, Goede Hoop Primary (where two focus groups were conducted with grade 6 and grade 7 learners respectively), St Michaels Primary and Witdeep Primary. These particular schools were selected based on the rapport gained with teachers, as well as to represent the variety of schools participating. Seven focus groups were conducted in 2010. Four of the participating schools (Boksburg High, Goede Hoop Primary, St Michaels Primary and Witdeep Primary) remained the same as in 2009, in order to maintain continuity and to explore whether change could be documented. Two of the new schools, Reiger Park High and Reiger Park Primary (where two focus groups were conducted), were chosen because of their inspiring involvement in environmental action. In 2011, five focus groups were conducted. Four of these schools were the same as 2010, namely Boksburg High, Goede Hoop Primary, Reiger Park High and Witdeep Primary. Leswabe Primary joined the SSE initiative in 2011 and was therefore also chosen. In 2012 one focus group was conducted with Reiger Park High, a school that was engaging in increasingly meaningful and inspiring environmental practice.

4.3.4 Document analysis

Document analysis generates data from public and or personal documents by interpreting their content and is described as an unobtrusive data collection method as the researcher is not directly connected to those who are being researched (Nachmias & Nachmias 1990).

Historical archives of Boksburg's local newspaper, the *Boksburg Advertiser*, provided the richest source for document analysis. These were examined both to provide an historical exploration of local worldviews and meaning attached to the Boksburg social-ecological system and a critical examination of structures and practices (generative mechanisms) that have led to the current social-ecological risk in the system. It is acknowledged that newspapers can have the unfortunate tendency of expressing biased views (something I was in fact looking for to reveal underlying ideologies and values), misquoting people and not being entirely accurate in their descriptions of events. The aim was to read all editions from the 1990s to the present. However, some editions were missing in the 2000s so could not be used. A representative sample from the early 1900s to 1990 was also read. The following years were read as sources of data: 1903, 1904, 1925, 1946, 1950, 1960, 1970, 1980, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2006, 2007, 2008, 2009 and 2011.

Content analysis was used to select and analyse data from archives. Content analysis involves the specification of the content characteristics that will be systematically and objectively selected and analysed (Nachmias & Nachmias 1990). In this case, I was informed by O'Donoghue (1986) who identified that a social-ecological system is made up of biophysical, economic, political and social aspects. I consequently selected all articles that had one or more of these themes in relation to the health and value of the Boksburg social-ecological system. Any information of possible interest was copied in an attempt to gain as complete a picture as possible.

To provide rich descriptions of the Boksburg Lake case study and emerging community of practice working to restore Boksburg Lake, document analysis was also undertaken on email correspondence between role players from 2009–2013 and the documentation and minutes of meetings during the same time frame. Meetings included those I had conducted with role players, when engaging as a practitioner, and the monthly Boksburg Lake Forum meetings that began in 2011. Content examined included events that happened according to a time frame, the various roles stakeholders adopted and what emerged through the process.

Learners participating in the environmental education initiative produced a rich variety of documents, which were transcribed or scanned for analytical purposes. These documents were useful for providing insight into the learners' experience of the initiative, and their developing knowledge, identity and agency in relation to the Boksburg Lake social-ecological system. The documents included the following:

- Solitaire sheets (209) written by learners during the 2009 and 2010 Boksburg Lake Days (see section 3.6.3 for a detailed description of this day) where they recorded their experience of smells, sounds, feelings and what they were learning. The schools represented were Boksburg High, Goede Hoop Primary, Hoërskool Voortrekker, Reiger Park High, Reiger Park Primary, Summerfields Primary, Sunward Park High and St Michaels Primary.
- Nine vision statements written during the 2009 Boksburg Lake Day, where learners expressed their vision for Boksburg Lake. The schools represented were Summerfields Primary, Sunward Park High and Witdeep Primary.
- Seventy-two essays written by participating learners. In 2009 and 2010, the essays were written on specific themes directed by me, namely "Giving Boksburg Lake a sustainable future" and "What can I do, what can my school do and what can my community do to save Boksburg Lake?" Schools represented were Boksburg High, EG Jansen, Goede Hoop Primary, Hoërskool Voortrekker, Reiger Park High, Summerfields Primary, Sunward Park High and

Witdeep Primary. In 2011, essays were written by learners from Dawn Park High without my prompting that expressed their experience of the Boksburg Lake Day.

- Six statements handed to the municipality during the 2010 and 2011 Boksburg Lake Days, which expressed the learners' feelings about the condition of Boksburg Lake and the role they would like to play in its restoration. Schools represented were Boksburg High, Goede Hoop Primary, Hoërskool Voortrekker, Reiger Park High and St Michaels Primary.

4.4 Analytical framework

My analytical framework is informed by the grounded approach, which comes from the inductivist tradition (Glaser & Strauss 1967), and the RRREIC (resolution, redescription, retrodiction, elimination, identification, correction) schema that Bhaskar (2010) identified as characterising the social scientific method. This analytical framework was adopted for two main reasons: firstly, to allow the data to emerge inductively without a preconceived hypothetical lens (grounded approach) and secondly, to identify key underlying generative mechanisms operating in the Boksburg Lake social-ecological system (RRREIC schema).

My data analysis was divided into two main processes, which are reflected in chapters 6 and 7. Chapter 6 draws on data analysis of the local newspaper archives to develop a narrative of the history of the Boksburg Lake social-ecological system. The process uncovers generative mechanisms driving the current degradation of the Boksburg Lake social-ecological system (research goal 2). Chapter 7 draws on data analysis from interviews, participant observation, focus groups and document analysis to examine the patterns of identifying with, knowledge about and agency for the Boksburg Lake social-ecological system that emerged through the SSE initiative. It explores the learning mechanisms that support the transformation of the Boksburg Lake social-ecological system (research goal 3). The particular analytical process followed is discussed in detail in each relevant chapter.

This section explains the difference between inductive and deductive philosophical approaches before examining the grounded approach. The different modes of inference are then examined, namely deduction, induction, abduction, retroduction and retrodiction. The limitations of induction and deduction are presented as well as how they can be addressed through abductive, retroductive and retrodictive creative

reasoning processes. This prepares the ground for discussing the RRREIC schema that relies on retrodiction.

4.4.1 Inductive and deductive philosophical approaches

Two levels of knowledge exist, namely the empirical and the theoretical (Erzberger & Kelle 2003). Research can begin at either the empirical level (inductive approach) or theoretical level (deductive approach) and the chosen starting point affects the research process. The inductive approach is characteristically an open-ended and exploratory approach, particularly at the beginning of the research process. It begins with specific empirical observations and derives general rules and theories from patterns found in the data; it is therefore associated with hypothesis seeking (Erzberger & Kelle 2003; Sullivan & Brockington 2004). It is adopted more for qualitative than quantitative research (Neuman 2003), but can be used to explore quantitative data (through, for example, multivariate statistics) that is designed to examine many variables simultaneously. If observed patterns are consistent this can lead to the development of a lawful relationship (Connole 1998).

The inductive approach is usually used in case study research because data is initially analysed from within its own context rather than through a predetermined theoretical lens (Eisenhardt 1989).

Rationalist philosophers such as Kant critiqued the inductive approach. They argued that observation is always theory laden, whether explicitly or not, and highlighted the importance of a pre-theoretical framework for making sense of data (Erzberger & Kelle 2003). This debate led to the popularity of the deductive approach, which proceeds from theory to data (Connole 1998) and has been popular in quantitative methodologies (Erzberger & Kelle 2003). A theoretical framework is made explicit, from which hypotheses emerge, which are then tested against empirical data (Erzberger & Kelle 2003). A critique of this approach is that it reduces research to testing empirical data against already formulated theories, and denies the possibility of empirically based theory generation (Erzberger & Kelle 2003).

Neither of these classic philosophical approaches of the research process capture the interplay that occurs between empirical and theoretical levels of meaningful knowledge production (Erzberger & Kelle 2003; O'Leary 2004). The process can rather be seen as one that continually cycles between the empirical and theoretical

knowledge levels. Data is observed, theory is developed and then tested through further observations (Harvey 1973).

4.4.2 Grounded approach

Glaser and Strauss (1967) developed the grounded approach as a nuanced inductive research process that begins with an open and relatively unbiased process of data collection rather than testing a hypothesis (Danermark *et al.* 2002: 130). The aim is to ground the development of theory in data that has been systematically collected and analysed (Strauss & Corbin 1998). In the grounded approach data collection, analysis and theory development are not seen as separate, but rather different steps to be repeated in a cyclical process until additional data no longer changes the emerging theory (Glaser & Straus 1967).

Coding is the analytical process at the core of the grounded approach (Danermark *et al.* 2002). The initial coding is called open or substantive coding and is the first level of abstraction. In this process, every line of data is coded according to common properties emerging in the data (Danermark *et al.* 2002). These codes are then grouped into similar concepts to make the data more workable. As the coding process continues throughout the data, the developing concepts are compared with each other, modified and sharpened. From these concepts, categories are derived that form the basis of conceptually dense theory, made up of plausible relationships among concepts and between sets of concepts (Strauss & Corbin 1998).

The grounded approach is concerned with generating concepts with wider applicability than the context from which they were derived where conceptualisation integrates data at a higher abstract level to form theory (Danermark *et al.* 2002). Through this abstraction the developing theory extends its reach from the particular data from which it was derived to provide insights into different social contexts.

This case study research followed a simplified version of the grounded approach. This is supported by Gillham (2000: 12) who stated that "the case study researcher, working inductively from what's there in the research setting develops grounded theory: theory that is grounded in the evidence that is turned up". As he has pointed out, case study research does not start with a priori theoretical notions because, until one has experienced the context and collected data, one will not know which theories are most suitable. Rather, one collects data inductively and thereafter makes sense of it (Gillham 2000). My research journey began at the empirical rather than theoretical level as I did

not have a carefully constructed theoretical framework from which to test particular hypotheses. However, from the outset of the research process, the concept of a social-ecological system was an interpretive theoretical lens. My research design was, therefore, based on a theoretically open space that would allow the data to emerge in the context of a social-ecological system, which I wanted to understand in depth.

4.4.3 Modes of inference

The inductive and deductive philosophical approaches are associated with inductive and deductive modes of inference, respectively. Inductive inferences derive a lawful relationship from consistent empirical patterns. For example, imagine a bag of beans and up until this point, all beans taken out of the bag have been white. An inductive inference assumes that the next bean taken out of the bag will also be white. This approach is limited, as one creates a generalisation from the observations made (Mingers 2011); it cannot explain what has caused these patterns (Erzberger & Kelle 2003) and remains at the level of the empirical, providing no insight into underlying structures and mechanisms (Danermark *et al.* 2002).

Deductive observations derive lawful relationships based on logic rather than empirical observations. Using the same example of white beans, a deductive inference would be as follows: If all beans in this bag are white; and if this bean has been taken out of this bag; it must be white. If the premises in this example are true, then the conclusion will also be true. The limitation of the deductive mode of inference is that the development of new knowledge is limited to the premises put forward and, therefore, the particular context in which they were derived (Mingers 2011). Both inductive and deductive inferences are therefore unable to postulate generative mechanisms operating in a particular context. They remain at the level of the empirical rather than exploring the deeper structures and mechanisms of the real, which Bhaskar (1975) argued make up the largest part of reality (Danermark *et al.* 2002; Mingers 2011).

Abduction, retroduction and retrodiction are forms of inference that address these limitations by postulating explanations (hypothetical reasoning) for empirical findings (Erzberger & Kelle 2003). C.S. Peirce (1839-1914) is regarded as the first philosopher to conceptualise hypothetical reasoning (Erzberger & Kelle 2003). He developed the logic of abduction as an alternative mode of inference to deduction and induction:

> With the process of abduction we begin with some particular occurrence or event, usually one that is unexpected or does not conform to current theories; and we then take an imaginative leap to think of some theory or explanation which might account for the

> event. This is…an explanatory or exploratory hypothesis as to why the situation might have occurred… Abduction is the point where novelty, innovation and creativity enter the scientific method, as indeed they must… with abduction we get explanation and the possibility of new knowledge. (Mingers 2011: 4)

Explanations are hypothesised by firstly, drawing on a variety of theoretical perspectives, secondly, using creative reasoning processes and imagination to identify non-obvious relations and connections, and thirdly, examining how the particularly empirical manifestations would be expressed in a different context (Danermark *et al.* 2002).

Retroduction and retrodiction are two concepts used by Bhaskar (2010) that have a similar function to abduction. He uses these terms to distinguish between abductive inferences in natural sciences based on experimentation to identify universal laws/ generative mechanisms (retroduction) and abductive inferences in social sciences that cannot rely on experimentation to identify generative mechanisms (retrodiction). It is rather through conceptualisation and abstract theorising that retrodictive inferences move from empirical observations to elucidating underlying generative mechanisms (Carter & New 2004). The use of available social concepts and theories becomes invaluable in this process. Critical realists thus adopt retroduction and retrodiction as useful inferential tools to probe underlying generative mechanisms operating in natural and social systems respectively (Danermark *et al.* 2002).

4.4.4 RRREIC schema

Bhaskar developed the DREIC schema for natural science that relies on experimentation within closed systems. The DREIC schema stands for D: **description** of the phenomena of interest; R: application of **retroductive inferences** to hypothesise generative mechanisms that, if they existed would account for the phenomena observed; E: **eliminate** the least likely hypotheses; I: **identify** the most likely correct mechanisms, and C: **correct** identified mechanisms through further engagement with colleagues and theory (Mingers 2011).

The RRREIC schema has been developed for the applied and social sciences that work in open systems. In this case, retrodiction is the inferential tool used to postulate generative mechanisms (Danermark *et al.* 2002). The RRREIC schema makes more refined use of theory and stands for: 1R: **resolution** of the complex event or research focus into its components and associated relations; 2R: **redescription** of these components into theoretically derived themes; 3R: **retrodiction** i.e. identify antecedent

causes, supported by theoretical perspectives E: **eliminate**, I: **identify** and C: **correct**, as highlighted above (Bhaskar 2010).

The first three Rs in the RRREIC schema were used in this study to identify underlying generative mechanisms. The first two steps (resolution and redescription) are well suited to a grounded theory approach, while retrodiction provides a space for a strong theoretical emphasis. The grounded approach was used to **resolve** (1R) my data into its components (through coding) and associated relations (through conceptualisation and categorisation). These components were then **redescribed** (2R) into theoretically condensed categories, and written up as my data representations (chapter 6 and 7). The represented data for each applicable chapter was then read through a number of times to identify all emergent themes. Similar themes were clustered and from this, key analytical statements (meaningful statements) were derived (Bassey 1999). These analytical statements were therefore strongly grounded in the data. Theory was then used to postulate causality associated with each statement in a **retrodictive** process (R3). Theory included both normative theory (which argues for the way things should be and focuses on moral, political or ideological issues) and descriptive theory (which helps one understand the factors at play) (Danermark *et al.* 2002). The analytical statements with their theoretical explanations, structure the discussion components of chapters 6 and 7.

Now that a broad description of the analytical process has been provided, the chapter ends with an explanation of my ethical position.

4.5 Ethics

Ethics provides a guide to right and wrong actions (Kimmel 1988; Farrimond 2013) and is increasingly recognised as an important consideration when conducting research (Tarling 2006; Farrimond 2013). An ethically sensitive research process should maximise its positive benefits and minimise its negative effects (Tarling 2006).

As already highlighted in section 4.2 my role was both as a researcher and a change agent, commissioned by UCEWQ to support the transformation of the Boksburg Lake social-ecological system. My research was therefore applied, where I hoped it would have benefit to local people and bring about increased social and ecological justice (Kimmel 1988; Farrimond 2013). According to Farrimond (2013) research becomes implicitly ethical through adopting such a purpose. I chose a number of ethical stances to maximise the benefits of this type of research process:

- Unlike many intervention projects, the SSE initiative was a response to a clear local need. It was an initiative of Unilever South Africa who had a local factory close to Boksburg Lake and were aware of the local concerns regarding the social and ecological degradation of Boksburg Lake. In addition, instead of an expert-driven, top-down approach that characterises conventional interventions and positivist research approaches (Farrimond 2013), I decided to follow a collaborative approach in designing and implementing the initiative so as to increase local ownership of and participation in the process.
- From the research outset, I made my role, as both a change agent and researcher, clear and my research intentions explicit to both research participants and applicable stakeholders. This relates to the importance of informed consent, where research participants are aware of what they are getting involved in and engage voluntarily in the process (Tarling 2006). Kimmel (1988) has stated that voluntary informed consent is the central issue in ethical relations between researcher and participant.
- I did not view myself as an outsider engaged in extractive research, but rather became part of the community, taking up an active role within it.
- It is widely acknowledgd that one of the problems of intervention projects is that when the catalyst leaves, the intervention process is often aborted (Keene 2007). To lessen this threat I worked hard to set up processes to enable the project to develop further without me. Helping to establish the Boksburg Lake Forum was partly done with this goal in mind. I ensured that participants knew my involvement in the project was for a limited time frame and dedicated 2012 to handing over the project, where forum members increasingly took over roles I had played. In addition, Unilever continues to be committed to the process of transforming the Boksburg Lake social-ecological system through working with schools and is building on the foundation laid by the SSE initiative. I also remain dedicated to the process of transformation and have committed to providing any relevant information or advice requested. I am available to participate in any further research in the area and/or to provide guidance for fellow researchers.
- Sharing research findings is an important aspect of such a research process (Kimmel 1988; Oliver 2003; Farrimond 2013). Two reports were produced of the most up to date research findings at the time and distributed amongst the research participants. Post PhD, a workshop (on two different days to ensure that interested people have a good chance of attending) will be held for relevant stakeholders with the aim of sharing the following four key aspects of the findings to benefit local people: The underlying generative mechanisms

producing the Boksburg Lake degraded social-ecological system; the impact of the SSE initiative; reasons why transformation was limited and, avenues for future transformation. Opportunities will be created for workshop participants to share their knowledge and perspectives on each of the four research aspects mentioned above. A report will be written on the outcomes of this workshop which will be shared with all research participants and relevant stakeholders. An article will be written for the *Boksburg Advertiser* (Boksburg's local newspaper).

I also adopted a number of ethical positions to minimise the possible negative effects of my research process:

- Bassey (1995) and Farrimond (2013) have highlighted the importance of 'respect for persons' that recognises research participants as fellow human beings with intrinsic worth and rights of dignity and privacy. I engaged with each research participant with this in mind. This was expressed in, for example, using social skills to develop a good rapport with each participant, fitting into their schedules, being considerate of interviewees' time needs and tailoring my interview script accordingly, as well as avoiding an extractive approach. I thanked several interviewees for their time by paying for their meals. Anonymity is an important aspect of respect for persons (Kimmel 1988; Farrimond 2013). I have thus used pseudonyms when a research participant is individually mentioned.
- Children fall under the category of vulnerable research participants and particular ethical care must be adopted when engaging with them as a researcher (Farrimond 2013). A number of children became my research participants, both through participating in focus groups and providing me with written material to analyse. Permission to work with children was received through the Rhodes University Higher Degrees Committee who approved my research proposal. Teachers gave me informed consent to work with children and provided me with their written material.

4.6 Conclusion

This chapter has described the methodologically plural approach that I adopted to generate data that included action research, case study research, interpretivism and critical theory. These methodologies and their associated methods enabled the collection of a range of data, including:

- The social and biophysical characteristics of the Boksburg Lake social-ecological system and its historical causes;
- Local people's experience and meanings attached to the Boksburg Lake social-ecological system;
- The manifest consequences of the SSE initiative;
- Local people's experience of the SSE initiative;
- Some of the important enabling conditions;
- Underlying values, power dynamics and worldviews characterising Boksburg's social-ecological system and their role in undermining resilience.

A combination of the grounded approach and the RRREIC schema characterised my analytical framework and allowed me to follow a process of inductively generating data and contextual theory, while also linking this with broader theoretical lenses as I probed for underlying generative mechanisms operating in the Boksburg Lake social-ecological system.

The dissertation moves to chapter 5 that synthesises applicable social-ecological theory so as to develop conceptual tools with explanatory power for deriving meaning from the empirical data and postulating possible generative mechanisms in operation. This chapter supports chapters 6 and 7, which represent the generated empirical data, summarise this into key analytical statements and then suggest explanations (generative mechanisms), drawing on applicable theory and the conceptual tools developed in chapter 5.

Chapter 5:
Synthesis of social-ecological theory to develop conceptual tools with explanatory power

5.1 Introduction

This chapter provides the conceptual foundation for the thesis. A multi-theoretical perspective from social-ecological literature was adopted to synthesise relevant concepts that would provide insight into modern processes expressed in the Boksburg Lake social-ecological system and explore transformative processes for increased system resilience. From this synthesis I developed conceptual tools with explanatory power to explore generative mechanisms operating in the Boksburg Lake social-ecological system (research goal 1).

No one concept can adequately express the relationships between humans and the ecological world. Three main concepts are used in this thesis: social-ecological, human-ecological and cultural-ecological. Each concept signifies particular nuances of meaning in a conceptually contested space. The concept 'social-ecological', currently in vogue, has emerged from systems ecology and complexity theory and is often used in resilience discourse (Armitage *et al.* 2012; Folke & Gunderson 2012). It is used when I want to reflect this discourse. An argument developed in this thesis is that the social-ecological concept does not provide enough purchase to adequately explore and address the relationship between humans and the ecological world. Two additional concepts are used as an attempt to deepen this space, namely human-ecological and cultural-ecological (my adaptations). Human-ecological is the most neutral, least value-laden term to express humans in ecology. Cultural-ecological is used when I want to highlight the symbolic/ cultural aspects of humans in ecological systems.

An important point, raised by Certina (2007), is that social scientists obtain their explanations from metaphors built on abstractions. Although this is necessary for deriving meaning and explanation, the danger is that it can create a distorted lens that oversimplifies reality and does not account for diverse experiences in context. This is important to note in my study, particularly when considering the broad social-ecological lens I have adopted. I have necessarily made generalised explanations that do not fully account for the many nuances and diverse experiences in the Boksburg Lake social-ecological context.

This chapter is structured as follows: characteristics of ecological systems are described, followed by a description of human systems as characterised by culture, a property that largely distinguishes human systems from ecological systems (McCullum 2008). Examples are then provided of weak coupling between human and ecological systems and the factors that encourage this, followed by examples of strong coupling and their associated factors. A discussion follows on patterns of identifying with, types of knowledge about and forms of agency in ecological systems that influence the extent of human-ecological coupling. This includes an examination of modern hegemonic patterns of identifying, types of knowledge, and forms of agency. This is followed by an examination of the historical influences affecting the modern hegemonic worldview and consequent socio-economic practices, which are resilient to change. The chapter ends with a brief outline of alternative perspectives that are gaining legitimacy and challenging hegemonic systems.

5.2 Ecological system characteristics

Compared to conventional ecological understandings of the 'balance of nature' that dominated until the early 1970s, ecological systems are increasingly viewed as highly complex and adaptive and complexity studies have developed to explore this (Cilliers *et al.* 2013). Ecosystems are currently viewed as variable and cyclical, moving between stable and unstable states; they are characterised by multiple, dynamic equilibria and outcomes, non-linear processes, cross-scale interactions, emergent outcomes, threshold effects and system flips; and they have ecological memory, in that ecosystems have genetic and biotic legacies that influence the processes of succession after disturbance and thus landscape patterning (Fairhead & Leach 1996; Woodgate & Redclift 1998; Scoones 1999; Sneddon 2000; Holling 2001; Peterson 2002; Davidson-Hunt & Berkes 2003; Editorial 2010; Sterling 2010).

Holling (1986) introduced his adaptive renewal cycle (figure 5.1) that suggested that ecosystems cycle between exploitation, organisation, collapse and renewal, rather than progressing to a fixed climax and stable state (Berkes *et al.* 2003). Exploitation is characterised by pioneer, establishing species, while the organisation stage comprises the steady accumulation of nutrients and biomass as the ecological system moves towards a "climax" state of high complexity and connectedness. Levels of complexity and biodiversity may be bio-physically similar e.g. at high latitudes and altitudes. However, stagnation, a lack of flexibility and higher biomass, makes the system vulnerable to disturbance such as fire, insect pest outbreaks or disease (Marten 2001; Berkes *et al.* 2003). This can cause the system to move into the collapse stage, where

positive feedbacks, for example the exponential growth of budworm that kills spruce trees, generate dramatic change (Marten 2001). The ecosystem begins to recover in the reorganisation phase, a creative time where opportunities are open for a new trajectory of growth and species colonisation, and change can take on a variety of possible directions (Holling 2001; Marten 2001).

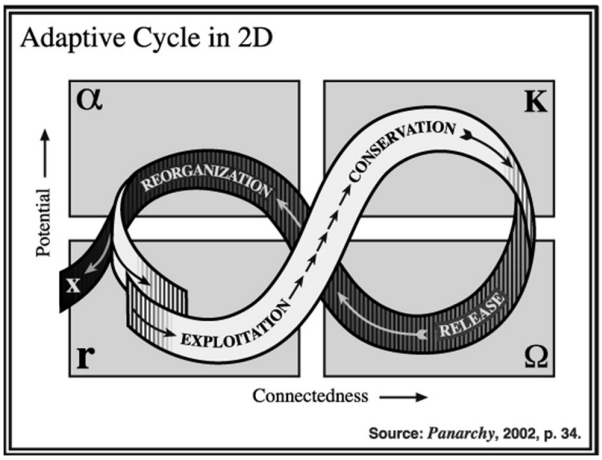


Figure 5.1: Holling's (1986) adaptive renewal cycle indicating that ecosystems are not stable but rather typically cycle through the following four stages: exploitation, conservation, release and reorganisation

Ecological system components may be more or less resilient (Biggs *et al.* 2012). Resilience is often seen as an important indicator of system sustainability; it is defined as "the capacity to create, test, and maintain adaptive capability" (Holling *et al.* 2002c: 76). In support of Holling's adaptive renewal cycle, Adger (2000) argued that resilience is about ecosystem cyclical functioning rather than maintaining a steady ecological state. Resilience can be measured by the following criteria: firstly, by the magnitude of disturbance that can be experienced before the system changes its conditions, state and functions (Adger 2000; Holling & Gunderson 2002; Folke *et al.* 2003); secondly, by the speed of recovery after a disturbance (Adger 2000); thirdly, by the system's ability to adapt and self-organise (Taylor 2002); and fourthly, by a system's capacity to incorporate change, while continuing to exist (Folke *et al.* 2003).

Biodiversity, ecological variability, redundancy and connectedness, are often cited as the key variables for ecosystem resilience requirements (Sneddon 2000; Turner *et al.* 2003; Biggs *et al.* 2012), ecosystem sustainability (Holling *et al.* 2002b) and ecosystem functioning (Adger 2000). Species-rich systems are often characterised by high levels of redundancy, meaning that each ecosystem function is underpinned by a functional redundancy among species and concurrent processes (Marten 2001) that increase the resilience of ecosystem functions (Folke *et al.* 2003). This becomes invaluable during

times of surprise and disturbance as functionally redundant species play important nuanced roles during the adaptive cycle stages (Holling 1986) of reorganisation and renewal by increasing the variety of ways ecosystems can reorganise themselves (Berkes & Folke 2001; Colding *et al.* 2003; Folke *et al.* 2003). However, it is important to note that species depauperate and degraded systems can also be resilient to change (Walker & Salt 2006).

'Structural coupling' is a useful term coined by Maturana (1978) to help understand ecosystem interactions. Maturana explained that each living system has a structure that becomes coupled to other elements within their biophysical context through processes of co-evolution. This is reflected in processes of natural selection that lead to organisms matching their local environments (McCallum 2008). Structural coupling has been used in systems thinking to explain how human systems are both independent from and coupled to ecological systems (Mingers 2006; Massey 2013). Hornborg (1996) makes a similar inference when he describes how a local people and their knowledge and meanings are adapted with and emergent from local environments. The extent of coupling thus reflects processes of co-evolution between social and ecological systems. In this thesis, I drew on the term coupling to argue that the more closely coupled human cultures are to ecological systems, the more valued and healthier ecological systems will be. Increasingly devalued and unhealthy ecological systems increase the risk of human-ecological system decline while the reverse increases the likelihood of sustainability. The discussion moves on to examine the human aspect of ecological systems and what underlies weak or strong coupling.

5.3 Human systems: cultural characteristics

5.3.1 Introduction

Human beings are classified as animals and are part of the ecological world (Westley *et al.* 2002). However, distinct differences between humans and other animals can lead to a sense that we are separate from ecology. Westley *et al.* (2002) identified the human ability to symbolically represent the world as one of our distinguishing features. They explained that ecological systems have time and space dimensions, while social systems have time, space and symbolic dimensions (structures of signification where symbols and meaning are constructed). This ability to symbolically represent the world is an emergent property of a human-ecological system. This claim is based on Bhaskar's view of human-ecological systems that demonstrates how layers of

increasingly complex reality emerge. Bhaskar (2010) identified three essential properties of emergence:

1. An emergent level (in this case symbolic representation) is unilaterally dependent on a lower level (in this case the ecological system);
2. The emergent level (symbolic representation) has new and different properties that cannot be predicted from the lower level (ecological system); and
3. An emergent level (symbolic representation) is causally irreducible to, and can affect, the lower level (ecosystem) from which it has emerged, but in unpredictable and complex ways, i.e. the emergent level is more than the sum of the parts of the lower level and process causalities between the layers are complex and often unpredictable.

The symbolic dimension is closely related to the unique human capacity for culture (Thompson 1990; McCallum 2008). Culture is a contested term with various uses according to context (Taylor 2007; Guthrie 2007). It emerged as a central concept in Anthropology to refer to human aspects that cannot be attributed to biology, particularly our capacity to represent meaning and experience through symbols (Rappaport 1979).

Two additional structures making up human society are "structures of domination" (power dynamics and influence over the flow of resources); and "structures of legitimation" (rules, norms and routines) (Westley *et al.* 2002), which both have a bearing on cultural practices. The kind of symbolic representations, nature of power dynamics, flow of resources and social rules are culturally mediated, determine human perceptions of and interactions with the ecological world (Bowie 2000) and become inscribed on local landscapes (Peirea & Lewis 1979; Fairhead & Leach 1996; Kothari & Das 1999; McCallum 2008; Rogers & Luton 2011; Massey 2013). The way cultural practices are mirrored in ecological systems can be understood by the third characteristic of emergence, where the emergent level (culture) can provide feedback on the lower level (ecosystems). It is also a consequence of human-ecological co-evolution. As Norgaard (1994: 41) has stated:

> … social and environmental systems co-evolve such that environmental systems reflect the characteristics of social systems – their knowledge, values, social organization, and technologies – while social systems reflect the characteristics of environmental systems – their mix of species, rates of productivity, spatial and temporal variation, and resilience.

There are close parallels between the concepts 'culture' and 'worldviews' (Taylor 2007). Sterling (2007) identified three aspects of worldviews: the normative, which refers to attitudes, norms and values; the descriptive, which refers to cognition and affects how the world is perceived; and the purposive, which influences action (Sterling 2007). These three aspects of worldviews can be interpreted in terms of identity (normative), knowledge (descriptive) and agency (purposive). **A key premise in this thesis is that cultural worldviews, possible because of structures of signification, determine patterns of identifying with, types of knowledge about, and forms of agency in ecological systems with fundamental effects on ecological value and health.** Social-ecological transformation therefore includes changed patterns of identifying, new knowledge and the capacity for agency that gives effect to normative change.

A notable property of culture is that it enables human societies to become more or less embedded within and congruent with ecological realities. As Westley *et al.* (2002: 108) stated: "Through the use of communication, language, and symbols [we] collectively invent and reinvent a meaningful order around [us] and then act in accordance with that invented world, as if it was real", thus creating a virtual reality.

Kellert (2007: 28) has discussed a possible genetic tendency within humanity to desire connection and unity with nature, which he argued is evident in religion and science and "is at the heart of our capacity for culture". Evidence for this includes the extent people go to include other animals in their lives and the love and attachment they can develop for the landscapes they live in (Anderson 2010), an experience common to human societies (Descola & Palsson 1996). This propensity Kellert (1984) terms 'biophilia', a concept coined by Edward O. Wilson (1984). However, Kellert (2007: 28) explained that this is a weak tendency dependent on "stimulation, learning, and social support to become functionally manifest". Science and religion have the power to guide us either towards or away from biophyllic instincts, leading to greater or lesser cultural-ecological embeddedness respectively, with consequent harmony or "intolerable excess and violent destructiveness" (Kellert 2007: 28). Our patterns of identifying with, types of knowledge about and forms of agency in ecological systems will reflect the extent that a society has cultivated its weak biophyllic tendency, through religion and education. This in turn will affect the extent of cultural embeddedness and congruence to ecological realities with consequences for the strength of cultural-ecological coupling. The discussion moves on to examine weak and strong coupling in social-ecological systems.

5.3.2 Weak coupling in cultural-ecological systems

History is littered with examples of human-induced ecological collapse (Anderson 2010). In some examples, this led to cultural collapse. Weiskel (1989: 98), focussing on the Mediterranean region, described how many ecological disasters believed to be "'acts of God' or 'natural disasters' were in fact largely generated or substantially aggravated by collective and cumulative human behaviour… The general pattern was one of gradual emergence, brief flowering, and rapid collapse of civilizations". Evidence indicates that the Mesopotamian empire collapse was a result of unrestrained use of local ecological systems (Jacks & Whyte 1939; Janssen & Scheffer 2004) while the Northern Ngoni Kingdom, in Malawi, crashed because of ecological degradation (McCracken 1987). The extinction of about 2000 bird species (15% of the world's avian diversity) (Dolman 2000) and vast tracts of deforestation (Bowie 2000) was a consequence of the Polynesian expansion across the Pacific Islands. A similar experience occurred when the "first people" arrived in the Americas, Oceania and Madagascar, where over one-hundred genera of large mammals were lost (Dolman 2000). The discussion moves on to examine human-related factors that can underpin ecological degradation.

Human-related factors enabling weak coupling processes in cultural-ecological systems

There are a number of human-related factors, discussed in the literature, that lead to weak coupling of cultural-ecological systems. Firstly, increased social mobility leads to "footlooseness" with people no longer rooted to a local place (Schumacher 1998: 51). In the negative examples of ecological damage mentioned above, a common theme was a group of people having moved to another locality. Pioneers new to an area often manipulate ecological processes based on their knowledge of a previous ecosystem. In the process, they impose their ideas on how a landscape should be. This is done without adequately understanding the local ecology and can lead to negative ecosystem consequences (Anderson 2010). Forman and Godron (1986) explained that different ecosystems respond in varying ways to use, so that practices sustainable in one area may lead to degradation in another. Payne (1999) described how the early British colonists tried to create a mini-England in the Zuurveld of South Africa. This resulted in a significantly altered environment characterised by, for example, a loss of indigenous vegetation and an increase in exotic plant species. Strang (1997) described a similar consequence when the British moved to Australia.

Secondly, linked to increased social mobility and the emergence of urbanisation, is a decreased dependence on local ecologies to meet people's basic needs. This reduces

the imperative to develop and maintain knowledge about ecosystem processes and to base management decisions on achieving ecosystem health (Schumacher 1998). Cities can "blind" people to ecological realities "by separating people both spatially and psychologically from the ecosystems that support them" (Schumacher 1998: 51). Related to this, modern conventional resource management manages systems for the maximum yield of a few particular species (Anderson 2010). For example, Mexican developers dramatically alter the locally diverse Yuctan ecosytems to farm an agricultural monocrop such as rice or cattle. Anderson (2010: 34) stated that "all schemes to convert the Yuctan bush to monocrop agriculture or grazing have failed dismally".

Thirdly, large-scale technology has allowed the rich and powerful to utilise 'resources' at a rapid pace (Rajotte & Breuilly 1992; Schumacher 1998; Fox 2003). Fox's (2003) research amongst the Xhosa in the Eastern Cape identified that the extent of technological impact was an important driver affecting whether anthropogenic disturbance led to a coupled or decoupled cultural-ecological system. One of the findings was the role of anthropogenic disturbance in creating landscape patchiness and the consequent increase in useful resources, in spite of the reduction in overall species richness. However, some areas, such as sacred pools and dense forests, are revered and strict taboos are placed on resource harvesting (Fox 2003). These areas are consequently biologically diverse relative to the rest of the landscape, act as an ecological resource bank and become invaluable during times of disturbance, such as droughts and fires, as they are more resilient to these disturbances and contain the ecological memory and resources needed to restore the system (Biggs *et al.* 2012). Fox (2003) found that low-impact technology supports these taboos around sacred pools and forests making them difficult to penetrate and they remain inaccessible and revered. The introduction of high-impact technology, accompanied by a change in cultural values, provided local people with the impetus to penetrate them (Fox 2003). As they are opened up, they become less revered, even more accessible and a reinforcing feedback loop is set in motion, leading to their diminution (Fox 2003). This diminishes the critical role of dense forests and sacred pools in containing the ecological memory and resources needed to restore the system during times of disturbance. Cultural-ecological resilience is consequently reduced.

5.3.3 Strong coupling in cultural-ecological systems

There are, in contrast, many examples of cultural-ecological systems that can be described as strongly coupled, characterised by enhanced ecosystem functioning,

appropriate biodiversity and resilience and that have been managed intensively for thousands of years (Anderson 2010). A number of examples include human societies that initially caused a high loss of ecological diversity and function, but in time learnt to become strongly coupled with local ecological systems. Indigenous groups in North America provide a telling example. History indicates that Native Americans were responsible for extensive ecological loss when they first crossed the Bering Strait onto the American continent (Diamond 1989). However, when European settlers moved to North America, in the 1400s they, for example, mistook the intensively managed oak hickory forests as wilderness areas, reflecting how Native American groups had learnt to effectively manage the biodiversity of these forests (Anderson 2010). Another well-known example is the large-scale social-ecological collapse that initially happened on the Polynesian islands when groups of people colonised them. Social-ecological collapse was particularly severe on the smaller islands (Anderson 2010). However, on the larger islands the pioneers began to adapt to the local ecologies and "extremely fine-tuned systems arose" with strict taboos placed on resource overuse (Anderson 2010: 43). Tellingly taboo is a Polynesian word (Anderson 2010). Additional examples include the Montane Rain Forest of south-east Mexico, which is believed to be one of the most biologically diverse neo-tropical formations, in spite of the system having experienced centuries of intensive anthropogenic disturbance in the form of slash and burn agriculture (Ramírez-Marcial *et al.* 2001). Berkes and Folke (2001) described how the practices adopted by indigenous peoples of the Amazon (swidden fallow management, patch clearing and burning) have resulted in the long-term supply of a diversity of resources and ecosystem services.

From a reading of the literature I suggest that the threat of human-ecological collapse prompted the transformation of religious and educational institutions in a way that the weak genetic tendency for biophilia was encouraged (Kellert 2007). Anderson (2010) supports this. He describes how people new to an area increasingly learn to use their environment sustainability and calls this a "learning curve". This could have translated into changed patterns of identifying with, types of knowledge about and forms of agency in ecological systems.

Human-related factors enabling strong coupling processes in cultural-ecological systems

There are a number of human-related factors that lead to healthy coupling in cultural-ecological systems, of which three are discussed. Firstly, the relevant culture experiences continuity of place (Strang 1997) or emplacement, a term coined by De Wet (2008) to refer to the long-term generational occupation of an area and resulting cultural-ecological connectivity. Emplacement facilitates the development of affective

values and a strong sense of collective identity with and dependency on the local landscape (Strang 1997). Knowledge, particularly of ecological processes and functions, relies on generations of accumulated experience, expertise and social memory (where successful adaptions become embedded in values and practices that guide communal stategies for dealing with ongoing change), indicating the importance of continuity of place (Berkes *et al.* 2003; Olsson *et. al* 2004).

Generational knowledge and expertise can be used to monitor and be responsive to change in ecological systems and enhance the learning capacity of a local community (Berkes *et al.* 2000). Generational knowledge also increases sensitivity to ecological feedback mechanisms, essential for successful adaptation to dynamic and constantly changing ecosystems (Berkes & Folke 1998). Continuity of place also enhances the ability to adapt to a particular landscape as cultural practices and values co-evolve to enhance rather than diminish ecosystem function (Norgaard 1994). Indigenous Australians, for example, have lived in Australia for about forty thousand years and, before their culture was disrupted through colonisation, experienced (and to a degree still do) a deep engagement with their local landscape, where every aspect of their life – social, physical, economic, intellectual, emotional and spiritual – was invested in their locality (Strang 1997). The land was steeped in symbolic meaning and value, with which they experienced a deep and intensely relational interaction (Strang 1997).

The second factor supporting cultural-ecological coupling is that local communities rely on the biological resources of local ecosystems to fulfil most of their needs, including energy needs (Bawa & Gadgil 1997; Berkes & Folke 1998). For example, the indigenous Maya people of Quintana Roo use thousands of plants species and hundreds of animals for a wide variety of uses including food, medicine, firewood, building materials, poison and soil restoration, to name a few (Anderson 2010). This provides an incentive to manage the ecosystem as a whole for sustained health, as even minor species are valued. Consequently such communities often behave as an integral component of the ecosystems they inhabit, which can lead to sustainable management practices (Bawa & Gadgil 1997; Kothari & Das 1999).

The third factor supporting social-ecological coupling is moral restraint when harvesting ecological resources. Religious institutions and ritual activities that support internalisation of moral rules and encoding of ecological respect can play an important role (Hornborg 1996; Berkes *et al.* 2000; Anderson 2010). The value of religion is that it can both teach care for the environment and develop a conscience in the believer that motivates them to follow the rules, “even when no game warden is near” (Anderson 2010: 46).

There are numerous examples of traditional communities showing moral restraint when utilising ecological resources. Anderson (2010) described how Native American Indian groups highly valued the rare western red cedar for its bark. For the tree to continue growing only one narrow piece could be removed. It has been documented that these local people would walk miles to find several trees when harvesting the bark so that one tree would not be stripped beyond its capacity to re-grow. A deeply felt prayer would be said and the tree thanked for what was taken. Anderson (2010) explained that strong internalised social rules prevented people from over harvesting the bark. Religious reasons also led to the conservation of local ecologies by natives of the American North West who believe that the trees, mountains and animals have personal and powerful spirits that can be communicated with. For bark, berries and animals, humble requests would be made to these spirits: "Taking too many animals, or taking them without the proper rituals alienated the animal spirits, and guaranteed failure in the next hunt" (Anderson 2010: 36).

Figure 5.2 provides a conceptual diagram synthesising the discussion thus far. It highlights the emergence of symbolic representation from co-evolving human-ecological systems. These symbolic representations become expressed in culture and worldviews, and influence patterns of identifying, types of knowledge and forms of agency. The nature of these will determine the degree that cultural systems are embedded within ecological reality and the extent of cultural-ecological coupling. A cultural system closely coupled with ecological realities is likely to value ecological systems and manage them for their health, while less coupled cultural-ecological systems are likely to lead to the opposite. Because of their integrated nature, the extent of ecological health and value will affect the decline or sustainability of cultural-ecological systems. Examples have been provided of the learning that can take place when cultural-ecological systems are facing decline. This learning can enhance or reduce biophyllic instincts that become encoded in patterns of identifying, types of knowledge and forms of agency. This in turn affects the strength of cultural-ecological coupling and extent that human societies co-evolve with ecological systems.

The chapter now turns to a discussion of different patterns of identifying, types of knowledge and forms of agency that promote increased cultural-ecological coupling, based on insights from the literature. Some of the ideas are inspired by examples from non-western, more traditional societies. In each section I compare these insights to the hegemonic, modern, western patterns of identifying, forms of knowledge and types of agency that are supporting decoupling social-ecological processes. I am aware of the danger of creating a dialectic and that the modern, western experience is diverse and nuanced. However, for the scope of this thesis I

examine the hegemonic, rather than diverse and nuanced, modern western patterns of being.

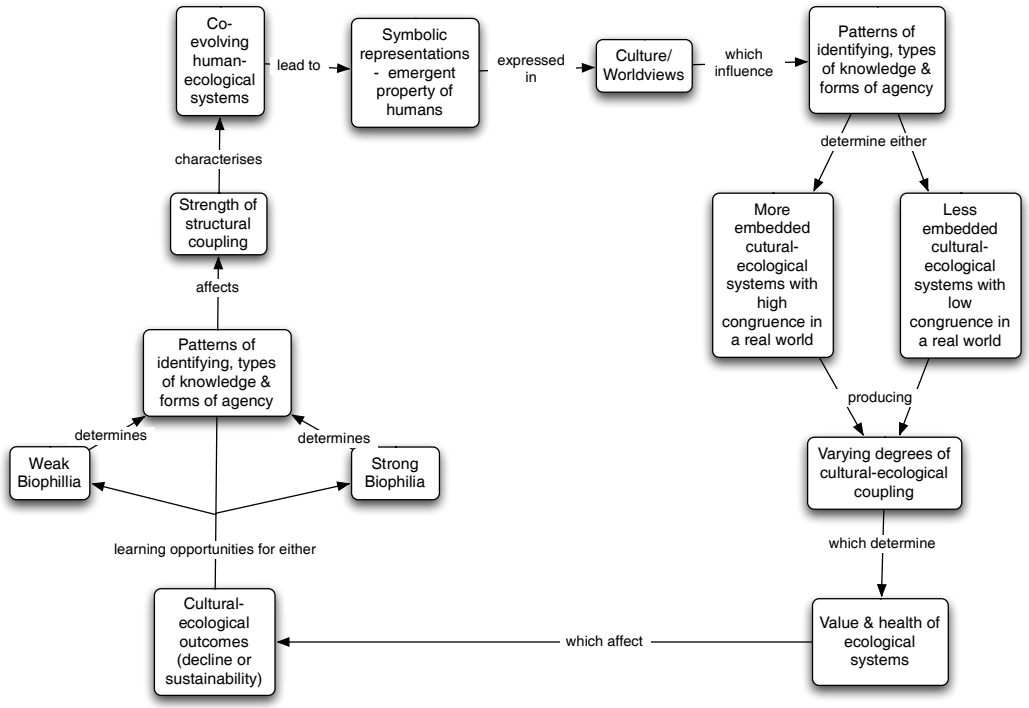


Figure 5.2: A conceptual synthesis of processes leading to cultural-ecological sustainability or collapse (based on Norgaard 1994; Westley *et al.* 2002; Mingers 2006; Kellert 2007; Sterling 2007)

5.3.4 Patterns of identifying with ecological systems

Sfard and Pruask (2005:14) suggested that identity can be approached "as a set of reifying, significant, endorsable stories about a person", stories that imply membership of or exclusion from various human and non-human communities. Identities are thus based on and affect relationships with ourselves, with others and with the ecological world.

McCallum (2008: 173) stated that human identity "is intimately associated with a deep historical sense of kinship with wild places and wild animals", that we need to realise our poetic and meaning making capacity and that we are "keepers of the zoo", expressing an identity of responsibility that reflects the human propensity to alter and manage ecosystems (Anderson 2010). Other authors have expressed the importance of recognising this identity of being part of the natural environment that is built on belonging and interdependence with, and responsibility for, the earth (Golliher 1999).

Anthropologists have found that among many peoples there is no concept of a nature-society divide. Three notable examples come from tribes living in the upper Amazon, namely the Tukano, Jivaro and Makuna peoples. The Tukano people do not have a separate term for 'nature'; their environment is as much a part of them as their digestive system: "an extension of biological man" (Reichel-Dolmatoff 1996: 8). The environment is thus highly valued because it directly relates to who they are; damage of the environment leads to damage of oneself. The Jivaro people view most local plants and animals as persons who live in their own societies and enter into relations with humans under strict social rules, while the Mukana believe they participate in a "wider community of living beings regulated by a single and totalizing set of rules of conduct" (Descola & Palsson 1996: 7).

Other examples reflect similar patterns of identifying with the natural world. For example, the Raramuri tribe of Mexico manage and live in the Sierra Madres, which is one of the three most biologically rich areas in the world (Salmon 2000). This group of people is highly connected to the local landscape, which is central to their theory of origin and cultural identity. The concept of nature being separate to their activities and culture is foreign (Salmon 2000). The Chewong of the Malay tropical rainforest do not have ontological distinctions between humans and other beings, where plants and animals are believed to have a consciousness, including their own language, moral code and intellect (Howell 1996). For the Huaorani hunters of the Amazon, the animals they hunt are social beings who actively engage in the world of the hunters. In this society plants, animals and other entities all belong to the same sociocosmic community, and operate under the same social rules as those applicable to humans (Descola & Palsson 1996).

This inclusivity of the natural world into human sociality encourages notable patterns of identifying that numerous authors hold up as positive for social-ecological coupling. Firstly, it encourages a view of the world that is animated, communicative and personal. This is argued to be a valuable way of viewing the non-human world that establishes a sense of connection with it (Nabhan 1997; Cheney & Weston 1999; Abram 2010). Berry (2009a: page number unknown) argued for the universe to be viewed as a "communion of subjects" with the capacity for intimate relationship, rather than a "collection of objects" to be exploited; when this view is adopted it "will enable the human to become present to the Earth in a mutually-enhancing manner". Cheney and Weston (1999) stated that our task is to participate in this animated world in ways that build relationships with the wider community of life.

Secondly, the lack of a nature/human divide supports a sense of kinship with non-human beings, where they are included in the community of concerns (Daly & Cobb 1994; Pierotti & Wildcat 1999). Anderson (2010: 44) argued that an environmental ethic should be built on an understanding of the "personhood of all beings". Bird-David (1993) observed that throughout the world hunter-gatherer cultures represent human-nature dynamics as personal and between subjects rather than between a subject and an object. The bushman hunter-gatherers of the Kalahari have a 30 000 year old mythology about the connectedness between all living things (McCallum 2008). The Raramuri tribe described earlier regard certain creatures, such as the bear and coyote, as cousins or siblings (Salmon 2000), while Daly and Cob (1994) have described the strong tendency in India to view animals as sentient beings with religion and ethics orientated to their concern. Evolution confirms this kinship where it is now understood that we are genetically related to all life (Cheney & Weston 1999; McCallum 2008).

This section moves to an examination of hegemonic modern, western patterns of being that contrast with those described above.

A fundamental aspect of the hegemonic modern, western worldview is the idea that humans are separate from ecological systems (McCormack & Strathern 1980; Rajotte & Breuilly 1992; Schumacher 1998; Pierotti & Wildcat 1999; Sterling 2007), which Ashley (2006) has termed the anthropocentric fallacy. As Schumacher (1998: 4) noted, "Modern man does not experience himself as a part of nature but as an outside force destined to dominate and conquer it". For example, a theme repeated in Marx's writings was the attitude "that humans should struggle against, conquer, and dominate nature" (Anderson 2010: 144). In its extreme form there is a belief that we have liberated ourselves from depending on ecological systems. For example, Eugene Rabinowitch, editor-in-chief of the Bulletin of Atomic Scientists stated in the Times newspaper, April 1972:

> The only animals … whose disappearance may threaten the biological viability of man on earth are the bacteria normally inhabiting our bodies. For the rest there is no convincing proof that mankind could not survive even as the only animal species on earth! If economic ways could be developed for synthesizing food from inorganic raw materials – which is likely to happen sooner or later – man may even be able to become independent of plants, on which he now depends as sources of his food. (Schumacher 1998: 82)

Accompanying the anthropocentric distinction between humans and ecosystems is an assumption that "all basic realities and values are identified with the human. The non-

human attains its reality and value only through its use by the human" (Berry 2009b: page number unknown). Ashley (2006) argued that this anthropocentric perspective has become the dominant mode of thinking in modern society, is a perspective that denies inherent value to other living beings, apart from their use to humanity, and is supported by the view that humans are separate from ecological systems.

This view of being separate leads to a detatchment from, loss of intimacy with and attentiveness to ecological systems, which become objects for domination and control (Cheney & Weston 1999; Massey 2013). This attitude of being in control is fuelled by a mechanistic, inanimate view that the world is composed of inert atoms, responding to the general laws of physics with no "feelings, soul nor mind" (Massey 2013: 104) and is expressed in dominant discourses that describe ecological systems as a storehouse of resources (Taylor 2004; Sterling 2007; Abram 2010) to be used for the advancement of society (Gottlieb 2009). Olvitt (2012) gave the example of the Millennium Assessment Report, which she explained adopts an instrumentalist approach, with an emphasis on ecological systems providing humans with resources and services. She further stated that "Through the services framework… our understandings of and respect for the diversity of life forms and their intricate relationships are pre-empted and coached by a human-centred, resource-oriented view" (Olvitt 2012: 85). Miller (1998) argued that this has led to a lack of moral restraint when managing nature and, supported by the capitalist ideology of maximisation of profits, and industrialisation, 'resources' have been increasingly harvested and consumed for short-term economic benefits. An example graphically expressing this is an advertisement of the development arm of a bank that had a picture of the globe and the following caption: "Businessmen Devour This Planet!" (Holling, Gunderson & Peterson 2002).

This section has focused on patterns of identifying that lead to stronger cultural-ecological coupling processes and includes those that encourage a sense of connectedness and interdependence with and responsibility for the earth. There are numerous examples of local peoples making little distinction between their sociality and ecosystems. This encourages the view of a personal and communicative world in which non-humans are related to as morally conscious subjects. This has been contrasted with hegemonic, western, modern patterns of identifying that are built on a human/ecological divide, an anthropocentric, conquering and controlling attitude and a view of a mechanistic natural world consisting of resources to be exploited for human development. The discussion moves on to examine the role that knowledge has in processes of cultural-ecological coupling.

5.3.5 Knowledge about ecological systems

Schumacher (1998) highlighted the value of knowledge by stating that its purpose is to make the world and our lives intelligible. He further explained that one is able to engage with what is intelligible, whereas a lack of intelligibility leads to estrangement. There are, however, different forms of knowledge that develop out of various cultural trajectories. These will have an important impact on human interactions with the ecological world; knowledge can lead to domination, control and detachment; or greater intelligibility, understanding, empathy and connection (Schumacher 1998; Cheney & Weston 1999; Abram 2010).

McCallum (2008) highlighted the value of developing knowledge grounded in an ecological intelligence that is able to see the interconnections between things and read and interpret patterns in local ecosystems, such as the particular movements of animals. He provides an example of the Andaman islanders who live in Yala National Park on the coast of Sri Lanka. These are people indigenous to the area, who have a highly developed ecological intelligence of their local environment. Due to this intelligence, developed over generations, they were able to read and interpret signs in the environment that warned them of the 2004 tsunami that impacted countries and islands in the Bay of Bengal. They consequently moved to higher ground before the tsunami hit and experienced no immediate causalities. This contrasts with the tens of thousands of people who died in other areas along the coastline, particularly in places where the ecological systems had been replaced with high-rise buildings and concrete.

Related to the value of ecological intelligence, Abram (2010) has highlighted the importance of knowledge gained from direct, intimate experience of ecological systems, which he stated opens up a world with which one can communicate. This is supported by Cheney and Weston (1999: 124): contrary to the emphasis some place on the "constructed nature of the worlds we live in, reflected in the catch phrase 'It's words all the way down,' we suggest a different emphasis: 'It's world all the way up'", which encourages a knowledge that is built on attentiveness to and intimacy with the human-ecological world. Abram (2010: 11) examined the language and consequent types of knowledge often developed in oral cultures and noted how they could "speak directly to that world, acknowledging certain animals, plants, and even landforms as expressive subjects with whom they might find themselves in conversation". He stated that the

> power of language remains, first and foremost, a way of singing oneself into contact with others and with the cosmos – a way of bridging the silence between oneself and

> another ... language's primary gift is not to re-present the world around us, but to call ourselves into the vital presence of that world – and into deep and attentive presence with one another.

The kind of knowledge described above can be associated with contextual and embedded knowledge systems and develops as a people are rooted to a local place (Hornborg 1996). This indicates the importance of local people having autonomy over their land (Hornborg 1996) as well as the value of local knowledge (McCallum 2008). As Hornborg (1996: 54) stated,

> Because of the sheer complexity and specificity of ecosystemic interrelationships and fluctuations, it is not unreasonable to expect that optimal strategies for sustainable resource management are generally best defined by local practitioners with close and long-term experience of these specificities, and with special stakes in the outcome.

Although the codification of ecological processes by local people may be different from modern science they can still be highly relevant and contain sophisticated ecological intelligence (Hornborg 1996; McCallum 2010).

Hegemonic knowledge forms venerated in the modern world have particular characteristics that may contradict those described above. Firstly, scientists develop knowledge that represents the world, expressing the dualism that humans are "outside of and not really a part of, this world" (Abram 2010: 11). Edwards (2012: 524) has critiqued this representational form of knowledge acquisition, which he argued is founded on a dualistic separation between for example, "meaning and matter, object and subject, practice and theory". He stated that "within this epistemological position, a gap is assumed between matter and meaning which is taken as foundational and unquestionable. This gap then has to be filled through representations, with all the problems and philosophical traditions associated with such approaches" (Edwards 2012: 524). Adopting a similar perspective to Abram (2010), he argued that this representational form of knowledge conceptually disconnects humans from their materiality and understanding of being fundamentally part of the natural world.

A second characteristic of hegemonic knowledge forms is a growing dominance of disembedded rather than embedded knowledge systems that result from processes of "decontexualisation pervad[ing] all aspects of modern society" (Hornborg 1996: 45). Linked to these disembedding processes expert knowledge is highly valued. This knowledge is often based on abstract concepts and totalising knowledge systems, which hold the danger of supporting detachment from the natural world (Hornborg 1996;

Abram 2010). Hornborg (1996) stated that a source of maladaption is the objectivism of modern science that elevates explicit facts and rationality while systematically destroying meanings. Such "decontextualised rationality" is ill suited to sustainably managing ecological relations (Rappaport 1979).

Bhaskar (1975) highlighted a valuable nuanced perspective on valuable types of knowledge of the world, that has room for both local, contextualised, meaning rich knowledge and modern expert scientific knowledge based on empirical observations, abstraction and rationality. He introduced the layered ontology of reality (see section 2.3.2 for a detailed description) that depicts the value of both empirical, direct knowledge of the world (that can include both local and expert knowledge systems), as well as abstract, conceptual knowledge derived from metaphors, that allows one to probe deeper structures and generative mechanisms (see sections 2.2 and 2.3.2 for an explanation of generative mechanisms). Traditional cosmologies that embed metaphorical knowledge in ritual and religion can also provide implicit insights of deeper structures and mechanisms. The combination of direct experience, local embedded meanings and abstract conceptualisation provides knowledge that is more reality-congruent, an important characteristic of coupled cultural-ecological systems.

This section has explored different types of knowledge and hinted at their potential impacts. The section first examined local, contextualised knowledge systems that are built on intimate experience with a local landscape and encourage participation with the world. This embedded knowledge often becomes encoded in ritual and religion. This was then compared to modern, disembedded knowledge systems that represent the world and place high value on expert, objective and totalising knowledge. Bhaskar's work provides an inclusive space for different knowledge systems where each contribute to a deeper understanding of the real, and therefore support greater reality cognisance and consequent cultural-ecological coupling. The discussion moves on to examine the role that agency has in processes of cultural-ecological coupling.

5.3.6 Agency in ecological systems

Agency is the human ability to act for an intended outcome; it has a causal effect on the world, and indicates the human capacity to transform situations (Harvey 2002). These actions occur in a "pre-structured world of language, practices, norms and values, oppressions and distortions" (Mingers 2006: 246) that has particular constraints and enablements (Bhaskar 1998). Authors introduce the dual nature of power that can either be hegemonic and constraining, or enabling and productive (Foucault 1981; Bhaskar

1993). Hegemony refers to the domination of a ruling class by manipulating culture so that their worldview becomes the cultural norm (Gramsci 2000). This is elaborated by Bhaskar (1993) who identified two types of power: power$_1$ and power$_2$ relations. Power$_1$ is empowering and refers to

> The general causal powers of human agency whose characteristics entail the possibility of human emancipation, such as our capacity to investigate, communicate, plan, construct moral and ethical systems, feel and care for others, and come to agreement based on judgmentally rational arguments directed at practices that transform our lived circumstances. (Hartwig 2007: 372)

Power$_2$ relations are hegemonic, exploitative, dominating and are concerned with maintaining control. They are based on excluding alternatives or socialisation that negates an individual's understanding of their real interests and needs (Hartwig 2007).

Forms of agency can influence the sustainability or degradation of cultural-ecological systems depending on the motivations, reflexivity, knowledge and power dynamics influencing action. The discussion now turns to an examination of five characteristics of modern society that reduce individuals' agency to tackle the pervasive and far reaching social-ecological problems faced.

The first modern characteristic examined in some detail is what Giddens (1990) referred to as time-space distanciation, which he explained is an experience unique to modern society; in pre-modern societies time, space and place were interconnected and had meaning in relation to each other (Giddens 1990; Westley *et al.* 2002). It was through the invention of the clock that time was systematised and rationalised and society was able to keep track of it, regardless of place (Westley *et al.* 2002), while the development of universal maps resulted in space no longer being referenced to a particular place (Giddens 1990). Through this time-space distanciation, social institutions and relations are disembedded and de-territorialised from local place and re-embedded in new space configurations that have a more global reach linking the local and global in ways unthinkable in pre-modern societies (Giddens 1990; Westley *et al.* 2002). This powers the dynamism in modernity and disconnect from local place (Giddens 1990). Bauman (1994: 17) described the consequent space:time discontinuity between actions and their consequences:

> What we and other people do may have profound, far-reaching and long-lasting consequences, which we can neither see directly nor predict with precision. Between the deeds and their outcomes there is a huge distance – both in time and in space – which we cannot fathom using our innate, ordinary powers of perception.

Environmental degradation is therefore often experienced indirectly, and enlightened self-interest is not a possible response to such degradations.

Fueled by this time:space distanciation, Hornborg (1996) stated that processes of disembedding and decontextualisation pervade modern society and highlighted their dangers, including a loss of local meaning and the objectification of that which was decontextualised. Objectification, Hornborg (1996: 51) stated, is "the ultimate foundation of power, repression and exploitation".

A second characteristic of modern society is the highly differentiated division of labour: "one can do something and continue doing it without having to take personal responsibility for it. It is as if one were acting while being personally absent. One acts physically, without acting morally or politically" (Beck 1992: 33). This supports a fragmented and floating sense of responsibility among citizens. The third aspect is the modern commitment to human progress (Taylor 2004) that becomes expressed as economic growth, consumerism and hedonistic lifestyles. These factors negatively impact our ability to act in our own best interests (Conradie 2011). The fourth aspect is large-scale technology that is directed towards the realisation of human progress, particularly from an economic perspective. Schumacher (1998: xiv) critiqued the obsession modern society has with large-scale technology with its highly detrimental human and ecological effects: "there are inherent thresholds in the scale of human activity that, when surpassed, produce second-and third-order effects that subtract, if not destroy, the quality of all life". Fifthly, because the risks produced by modern socio-economic systems are so far reaching and hard for an individual to counteract, a feeling of fatalism can be adopted, reducing an individual's agency to adequately respond to these threats (Giddens 1990), while responsibility is left nameless: "Sin without sinners, crime without criminals, guilt without culprits! Responsibility for the outcome is, so to speak, floating, nowhere finding its natural haven" (Bauman 1994: 18).

Max-Neef (1992) and Schumacher (1998) have both critiqued modern forms of agency that are encapsulated in the idea that bigger is better and aim to extract as much of a resource as quickly as possible. Max-Neef (1992: 133) highlighted the problematic nature of large-scale modern economies:

> Economics has worshipped efficiency, and on its behalf we have evolved from economies of scale to what I would like to call 'diseconomies of uncontrollable dimensions'. The economic efficiency of this process is incontestable and so is its power to pillage natural resources, its capacity to pollute and its contribution to the rise

> in heart attacks and hypertension. And once dimensions of large scale have been consolidated, their evolution is possible only in terms of becoming even larger. The system no longer expands to meet the consumption needs of people; it is people who consume in order to meet the system's requirements of growth. As long as alienation, boredom, dissatisfaction, rural and urban decay, pollution, insecurity, anxiety and, finally, dehumanisation are not measured as costs of the process, it will continue to be seen as positive, efficient and successful in terms of the traditional criteria by which it is judged.

The large scale at which the technologies are promoted, economies grow and things are built, for example cities, is problematic partly because scale is another factor removing humans from the consequences of their actions:

> The attainment of a dynamic equilibrium between nature, human beings and technology … is only possible when humans, both at the collective and individual level, feel themselves directly responsible for the consequences of their actions within their environment, and this can only happen if the dimension of that environment remains within the human scale. (Max-Neef 1992: 132)

The degraded and risk-infused ecological condition of the present world system (Beck 1992; Rockstrom *et al.* 2009; Swilling & Annecke 2012) calls for change in forms of agency, patterns of identifying and types of knowledge. The highly complex, elusive nature of these problems, the time-space disconnect in society (Bauman 1994) and ideologies of progress, economic growth and consumerism (Conradie 2011) make this a difficult challenge.

The next section provides a generalised overview of western history from Plato to the present and indicates how ideas over time have lasting and profound effects on humanity's relationship with ecological systems.

5.3.7 Historical influences on modern hegemonic patterns of being

Lakoff and Johnson (1980) explained that metaphors underpinning society structure conceptual systems are aligned with cultural values and consequently impact what is seen, thought and done. Metaphors touch us on deep emotional and aesthetic levels and fundamentally affect experience and understanding of the world (Massey 2013). In addition, language fundamentally influences how one thinks about the world. As Lakoff stated, "Thinking differently requires speaking differently" (2004: xv in Massey

2013). It is therefore useful to identify dominant metaphors and discourses in society when exploring human-ecological systems.

A long history of ideologies, philosophies and events has affected the influential metaphors underpinning the hegemonic western worldview. Drawing from a broad range of sources, important influences are highlighted in chronological order. Four main western eras are discussed, namely:

1. Ancient western philosophy;
2. Adaption of the Judeo-Christian religion to European culture;
3. The scientific revolution and secularisation of western society;
4. Industrialisation and the modern capitalistic economic system founded on principles of unlimited growth.

Each preceding era continues to have considerable influence.

Ancient western philosophy

Two metaphors have profoundly influenced western cultural-ecological systems since ancient Babylonian and Greek times, namely the separation between man and nature/woman; and the perception of conquering and controlling nature/woman. In ancient Babylonia cosmology, woman and nature were closely identified (the words 'matter' and 'woman' have the same etymological/ linguistic root), and both were to be conquered (Ruether 1999). The cosmology explained that Marduk, the male God, killed the mother Goddess Tiamat and fashioned her into matter. Ruether (1999: 457) explained: "She can be used as matter only by being killed; that is destroying her as 'wild', autonomous life, and making her life-giving body into 'stuff' possessed and controlled by the architect of a male-defined cosmos".

These metaphors were also emphasised in ancient Greek culture and reinforced under Plato's influence. He imagined the male mind as the divine architect, disembodied from and shaping nature that was also associated with women (Ruether 1999). This is an expression of the mind:body and man/human:woman/ecology dualism that has pervaded western thinking.

Adaption of the Judeo-Christian religion to European culture

Adaptations of the Judeo-Christian religion have had profound and varied influences on the dominant western worldview and have both perpetuated and challenged the man/human:ecology dualism. Berry (1996) explained that early Christianity celebrated the incarnation and redemption of Christ as for the whole cosmos. This view emphasised the immanence of God in and high value of the whole of creation that was under God's consideration and challenged human:ecology dualism. In the Greco-

Roman era, apocalyptical views and Gnosticism became prominent. These are beliefs that divorce humans from the ecological world as it is seen as contaminated and to be escaped from (Ruether 1999). Early Christianity struggled with these ideologies and theologians like Irenaeus (2nd century) promoted views of creation as "the sacramental embodiment of the invisible God" (Ruether 1999: 458). Origen, a Christian theologian who lived in the third century AD, described the world as "an immense living creature which is united by one soul, namely the power and reason of God, in whom everybody and everything exists" (quoted by Bettenson 1956: 260). However, the increasing influence of Neo-Platonism entrenched views of matter being bad and promoted ideas that the earth and body were to be escaped from (Rajotte & Breuilly 1992). An anthropocentric perspective was also encouraged by theologies like Augustine who believed that the Kingdom of God consisted only of the spiritual and did not include nature. This elevated the importance of the 'eternal' human soul (Breuilly 1989). Breuilly (1989: 51) claimed that in the following centuries "Western Religion, philosophy and literature all combined to reinforce the idea that human consciousness, human thought and human action were the centre of the created world".

During medieval times, nature was both sacramentalised (following the tradition of Irenaeus) and demonised, seen as embodying sexual and earthly temptations (Ruether 1999). The Great Plague (1347-1349), which killed a third of the European population, had a considerable influence on demonising the earth; with no scientific means to determine the cause of the plague, people believed that the physical world had become corrupt and evil, with the spiritual becoming of supreme importance (Berry 1996).

The Calvinist reformation, from the sixteenth century, undermined the sacramental view of nature and reinforced the notion of a corrupt creation with divine revelation and presence only contained within the scriptures (Berry 1996). Weber (1930) argued that Calvinism also encouraged the Protestant work ethic, which has been a driver of capitalism. Calvinism was built on the doctrine of pre-destination where an individual's eternal destiny was in the sole hands of God. Salvation was never secure but the evidence of good works signified being part of the elect. These good works became equated with hard work and the accumulation of capital (Weber 1930).

The scientific revolution and secularisation of western society

The current, globally dominant view of science emerged from major shifts in western thought that occurred between 1400 and 1800 and "resulted in possibly the most powerful complex of values, ideas and practices the world has known, including the scientific and Industrial revolution, capitalism and notions of linear time, progress and individual rights" (Janse van Rensburg 2001: 2). Massey (2013: 100) discussed the

"monumental shift" in metaphorical perceptions of the earth that also occurred during this period; prior to the scientific revolution the earth was perceived as organic and living. However, over a period of four centuries this was replaced by a mechanical metaphor where nature was perceived as a machine, legitimising views that it can be controlled solely for human purposes (Merchant 1983). Francis Bacon, Rene Descartes and Sir Isaac Newton are recognised as key players in the scientific revolution that entrenched the mechanical metaphor of nature. Each is discussed in turn.

Francis Bacon (1561-1626) is described as the father of science and founder of the scientific method based on empiricism (facts developed through empirical observation) and the inductive method (Russell 1946; Merchant 1983; Hindmarsh 2008). He argued that nature be used to improve society and advocated that science advance technological development (Hindmarsh 2008). He viewed nature as a woman to be conquered and science as a way of forcing her secrets to be revealed and thus promoted attitudes of mastery and control, which have influenced exploitative and disrespectful attitudes in contemporary human-ecological relations (Merchant 1983).

Rene Descartes (1596-1650) built on the scientific foundation laid by Bacon (Hindmarsh 2008) and has been called the 'Father of Modern Philosophy' (Russell 1946). He promoted a value-free, detached scientific method based on reductionism, which encouraged a mechanistic and atomistic view of the world (Janse van Rensburg 2001). This became known as the Cartesian worldview. He also introduced the idea that we can know through our reasoning. Combined with empiricism, this furthered the scientific endeavour that became known as 'logical-empiricist' where facts are observed (often through measurement) and relationships between things are then reasoned (often through statistics) (Janse van Rensburg 2001). He is famous for his philosophical proposition "cogito ergo sum"/ "I think, therefore I am", which emphasised individualism, as 'I' is before 'other' (Jensen 2000), and foregrounded mind above matter/the body. This philosophical proposition has had a profound impact on western human-ecological relations by entrenching mind-body dualisms and promoting anthropocentrism: "In its Cartesian form dualism was wholly anthropocentric, identifying everything other than the human mind as matter or extended substance" (Daly & Cobb 1994: 200). The earth was "de-souled" and divided into humans worthy of ethical consideration and the rest of the world, viewed as an assortment of complex machines without subjective experiences and as resources to be exploited (Daly & Cobb 1994; Olvitt 2012). Abram (2010: 108, 129) described this in some detail:

> … a presumption that lingers as our deepest inheritance from the Cartesian tradition: the assumption that awareness, or mind, is a special possession of our species, a property that isolates humankind from the rest of material nature… Descartes' segregation of the mind from the body… was but a means to a grander idea: it authorized the modern mind to reflect upon the material world as though it were not a part of that world – to look upon nature from a cool, detached position ostensibly outside of that nature.

Sir Isaac Newton (1642-1727) developed the classical hypothetico-deductive method (Connole 1998) and is regarded as the author of reductionism (Swilling & Annecke 2012). He claimed that all reality could be understood from a few basic components/ laws. These he identified as gravity, molecules and time (Swilling & Annecke 2012). His discovery of universal laws reinforced the mechanistic view of nature as it became seen as a perfect machine (Merchant 1983; Connole 1998). Nature was further desacralised as God was viewed as the Great Watchmaker or retired engineer who, rather than direct involvement, wound up the universe and left it to run according to universal laws (Rajotte & Breuilly 1992; Hindmarsh 2008).

The influence of the scientific revolution has been extensive. Through it nature became completely secularised; "matter in motion" without meaning, direction or soul (Ruether 1999). This secular worldview, based on materialistic and growth-based ideologies was configured by the late 17 century (Massey 2013) and is described by Merchant (1983: 2) as "the mainstream narrative of western culture" and "perhaps the most important mythology humans have developed to make sense of their relationship to the earth". Empirical realism became the hegemonic knowledge system that delegitimised non-rational experiences, the validity of emotions, spiritual revelations and longings (Hindmarsh 2008, Schumacher 1998), and non-western knowledge forms. Science became seen as "the foundation of all knowledge" and the "only justifiable access to the truth" (Hindmarsh 2008: 27). The assumption that the scientist was a detached, objective observer built on and reinforced human-ecological dualism. Connole (1998: 198) described how this models "passive spectators of a given world rather than active agents in a complex one". It also objectified and mechanised ecological systems by entrenching the view that the universe was a machine that could be controlled, and promoted a reductionist approach to viewing the world that ignored its complexity, interconnectedness and emergent properties. Seeming benefits include notable technological advancement, increased understanding of the physical world, enabling conditions for industrialisation and the capitalist economic system and improved material conditions for its beneficiaries (Janse van Rensburg 2005).

Industrialisation and the modern capitalistic economic system founded on principles of unlimited growth

The emerging capitalist economic system, supported by materialistic and growth-based ideologies resulted in an expansionist western empire associated with colonisation from about the 16th century (Weiskel 1989). This expansionism gave the illusion of a vast area of unlimited resources leading to a myth of "unlimited frontiers" (Weiskel 1989: 99) and entrenched a modern view of "ineluctable, boundless" progress, and articulated since the 6th century BC that human advancement is inevitable (Glasser 2007: 42; Norgaard 1994). "Having expanded upon the things of nature, the West came to believe that expansion was in the nature of things. Perpetual growth was considered both natural and good" (Weiskel 1989: 99). Progress became linked with economic growth (Norgaard 1994), facilitated by the emerging view of nature as a machine consisting of resources to be exploited for human betterment (Massey 2013). The human:ecology dualism and ensuing anthropocentricism that had been reinforced by Descarte's philosophy encouraged the view that progress was for humans only with soulless nature as the means to this end. This orthodox view of progress has "pitted humans against nature" (Glasser 2007: 42).

The discovery of fossil hydrocarbons in the late 18th century was another important moment in defining modern human relations with the ecological world. Norgaard (1994) explained that prior to their discovery, human societies had co-evolved with ecological systems to meet energy demands. However, with the exploitation of fossil fuels, human systems were seemingly freed from the constraints of ecosystems and began to co-evolve around these non-living, non-renewable energy sources. This created the illusion of becoming increasingly free of ecosystems and "drove a wedge between the earlier co-evolution of social and ecological systems" (Norgaard 1994: 47). It also reinforced a reductionist outlook (energy needs could be met without understanding ecosystems holistically); the view that ecosystems could be controlled (it is much easier to manage hydrocarbons than complex ecological systems to meet energy needs); and ideas of progress: "with the rapid rise of industry (fueled by hydrocarbons) and transformation of agriculture during the late nineteenth and early twentieth centuries, people in the First World became almost euphoric about the possibilities of knowing and controlling nature and rationally planning their destinies" (Norgaard 1994: 45).

In the 20th century 'development' was the new term linked to progress and economic growth. It was coined in Harry Truman's inaugural presidential address in 1949 where he distinguished between developed and developing nations (Rist 2007). This expressed the idea that nations are on a trajectory of development where those

described as “undeveloped” need to catch up (Rist 2007). To achieve this, ‘undeveloped’ nations’ ideals, worldviews and economic systems were aligned with the west (Sachs 1996). This led to a rapid transformation of ‘undeveloped’ nations as many began to participate obsessively in the development race. Consequently, western values and patterns of being that promoted rapid economic accumulation to sustain ‘development’ became hegemonic.

Rist (2007: 486-487) described how ‘development’ has shaped modern perceptions of reality, where it was viewed, not as a social construct or based on a political agenda, but rather as an “indisputable” religious-like truth; “the consequence of a ‘natural’ world order that was deemed just and desirable [and] equated with life itself… which is supposed to reduce unemployment and create new jobs and well-being for all”. This need to reduce unemployment and create jobs is inherent in the very consequences of development that supports the wage economy by negatively impacting the health of local ecosystems, and thereby undermining people’s livelihoods. Sachs (1996: 240) explained that societies were no longer seen as having an economy but became an economy. This “shift to a predominately economic system involves a considerable cost: it undermines a society’s capacity to secure well-being without joining unconditionally the economic race. The unfettered hegemony of Western productivism has made it more and more impossible to take exit roads from the global racetrack”. Anderson (2010: 13) has done extensive research on the impact of ‘development’ on rural people. He provided examples of rural Madagascans and Mexicans who, a generation ago, were living valued and productive lives through subsistence agriculture but are now “starving and dying”.

Rist (2007) described the considerable value placed on development as a modern addiction and referred to Bourdieu’s (1984) term “symbolic violence” to explain this process. Symbolic violence is a concept similar to hegemony where the powerful exert their influence by naturalising a particular worldview and set of values, with the tacit consent of those negatively impacted by it. “From then on, there is no choice but to match one’s behaviours to it and thus to reinforce it” (Rist 2007: 490). Two additional thinkers who deepen understanding of symbolic power are Foucault and Thomson (1990). Foucault is well known for his work on the knowledge-power nexus. He introduced the concept ‘bio-power’ that represents the mechanism by which people are socialised into the norms of society, a process he called normalisation (Foucault 1981). These norms have a powerful influence over social constructions of reality. Thompson (1990) complements and deepens Foucault’s work by examining the relationship between meaning and power. He uses the term ideology to express this:

> the concept of ideology can be used to refer to the ways in which meaning serves, in particular circumstances, to establish and sustain relations of power which are symmetrically asymmetrical. [Ideology is thus defined] as "meaning in the service of power" [and therefore] "serves to establish and sustain relations of domination" and maintain inequality. (Thomson 1990: 7; 56)

Ideologies can also become naturalised and part of the status quo. In this thesis I combine the work of Foucault and Thompson to coin the concept normalising ideologies. This refers to symbolic representations of reality that have become integral to a social fabric and determine meaning, while maintaining the domination of the powerful.

Two important normalising ideologies in western culture, as depicted in the figure are the human:ecological dualism that has persisted since ancient Greek and Babylonian times, and anthropocentrism. These can be seen as metaphors that underpin western social-ecological relations. A third normalising ideology that has become dominant since the scientific revolution, is the mechanisation of nature, and closely related to this, is the fourth normalising concept that nature is to be controlled.

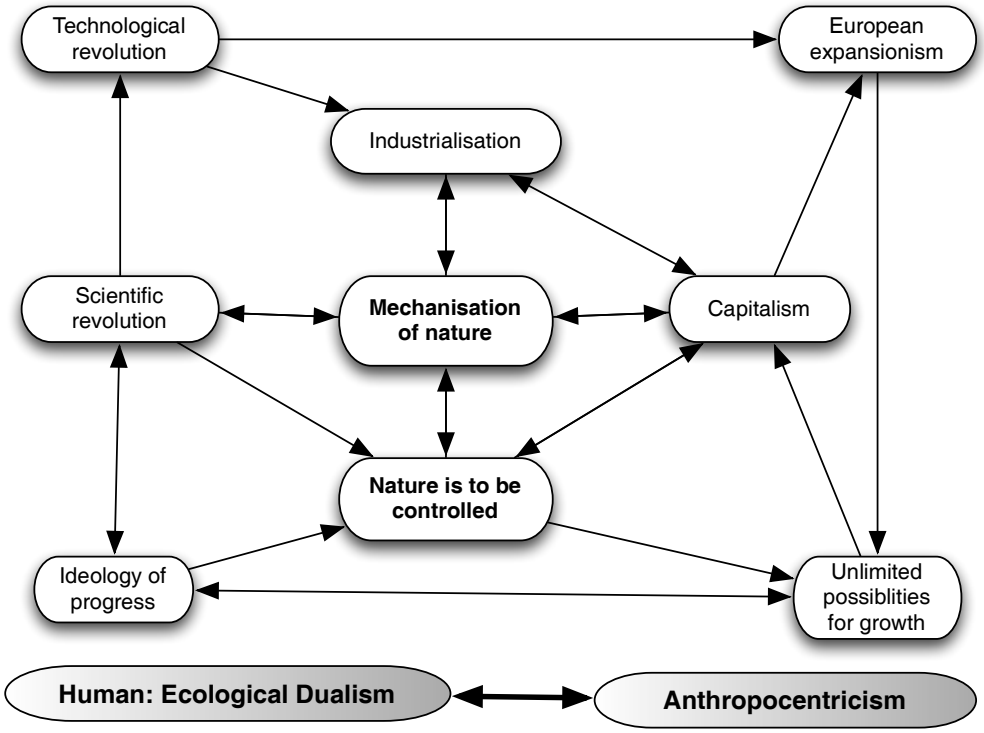


Figure 5.3: A conceptual synthesis of important drivers, events and normalising ideologies maintaining the resilience of the hegemonic modern social-ecological system. Normalising ideologies within the system are in bold – human:ecological dualism, anthropocentrism, nature is mechanised and nature is to be controlled (drawn from Weiskel 1989; Daly & Cobb 1994; Norgaard 1994; Connole 1998; Merchant 1983; Glasser 2007; Hindmarsh 2008; Abram 2010).

Three figures have been produced to synthesise this section. Figure 5.3 provides a conceptual synthesis of important reinforcing drivers, feedbacks, events and normalising ideologies that characterise the hegemonic and highly resilient western modern system.

Figure 5.4 depicts how these four normalising ideologies support each other and drive the ideology of human progress that is happening at the expense of ecological integrity. Human-ecological dualism has been particularly pervasive since ancient Babylonian culture. Figure 5.5 provides a map that indicates the influences over time that have entrenched human:ecological dualism in the hegemonic western worldview.

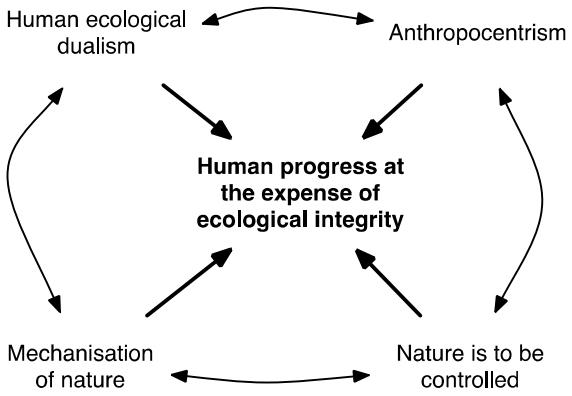


Figure 5.4: Four normalising ideologies that underpin hegemonic western social-ecological relations and promote human progress at the expense of ecological integrity (Merchant 1983; Cheney & Weston 1999; Ruether 1999; Glasser 2007; Sterling 2007; Abram 2010; Anderson 2010)

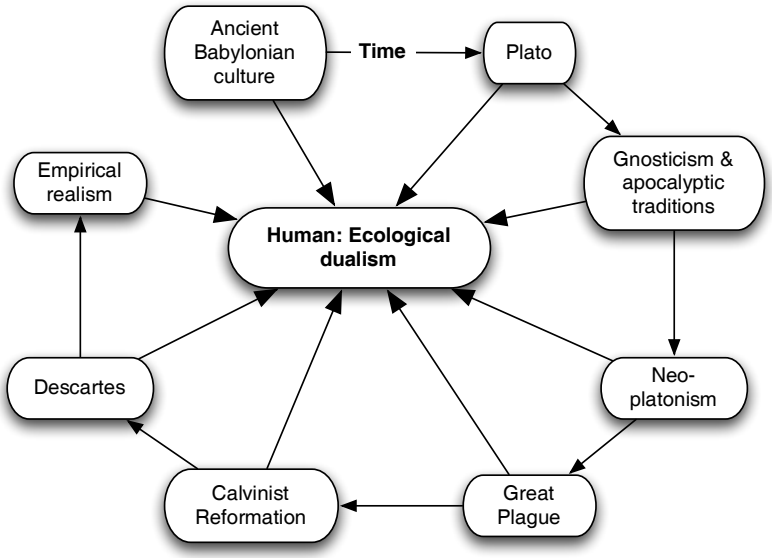


Figure 5.5: A suggestion of events reinforcing human: ecological dualism (derived from Rajotte & Breuilly 1992; Daly & Cobb 1994; Berry 1996; Ruether 1999)

5.3.8 Recent perspectives

A plethora of perspectives are gaining legitimacy and challenging the mechanistic and reductionist paradigm built on human:ecological dualisms and introducing new patterns of identifying with, types of knowledge about and agency in human-ecological systems.

Recent discourse on human-ecological relationships views humans and ecology as the same integrated system, (Berkes & Folke 1998; Posey 1999; Berkes & Folke 2002; Stepp *et al.* 2003; Plummer 2010; Sterling 2010; Folke & Gunderson 2012) leading to the concept of 'social-ecological systems' (Berkes & Folke 1998). It expresses how ecological processes have been fundamentally affected by cultural patterns of human use (Budiansky 1995; Woodgate & Redclift 1998; Folke *et al.* 2003; Folke & Gunderson 2012), including many seemingly natural ecosystems that are actually the products of human manipulation (Posey 1999; Laird 1999; Feinsinger 2001). This integrated approach challenges the fundamental belief that has dominated western philosophy, that humans are separate from ecological systems (Fairhead & Leach 1996; Folke & Gunderson 2012). I will adopt the concept social-ecological systems for the rest of this thesis although in the final discussion, I critique this concept and offer a possible alternative. However, the sense is that we presently lack the language to coin a concept that adequately expresses human-ecological systems in their diversity and totality.

There is also a growing recognition of the complexity inherent in social-ecological systems. Complexity based perspectives were profoundly influenced by quantum physics that developed from the 1900s and built on Einstein's theory of relativity; it was, for example, discovered that sub-atomic events do not obey Newton's laws and that the distinction between observer and observed is difficult to define (sub-atomic particles seemed to react to the observer's intentions) (Heisenberg 1963). This recognition supports the idea that humans are profoundly connected with ecology and challenges the ideology that one can and should control and manipulate these systems. The understanding is that cultural systems need to adapt to ecosystems, restoring a co-evolutionary perspective. It also challenges reductionist approaches to gaining knowledge, where the focus moves from building blocks to the relationships between entities (Swilling & Annecke 2012). Connole (1998: 12) sums up new understanding gained from this science: "The quantum universe is holistic rather than reductionist, organic rather than mechanistic and relative rather than absolute".

Systems thinking is a growing field that recognises the world is made up of complex systems built on sets of interdependent and interconnected elements that produce particular functions, affected by an often small set of drivers and feedback mechanisms (reinforcing and stabilising) (Capra 1999; Meadows 2008). The novel interaction of these drivers and feedback mechanisms leads to the complexity and unpredictability of system dynamics and potential for emergent properties (Swilling & Annecke 2012). It is through emergence that one can understand the importance of examining relationships between entities and the system as a whole rather than focusing only on the properties of particular elements (Mingers 2006; Mingers 2011). Systems thinking is therefore inherently holistic, challenges the reductionism underpinning classical scientific approaches and, as Golliher (1999: 445) stated, "lies at the scientific forefront of the ecological challenge to the mechanistic worldview".

5.4 Conclusion

In conclusion, human and ecological systems are now viewed as integrated and the concept of social-ecological systems was coined to express this (Berkes & Folke 1998). This challenges the human:ecological dualism that has dominated western philosophy. Social-ecological systems can be coupled to varying degrees, reflecting the extent that social systems are co-evolved to ecological realities. An argument made in this thesis is that social-ecological resilience is affected by the degree of cultural-ecological coupling. Patterns of identifying, types of knowledge and forms of agency, as expressed in culture, fundamentally influence the extent of cultural-ecological coupling.

Hegemonic western, modern patterns of identifying types of knowledge and forms of agency support the present economic system that is highly exploitative, profit orientated and obsessed by economic growth. These are underpinned by four normalising ideologies, which promote human progress at the expense of ecological health and integrity. These are human-ecological dualism, anthropocentrism, nature is mechanised and nature is to be controlled. The fact that the planet is finite indicates that the modern worldview is strongly decoupled from ecological realities and is consequently bringing about severe social and ecological harm that could lead to a global social-ecological collapse. Despite overwhelming evidence of these negative effects, the dominant western social-ecological worldview is highly resilient to change due to numerous reinforcing feedback loops that lock the system into its current form.

In the concluding discussion the synthesis of this chapter is more fully summarised to address research goal 1.

Chapter 6:
Boksburg's social-ecological system: an historical contextual analysis

6.1 Introduction

This chapter explores the history of the Boksburg municipal social-ecological system from the early 1900s until 2008, when the Schools for a Sustainable Environment (SSE) initiative began. It is a case study of a modern social-ecological system that is currently experiencing high social and biophysical risk after decades of economic growth and urban development (Beck 1992). The chapter records an historical narrative of the Boksburg Lake social-ecological system to provide the context for identifying key generative mechanisms driving the current degradation of the Boksburg Lake social-ecological system (research goal 2). This prepares the ground for chapter 7, which explores processes of learning and change within a social-ecological system at risk.

To provide context to the historical narrative, a brief overview of South Africa's modern history is first provided.

6.1.1 South Africa's modern history

Introduction

South Africa's history of social, political and economic relations has impacted considerably on social-ecological dynamics as narrated by Sparks (1990). He has been selected as the primary source for this section on South African history as he provides a critical and thorough account of ideologies underlying social-ecological system dynamics in South Africa. It is a history that vividly portrays the power of ideologies, particularly those entrenched with racism and attitudes of alienation towards people who are different, and how these shape social-ecological dynamics. These ideologies were institutionalised in Apartheid, and had particular consequences for social, political and economic relations that impacted South Africa's landscape (and soulscape).

The three main actors

Sparks (1990) identifies three main categories of social actors who each bring a unique ideology and set of values to influence South African social-ecological dynamics:

namely Africans, Afrikaners and the British. The San are not included in the discussion because, although they epitomise a society with positive social-ecological relations, they were largely destroyed as a group and have thus played a marginalised role in South Africa's modern social-ecological system.

The Nguni and Sotho/ Tswana were the two main linguistic groups of Africans who moved into South Africa. Traditionally they lived a communal and subsistence existence that expressed a deep attachment to and reliance on local place: "The land was revered in ritual, it held the bodies of the tribal ancestors, it was the concretion of the tribe itself, the thing that gave it life and substance and security and identity" (Sparks 1990: 20).

A diverse group of Dutch people, mostly from the working classes of society, arrived in South Africa in 1652 to work for the Dutch East India Company under the charge of Jan van Riebeeck. From this and successive groups arose the Afrikaner people, whose culture had been birthed and moulded by South Africa's landscape and history and influenced by notions of being a chosen people. Like many of their Protestant European counterparts they had strong ideas of being a master-race. By the 20th century a powerful Afrikaner nationalism had developed that embodied a strong attachment to, identity with and sense of entitlement to the South African landscape.

This attachment to the South African landscape, mixed with notions of being a chosen people and master class over subservient Africans, provided an influential ferment of ideologies that manifested in Apartheid. A quote from Daniel Malan, South Africa's prime minister during the 1940s, expressed some of the hubris and ideological power that fuelled Apartheid:

> Our history is the greatest masterpiece of the centuries. We hold this nationhood as our due for it was given us by the Architect of the universe. [His] aim was the formation of a new nation among the nations of the world… The last hundred years have witnessed a miracle behind which must lie a divine plan. Indeed, the history of the Afrikaner reveals a will and a determination which makes one feel that Afrikanerdom is not the work of men but the creation of God. (Sparks 1990: 31)

Apartheid was partly a safeguard for racial purity to protect this 'Afrikanerdom' from being tainted by black races, and a programme to restructure the South African social landscape so that each ethnic group maintained its identity.

Sparks (1990) has described how the Afrikaners were increasingly disconnected from European influences as they travelled from the Western Cape deeper into the interior. This is in contrast to the British who maintained strong links to Britain and consequently introduced South Africa to western modernising influences. The British have been the mainstays of the economy and the capitalist ideology. Their attitudes towards the land have been much more exploitative than either the Africans or Afrikaners and they expressed a desire to conquer rather than to live with the land. A characteristic quote, stated by John Mitford Bowker, one of the British Settler leaders, expressed the attitude of the British settlers as they planned to expand their territory over the Fish River, soon after their arrival in the 1820s.

> The days when our plains were covered with tens of thousands of springboks; they are gone now and who regrets it? ... Their place is occupied with tens of thousands of merino… I begin to think that he too [the Xhosa] must give place, and why not? Is it just that a few thousands of ruthless worthless savages are to sit like a nightmare upon a land that would support millions of civilized men happily? (Sparks 1990: 64)

Modernity and Apartheid

The discovery of gold and diamonds in the late 19th century catapulted South Africa, and particularly the former Transvaal (in which Gauteng Province and Boksburg City are now located) (see figure 3.1) into the throes of modern forces with economic relations built on capitalism and industrialisation. Sparks (1990: 119) described this as the "watershed event in South African history. Overnight it turned a pastoral community into an industrial one". The speed at which South Africa became a modern state was breathtaking, compressed into about 50 years between the discovery of diamonds in 1867 and the First World War.

Gold (discovered in about 1884 on the Witwatersrand, a 56km long escarpment in the Gauteng Province) was deep in the ground and could only be extracted economically with a large pool of cheap labour. This, coupled with the earlier demand for cheap labour required for diamond mining, was a source of Apartheid's exploitative roots where it became economically expedient to create a social class forced to accept a wage just meeting subsistence needs. The Land Act of 1913 established by the British was the means of achieving this: by making it illegal for black people to own land outside designated reserves, many people were evicted from the land. This forced a large population of Africans to become part of the "captive labour pool" where they were paid meagre wages in unskilled mining jobs (Sparks 1990: 141). Olive Schreiner, a South African Nobel Laureate, vividly portrayed the horror of this:

> If, blinded by the gain of the moment, we see nothing in our dark man but a vast engine of labour; if to us he is not a man, but only a tool; if dispossessed entirely of the land for which he now shows that large aptitude for peasant proprietorship for the lack of which among their masses many great nations are decaying; if we force him permanently in his millions into the locations and compounds and slums of our cities… if, uninstructed in the highest forms of labour, without the rights of citizenship, his own social organisation broken up, without our having aided him to participate in our own; if … we reduce this vast mass to the condition of a great, seething, ignorant proletariat – then I would rather draw a veil over the future of this land. (Schreiner 1960, in Sparks 1990: 141)

The reference to the proletariat is apt: black Africans were reduced either to a cheap labour force or the 'industrial reserve army' (Marx 1849), a group of chronically unemployed people who would keep the minimum wage low and thereby fuel capitalism, industrialisation and economic growth.

Consequences

Apartheid has had devastating consequences, both on South Africa's social landscape, where it has, for example, institutionalised black poverty (Khan 2002) and its ecological landscape. Sparks (1990: 168) has described some of these consequences:

> [It] would uproot millions of people, split families, demolish homes, shatter whole communities, and ravage people's lives in an incredible attempt to reverse the integrating forces of South Africa's industrial revolution and divide its people of various races, colours, and tribes into separate "nations" – according to 'God's natural law'. Thus did reality begin to perish in South Africa and its inhumanity get underway behind a cloak of righteousness.

Apartheid divided the landscape up according to race, creating zones of severe poverty where Africans were forced to live before Apartheid's demise. Sprawling townships and illegal squatter settlements were (and remain) evident in every town and city and are places characterised by social ills (for example, crime, vandalism, a lack of services) and ecological ills (for example, air and water pollution, soil degradation and loss of biological diversity) (Durning 1990).

The speed of industrialisation, particularly in what is now called Gauteng, has resulted in the sprawling nature of industrial cities such as Johannesburg and its satellites, like Boksburg, located in Gauteng Province, where development has been haphazard and unrestrained. Industrialisation has also been accompanied by environmental risks that typify modern society. Johannesburg, South Africa's glittering city of modernity and

heart of industrialisation, and its surrounding centres, including Boksburg, are facing a number of severe environmental risks and degradations. These include acid mine drainage from the disused gold mines, acute water pollution, wetland destruction, and loss of biodiversity and ecosystem functioning (Durning 1990; McCarthy 2011).

The remaining structure of the chapter is as follows:

- An overview of the methodological framework with a more detailed explanation of the process of data analysis.
- Representation of the empirical data under four main categories: Boksburg's economic and developmental trajectory; Boksburg's environmental deterioration; civil groups and their action campaigns; Boksburg Lake.
- A discussion based on five analytical statements emerging from the data.
- The conclusion.

6.2 Methodological overview

The methodological framework was discussed in detail in section 4.2. This overview highlights the two methodologies and method used to develop a historical contextual analysis of the Boksburg Lake social-ecological system to probe for generative mechanisms supporting its degradation (research goal 2). A more detailed explanation of the analytical process is then provided.

A case study approach (Bassey 1999; Gillham 2000) guided the historical contextual analysis while a critical methodology (Horkheimer 1972) was used to identify and critique the degrading processes at play. Document analysis of the *Boksburg Advertiser* archives was the method used to generate data (Nachmias & Nachmias 1990). Refer to sections 4.2.2, 4.2.4 and 4.3.4 respectively for more detail on these two methodologies and method.

The analytical process was as follows. All applicable articles and extracts from the *Boksburg Advertiser* archives were ordered and collated into four categories: biophysical, economic, political and social. These categorised documents were read to identify concepts, which emerged as: 1) the economic and developmental trajectory of Boksburg (that drew on data from the initial economic, social and political categories); 2) environmental deterioration in the system (that drew on data from the initial biophysical category); 3) civic responses to biophysical risk (that drew on data from the initial social and political categories); and 4) the story of Boksburg Lake (that drew on data from the initial biophysical, economic, social and political categories). Each

concept was then sorted according to the following two themes: historically applicable events and structures of signification. These themes were selected to 1) develop an historical timeline that would guide the write up of an historical narrative, and 2) to probe the symbols (Bourdieu 1984; Westley *et al.* 2002), metaphors (Lakoff & Johnson 1980) and normalising ideologies (Foucault 1981; Thompson 1990) that were influencing the Boksburg Lake social-ecological dynamics. The RRREIC schema was then followed as explained in section 4.4.4.

This process of data collection, analysis and drawing on a variety of theories for interpretive power is consistent with my meta-philosophical framework based on Critical Realism (see section 2.3 for detail on this framework).

The chapter now moves to the data representation.

6.3 Results

6.3.1 An historical overview of Boksburg's economic and developmental trajectory

Boksburg was established in 1886 with the discovery of gold and coal. It was the same year that gold was discovered in Johannesburg thereby making these two cities the same age. The East Rand Proprietary Mines (ERPM) gold mine was developed and became the backbone of Boksburg's economy. Its significance is indicated in a 1970 article where it is described as one of the largest gold mines in the world: its Hercules shaft system was the deepest (3 428 metres below surface) and its Cason Dump the highest (about 113 metres and visible at a distance of 20 kilometres). In 1946, at a meeting of the chamber of mines, President McLeans expressed the value of gold and the attitude that it must therefore be mined:

> *Gold bearing ore, like any other form of mineral wealth is a valuable asset only if it is worked. Left in the ground it is merely a wasted asset. The greater the tonnage of gold-bearing ore that can be mined and treated by the industry, the greater will the value of the industry be to the community as a whole. It is for the government to see that the country's deep-hidden assets are not wasted by a fiscal policy which serves to kill enterprise*. (April 5, 1946)

An assumption expressed is that the more gold is mined, the more the community benefits. No consideration is expressed of possible negative consequences, such as the environmental impacts of mining.

In the early 1900s the mining economy faced a dilemma. There was considerable potential to mine valuable resources, but it required a cheap and large labour force. However, "*natives*" were not choosing to move to the Vaal and a largely racist white population felt it was beneath them to work for "*starvation rates*". Two representative quotes from the 1903 and 1904 archives express this dilemma:

> *Underneath our feet is an almost untold wealth of gold, but as things are at present it might just as well be at Timbuctoo for any good it is to us. Yet the capital to develop the properties is at hand, the necessary white labour is here or within easy reach, and all that is wanted is unskilled natives or Asiatics to do the rough work. The natives cannot be obtained and what is worse, everything points to greater scarcity in the future. We are at close grips with poverty, and when that condition is reached theories and fads as to what might be done in some distant future do not appeal to the ordinary man. We want prosperity, and we know that unless we go outside Africa for the labour, we shall have in its stead ruin.* (December 19, 1903)

> *It is all very well for people at a distance to tell us that all will come right if we only give time to the natives to grow, or import white men at starvation wages.* (January 2, 1904)

These quotes indicate that Boksburg's mining economy was explicitly built on the foundation of social exploitation and would probably have been otherwise uneconomical. In these early years of Boksburg's history, white racism, the need to preserve one's culture and maintain power was explicitly expressed. During 1903 and 1904, the Asiatics, who made up a notable part of the population, experienced the brunt of white racism. They were called "*coolies*", "*filthy*" and in one article described as "*specimens of humanity*" (October 3, 1903). In later articles it became apparent that part of the racial tension arose from needing a cheap and abundant labour force to work on the mines, while having to maintain white supremacy and purity: 'Natives', Asiatics and Chinese were seen as second- and third-rate citizens. The *Boksburg Advertiser* reports on a public meeting held in November 1903 where discussions indicated that white people feared the economic advantage Asiatics would obtain if they were not controlled: "*it was not really a question of equity, but of self preservation*". The expressed fear was that if Asiatics were unrestricted, they would take over the country. In another article from the December 5, 1903 edition, it was apparent that the less profitable mines were threatened with closure because they lacked available labour. An option was to bring in unskilled Chinese labourers with the proposed proviso that it would be a criminal offence to employ a Chinese person in any capacity other than an unskilled mine worker. The fear of non-whites becoming skilled and consequently

posing a threat to white dominance was expressed. Economic goals and ideologies of racial purity and supremacy were therefore closely interlinked and, for a while, pitted against each other. The question was which would win? In the end Apartheid helped ensure that both ideology and economics won.

For the first thirty years Boksburg was predominantly a mining town surrounded by agricultural activities. World War I brought industrialisation and significant changes to the town's character adding, for the first time, another economic activity apart from mining and agriculture. This was consolidated in World War II as imports from England were scarce. This encouraged local economic activity and growth. Boksburg and neighbouring Benoni were the main foci and within a decade, Boksburg grew from a small town to one of South Africa's biggest industrial sites.

By the 1960s industry had replaced mining as the main economic activity: "*The biggest role in Boksburg's new-found status has been played by the industries.* ***Giant, sprawling*** *factories – many of them national concerns – are pumping new life – and income – into the town*" (January 8, 1960, my emphasis). These factories were described as enormous, spreading across the town in an irregular and untidy way. In 2013 this would probably be seen as a negative thing, but in 1960 the description was positive: the factories were "*pumping new life*" into the town and therefore had high, expressed value to local people. These industries brought rapid development, which was welcomed wholeheartedly. An article from January 8, 1960 (my emphasis) stated:

> *It looks like another go-ahead year for Boksburg as it enters 1960 with a year of surging development in many fields behind it. It now stands poised on the brink of solid, substantial expansion which will do much to push the town ahead of its* ***Reef rivals*** *and* ***finally silence*** *the* ***sneer*** *of* ***sleepy dorp*** *being* ***thrown*** *at it.*

This quote is representative of many that express the disdain local people felt towards Boksburg being a sleepy, small and unfashionable place. What was valued was being the biggest and best; a competitive spirit towards "*rival*" towns on the reef comes through in many of the articles.

In the 1970s rapid expansion continued to be celebrated, with strong values for economic growth and the importance of being the biggest and best, explicitly expressed. It is recorded with pride that Boksburg had become the third largest town on the reef; in 1969 only Johannesburg, Pretoria and Germiston had approved more building plans and it was described as an "*industrial giant*" (April 19, 1971). A large part of Boksburg's identity was therefore based on being one of South Africa's biggest

industrial hubs of economic growth. The ERPM gold mine was still in operation and a new shaft had recently been built. This was a clear indication of the mine's economic viability. An article from January 2, 1970 titled: "*Today Boksburg and the ERPM are synonymous*" expressed how Boksburg's identity was wrapped up in the mine. During 1970 a clear vision of becoming a city was also expressed, which finally materialised in 1992.

The emphasis on growth continued into the 1980s: "*It is the town council's hope that Boksburg will grow as fast during 1980 as it did in 1979*" (January 4, 1980). At the time this was regarded as an entirely positive thing, as the following front-page article implies: "*Plans in pipeline for faster growth of Boksburg: The rapid growth and expansion in Boksburg during the past year, and plans for further improvements, could turn the town into one of the most important areas on the East Rand"* (February 15, 1980). The value of this is expressed in the May 2 edition of the *Boksburg Advertiser*: "*From dull, drab and dreary dorp to a bright, brisk and breezy metropolis – that's the story of Boksburg*". The stigma of Boksburg being a 'sleepy dorp town' continued to be expressed. The explicit aim has been to throw this off by becoming one of South Africa's economic giants.

In 1980 a building boom was in the pipeline as the council had approved plans to the value of almost R66.5m, more than double that of the previous year (Nov 29, 1980). In August 1980 there was also an article about ERPM being turned into a super mine through a R300 million investment (August 22, 1980). Councillor Smith compared the mine to the goose that "*lays the golden egg*" and it was stated that this would catapult Boksburg into city status. The M.P.C. Mr. Galloway tempered this enthusiasm by saying that "*Development for the sake of development is not always advisable as it could influence the way of life of local residents. It is no good getting enthusiastic if there is a chance of being disappointed with the eventual results of these developments*".

This tempered attitude did little to limit the development that happened throughout the 1990s. Article after article triumphantly celebrates the continued expansion of Boksburg. The following are typical headlines in the *Boksburg Advertiser*: "*Boksburg will boom. Industrial giant raring to go"* (February 22, 1991); "*Gear up for growth*" (May 10, 1991); "*Boksburg is growing*" (January 24, 1992); "*Boksburg attracts mega investments*" (June 19, 1992); "*City is a giant in the making*" (June 18, 1993); "*City is booming*" (March 11, 1994); "*Boksburg is geared for industrial expansion"* (June 26, 1995); "*Its boom time in Boksburg*" (May 31, 1996); "*Boksburg is still growing*"

(November 21, 1997); "*East Rand growth, development and transport to sparkle*" (July 24, 1998).

On January 12, 1990 Mr. Coetzee, the Town Clerk, outlined a number of development plans for the year and ended with the following: "*I would like to wish every inhabitant of Boksburg a prosperous 1990, and may we all work together for a bigger and brighter town*". In this representative quote, wealth, size and brightness are valued and equated with each other. These themes continued in 1991 with a focus on the city status soon to be achieved; the headline of a front-page article on this theme stated: "*On the threshold of a dream*" (April 5, 1991).

The main focus of 1992 was the newly built R150 million East Rand Mall (ERM) that was officially opened on March 19 with a day-long carnival. An article from the March 27 edition described how "*excited customers prepare to 'storm' the complex after the ribbon cutting ceremony*". It was described as "*our pride and joy*" by the Boksburg Mayor; as "*spectacular*"; a "*beautiful complex*"; "*un-paralleled in South Africa*"; and rising "*majestically*" out of the investors' children's former playground (March 20, 1992). In 2012 a member of the Boksburg Lake Forum was questioned whether, in retrospect, the ERM has been a good or bad thing. In reply he said,

> *It has been a good thing [as] its put Boksburg on the map. I would go as far as to say it is the commercial centre of Ekurhuleni. And it has led to a lot of adjacent development of town houses, as much as that carries with it the infrastructural problems I was mentioning before… Before this people from Benoni would say you live where? One wouldn't want to shop in Boksburg. It was seen as third rate. So people are no longer ashamed to say they live in Boksburg.*

It is notable that it took a sophisticated shopping experience for people to feel proud to call Boksburg their home, pointing to the high value placed on consumerism.

The ERM soon became Boksburg's social and commercial centre and by April there were articles about the Central Business District (CBD) entering a period of decline. By July an article titled "*CBD is dying*" described how shops in the CBD have to now unsuccessfully compete with the East Rand Mall. Another theme of 1992 was Boksburg finally achieving city status in October. This was celebrated by a "*mammoth, fun-filled festival for everyone at the [Boksburg] lake*" (October 16, 1992).

By 1993 it was becoming apparent that the ERM could have negative economic effects, not only on the CBD but other nearby cities. In an article titled "*Boksburg will*

dominate the East Rand", Councillor Wolmarans predicted that the East Rand Mall would double in size making it the biggest mall in the Southern Hemisphere: "*It will undoubtedly harm neighbouring cities and they will protest, but I cannot see them stopping this development*", he stated. In the same talk he also predicted, "*Boksburg will undergo tremendous development in the next seven years – to the detriment of other East Rand cities and towns*". This value of unrestrained domination continued to be expressed in disgruntled articles about the numerous objections made by the Benoni City Council to development around the East Rand Mall. Boksburg's mayor, Councillor Ferreira, is quoted as saying, "*Lay off Boksburg*" in reference to these objections (February 19, 1993), while the former mayor stated, "*Hundreds of Boksburg residents could be deprived of employment to safe-guard Benoni's lakeside development – which may never materialise! And that's not all, they could also be denied the opportunity of buying low-cost clothing and appliances at factory shops*". In addition to the rival attitude towards Benoni, this quote also expresses a high value placed on consumerism. An article from March 1995 discussed the extensions that will happen in the East Rand Mall; Joe Bentel (the prime developer) stated "*Once completed the strength and magnitude of this complex does not warrant the development of a further retail regional shopping centre – more particularly, Benoni Lake*". The spirit of competition and lack of regard for nearby cities' economic welfare was clearly expressed.

Back to 1993, where an article from the June 18 edition stated that the City Council had approved building plans valued at R30.1M for May, almost three times that approved in the previous month. This was only the beginning of the development boom in Boksburg, according to Councillor Beyers de Klerk. He was quoted as saying: "*This city is on fire. It is the only municipality on the East Rand with a positive growth*". Once again the competitive value comes through strongly. The value placed on development and economic growth is clearly expressed in an article written for the November 5 edition. Boksburg is described as the ideal because of all the economic advantages it presents:

> *In the vibrant, high potential South Africa, the City of Boksburg, a major centre in the industrialised region of the Transvaal, provides the far sighted investor with all the advantages of established, sophisticated infrastructure, a strategic geographical location, historical growth, modern outlook, advantageous financial opportunities, transport and labour access and strategic planning for urban growth. Boksburg is truly closest to ideal.*

Another important event in 1993 was that the "*Grand Old Lady*" of Boksburg, the ERPM mine, celebrated its centenary of 100 years of non-stop production. Its production of over 1.4 million kg of gold was described as a "*golden harvest*". This "*has added considerably to the country's economic stability and, needless to say, played a major role in Boksburg's progress and its achieving city status in September, last year*" (February 26, 1993). The mine has been a celebrated and highly valued feature of Boksburg, often linked to its identity. This is largely because of the economic benefits it has brought. When its Cason mine dump, that dominated the skyline, was going to be removed, a reporter interviewed a number of people. Interestingly, all interviewees said that they would miss it. For example, Merle of Boksburg East stated, "*It will be very sad, because Cason mine dump is a part of Boksburg, particularly for people like me, as I have lived in Boksburg all my life*" (February 7, 1997).

Throughout 1995, 1996 and into 1997 large development projects were approved and Boksburg continued to expand at a rapid rate. An interesting article from the June 16, 1995 edition describes how "*Boksburg East, Lilianton and Anderbolt are almost totally developed, but there are still ample vacant industrial stands in Jet Park, Hughes, Bartlett and Mapleton"*. The use of the word vacant is noteworthy, expressing the perceived value of this land. Synonyms for vacant include 'uninhabited' and 'empty' implying a lack of recognition that this land would have been inhabited by an ecology.

In 1996 there was an interesting shift in attitudes towards development. Boksburg's town council planning department and a town planning firm organised a workshop for all interested parties to discuss how to guide the city's growth over the next ten years "*in such a way that its inhabitants – the poor and the rich – will benefit"* (February 16, 1996). One week prior to this, a letter had been written to the editor that summed up many of the issues being faced at the time:

> *Prior to the 1940 period in our town's history, we were regarded essentially as a residential town, a virtual dormitory town. Subsequent to that time, the necessity arose to establish industries and the like. It was accepted in the interests of progress, but not at the expense of homes and residences already so well established. Rezoning – to give it its official title – has got quite out of hand and former purely residential areas are becoming hotch-potch developments with little or no concern for aesthetics, the ecology, the environment or what have you. Vested financial interest, massive profits, massive and quick returns now seem to be the order of the day.* (February 9, 1996)

What is noteworthy is the reference to unrestrained development in the name of "*vested financial interest"* and *"massive profits*" and the associated negative social and ecological impacts.

The last year where the development and growth of Boksburg dominated the local newspaper's headlines was 1997. In the March 21 edition, the North Rand Road, a main commercial hub in Boksburg and the site of the East Rand Mall, was described as the "*fastest growing commercial area of Gauteng*". On May 2, an article described how "*the value of building plans in the city is soaring*". However, in spite of this, an article titled "*Growth and revival is needed on the East Rand*" appeared in the June 13 edition explaining that industrial growth in the region was stagnating. The Mayor, Eric Xayiya, was quoted as saying: "*This is the heartbeat of the country and, therefore, we need to make sure it survives... The revival of the East Rand will mean not only the survival of the province, but also that of the country*". To describe the area as the heartbeat of the country is telling. It indicates a belief that the growth of the East Rand was essential to the country's well-being and therefore justified an insatiable hunger for economic growth. This hunger for growth is expressed in the August 22 edition: "*Boksburg is going all out to market the city and to promote economic growth. So committed is it to this project, that it has hired a firm of conference organisers to plan a major five-day event in March, 1998, to showcase Boksburg and its investment potential*".

There were few articles on development and growth in 1998. The focus was beginning to move to the social and environmental ills in the city and the emerging activist response. By 1999 the city was facing financial problems and there is a June 26 article titled "*City may go broke*" due to a R136 million debt owed to Eskom. This was in spite of all the economic growth and development that had preceeded this year. The other big event of 1999 was news that the ERPM mine was closing down, which happened in July 1999. This led to many social and environmental challenges. The three main ones were the consequent unemployment of a notable segment of the population; the threat of acid mine drainage due to the unpumped groundwater flooding the mine shafts and oxidising metal sulphides exposed through mining; and the dust clouds due to the neglect of the regular procedure of wetting the dumps.

In 2000 there is continued concern about the lack of growth in the area and on June 2, an article reported that 300 businesses had left Boksburg in the past year, largely due to increasing crime. In a July 14th edition, the mayor warned that the East Rand was facing a serious decline in industry due to a lack of growth.

Throughout 2001, 2002, 2006, 2007, 2009 and 2011 there were none or few articles on development. In 2008 the growth of the economy was again highlighted and described as "*vital*". At a council meeting Councillor Mekgwe stated that the metro had experienced an economic growth increase from 1% to 2,7% between 1996 and 2000 (November 21, 2008). In spite of all this growth, unemployment and social problems had increased.

This section has indicated that throughout Boksburg's history, values of economic growth, progress, expansion and competition were at the heart of and fundamental to Boksburg's identity and aspirations. The chapter moves on to explore the increasing environmental deterioration in Boksburg that paralleled its economic and developmental trajectory.

6.3.2 An historical overview of environmental decline

The general condition of the environment experienced a steady decline over the years, but only began to dominate the news in the late 1990s and 2000s.

The first noteworthy mention of environmental degradation was in October 23, 1970 where pollution of the municipal drainage network by industrial effluent had increased to such an extent that available staff could not cope with the problem. The next recorded mention of environmental issues was in June 6, 1990, more than twenty years later, where there were a number of water quality issues concerning both tap water and the dams. However, Dries Louw, the chief chemist on the Boksburg town council, dispelled the then-current concerns: "*Boksburgers can rest assured – the town's drinking water is safe, and chemical pollution in dams and streams is not a cause for concern*". He downplayed the threat of chemical pollution and explained away the lack of life in Cinderella Dam as being caused by the water having a high salt content, with a pH lower than 2. He went on to explain that water leaching through gold mines picks up the heavy minerals that are released. In spite of dismissing concerns he said that the dam's water should not be drunk, nor should it be used for recreational purposes. In 1990 there was also an article reflecting the problem of solid waste dumping.

An article from the May 21, 1993 edition reports a statement by Councillor Steyn when he chaired a meeting for the Boksburg Open Space Systems (BOSS): "*Urbanisation, inner city decay, squatting and decades of environmental abuse have presented modern Boksburg with a problem that has to be eradicated as soon as possible*".

In December 1995 the issues around Cinderella Vlei surfaced, where dumping on this natural asset and plans to build on it were the focus of vehement protests (described in detail in section 6.3.3). Articles on the deterioration of parks and public spaces began to appear in 1996. Reiger Park was the first to be in the press, where its "*beautiful, spacious park*" and Cinderella Dam were becoming dangerous and unsightly places (March 29, 1996). An article from the March 29 edition highlighted the problems of rubbish and the park being used as a shooting range and sex spot, while rotting dog carcasses could be found on the rubbish dump bordering the park. In 1997, 1998, 1999, 2008 and 2009 letters about the deterioration of aesthetics and the growing pollution and filth in Boksburg appear: "*Why is our city such a mess?*" (December 19, 2008); "*Once upon a time the town was clean*" (April 4, 2008); and "*Resident vexed over deteriorating Boksburg*" (January 23, 2009). Rolfe's Pan, a natural haven in the industrial area of Jet Park, was in the news for the pressure it was experiencing from illegal angling and industrial pollution that continued into 1998.

In 1999 ERPM's closure posed considerable environmental threats. There was the threat of polluted waters entering the watercourses and causing flooding because the mine water would no longer be pumped. The most immediate problem, however, was the dust clouds caused because ERPM was no longer wetting the dump. This continued to be a serious issue until late 2000. It threatened the closure of a school and angry Reiger Park residents became so exasperated with the incessant dust clouds that they were ready to take ERPM to court and organise an embargo on gold. In November 1999 a photo of Reiger Park protestors appeared with the following caption: "*Reiger Park residents protested against the mine engulfing their homes and schools*". Placards read: "*Action against mines who poison our children*" and "*We demand a clean environment*". Reiger Park and ERPM were again in the news in May 2001, this time over polluted water that was coming out of the Elsburg sludge recycling complex. The water was highly acidic, dark orange in colour, and threatened to flow into Cinderella Dam. The contaminated environment showed no sign of bird life and the trees and other plants were dead. This problem continued into 2008, when an article described how the "*residents of Reiger Park are still up in arms over ERPM's slime spills that run down their streets. According to ward councilor Douglas Scholtz, the poisonous spills have been a problem for decades now*" (July 11, 2008).

Illegal dumping, litter and a lack of refuse service delivery were growing problems that dominated the environmental headlines in 2001, 2002, 2007 and 2009: "*illegal dumping sites are becoming an all too familiar face in Boksburg"* (March 16, 2001); "*Residents fuming over dumping*" (July 6, 2001); "*The trashiest in Gauteng*" (March 8, 2002); "*Boksburg becomes a litter dump*" (May 17, 2002); "*Residents are outraged at*

the increasing amount of illegal dumping rearing its head around town" (June 1, 2007); and "*Reiger Park is drowning in refuse*" (January 23, 2009).

Witfield Dam, a valued recreational site, was also in the press for negative reasons: "*Witfield Dam has for some time, held the title of one of the city's well-kept public parks, but recent findings indicate that this once pristine recreational facility will soon be on a par with Boksburg Lake when it comes to being filthy*" (February 6, 2009). Writers complained about vagrants, inebriated youths and even goose remains that were found there. The degradation and destruction of wetlands was another environmental issue that dominated the late 2000s. Anne Mearns, who received the UN Environmental Global 500 Role of Honour award, explained that development and pollution has destroyed the wetlands of Boksburg (October 17, 2008). Illegal dumping on wetlands was another major concern.

This section has examined the growing environmental deterioration that was reported in the *Boksburg Advertiser*. Deterioration had a particularly negative impact on public areas and water bodies. Wetlands were heavily targeted for development purposes. Much of the civic action campaigns, discussed in the following section, were a response to the plight of wetlands in Boksburg.

6.3.3 An historical overview of Boksburg's civic groups and their action campaigns

Running parallel to the environmental decline was a growing civic response. Numerous action campaigns were organised by a wide spectrum of role players that cut across age, race, class and occupation and involved both individuals and groups of people as agents of change.

The first recorded civic response to environmental issues was reported in 1980 in the December 5 edition and involved an organised clean up of Reiger Park. Throughout the 1990s and 2000s, Reiger Park was the target of many such clean-ups with different organisations forming to address the illegal dumping and litter that was rife in the community. In 1990 the Live Clean Committee was set up with the explicit goal of keeping Reiger Park spotless through involving the community in organised clean-ups. In 1994 a new organisation came into being, called the Boksburg Environmental Awareness Campaign committee, which coordinated another large clean-up in Reiger Park. On May 16, 1997 there was an article titled "*Reiger Park residents declare war on illegal dumping*", which was led by a new civic group called the Reiger Park Environmental Awareness Committee. A letter written on behalf of this organisation

thanked the public for their involvement: "*We sincerely appreciate your co-operation and concern for our environment… We wish to appeal to all those who value, love and appreciate cleanliness, to assist by encouraging all the others to please keep our suburb clean*". In this quote the value of a clean environment is explicitly stated. In 2001 yet another group was initiated, called Simunye, to address the continual problems of illegal dumping and litter in Reiger Park. They managed to involve 40 local people in a clean-up operation that removed 80 tons of rubbish.

Throughout the early 1990s articles refer to recycling initiatives led by Pick n Pay. Their environmental focus was to set up environmental centres in all their stores. Other businesses also took up the challenge of the growing environmental degradation. For example, Avlock International, a company based in one of Boksburg's industrial zones, began a regular clean-up initiative in 2002. The managing director explained that:

> *This industrialist area, like many others in Boksburg, is suffering from increasing neglect by the council… Rather than campaign, we at Avlock decided to devote 30 minutes each Friday morning to cleaning along Paul Smit and Kent streets. The programme is entirely voluntary and is open to all the company's 130 employees, except for certain key staff. Some 30-40 volunteers assemble each Friday morning.*

Throughout the 1990s and 2000s action groups were mobilised around the deteriorating water bodies. 'Friends of Rolfes Pan' was established in 1993. It consisted of five friends who would meet on a monthly basis to preserve this natural wetland. BOSS (Boksburg Open Space System) was also established in 1993 with the aim of bringing nature back into urban spaces. In 1995 the Cinderella Vlei Action Committee was regularly in the headlines for their fight to protect Cinderella Vlei from unscrupulous development. This is described in detail at the end of the section and explores the confrontation between role players and the different values that were expressed in this campaign. In 2006, Nicole Barlow, a vehement and well-known local environmental campaigner finally won a strongly contested legal battle with Sasol that halted the development of a fuel station on Libradene wetland. She continued to play an active role throughout the 2000s, speaking out against development projects that threatened the environment. This continued involvement was encouraged by the battle she had won for Libradene. She was quoted as saying:

> *The fact that we have made so much progress in the fight against the development of this wetland has inspired us to take the fight to other areas currently under threat from*

> *development in the Ekurhuleni region… Developers in the Ekurhuleni area will not bat an eye to develop a wetland to make millions for their company.* (February 24, 2006)
>
> *We have learned that if you exercise your rights maturely and conduct yourself peacefully and within the law, with a bit of patience and perseverance, you can win the battle between greed and the protection of the environment… We will not stop this fight and have decided, as ECA, to exercise what we have learned to benefit other areas which we believe are under threat. This judgment has provided us with the proof that we have more than just a right to say something – now we can do something.* (May 26, 2006)

These quotes express the momentum that builds when a change agent wins a battle: it gives a sense of empowerment and belief that more can change. The outcome of this battle for Libradene wetland inspired others, provided an example that the "*environmental underdog*" can win and expressed a recognition that the power dynamics between developers and environmentalists may be shifting: "*But now we have an example that developers do not have the last say on the use of land*". Two people wrote to the editor on separate occasions expressing these sentiments:

> *I would like to respond to the Advertiser's most recent article about the ongoing fight between the developers of a filling station in a wetland area and the Libradene Wetland Association. The courageous and principled efforts of Nicole Barlow and the LWA prevented massive potential damage, not only to the ecology of the Libradene Wetland, but as geographical evidence has shown, also to the greater Vaal River System. To these two parties specifically I say "Take heart!"* (February 3, 2006)
>
> *I was very impressed when I read the story of Nicole Barlow and her fight to prevent a petrol station in a wetland in Boksburg. It was nice to see the environmental underdog win for a change… For too long there has been a rush of unrestrained development, with too little thought for the consequences. But now that we have an example that developers do not have the last say on the use of land, one hopes that many other responsible people will copy it.* (June 2, 2006)

During my conversations with local residents about the environmental education initiative I was catalysing, many referred to this environmental success story.

Children's groups were also involved in the action. In 1997 there was an article about Brownies adopting Cinderella Vlei as one of their projects and in 1998 Busy Bees pre-school cleaned up a vlei near their school. An inspiring article from the November 2, 2007 edition focused on two local boys who undertook daily clean-ups in their neighbourhood. As one of the boys said: "*It's just a great feeling to do something good*

and we encourage other young people to get involved in similar projects in their communities". Another inspiring 2009 story, this time involving women, featured a picture of a woman with a lawnmower and had the following caption: "*These women from the Libradene Village have taken it upon themselves to make a difference by cleaning up the Issie Kramer Park*" (November 27, 2009).

This section concludes with a case study that portrays the power dynamics and values expressed by developers and environmental activists around Cinderella Vlei.

Cinderella Vlei: A case study of power dynamics and values expressed by developers and environmental activists

In 1995 there was a series of articles on a conflict of interests around Cinderella Vlei that ran over a couple of months. This case provides a clear example of power dynamics between different groups of people and how particular values retain or challenge existing hegemonies.

The first article on this case appears in the December 15, 2005 edition of the *Boksburg Advertiser*, titled "*Residents go all out to save vlei*". The point of contention was around Cinderella Vlei that consists of a number of wetlands. An office block developer had begun to dump rubble on the vlei as landfill. Two residents responded strongly to this and formed the Cinderella Vlei Action Committee (CVAC) to resist the proposed development. A member of the committee was quoted as saying "*I'll do whatever it takes to fight the development*" and referred to a reed bed filled with red bishop birds, which the development would destroy. The developer, in contrast, argued that this kind of development was preferable to "*squatters*" implying that they inhabit open land.

The CVAC held an open meeting for anyone wanting to join the fight and started a petition. In February they manned tables at shopping centres, with a description of the proposed development and photographs of a similar office block. The petition was a success with over 2 000 signatures. Some people, however, were reluctant to sign as the vlei was being used as a toilet and they were unhappy with the smell, supporting the notion that development was preferable to squatters.

In the February 2, 1996 edition of the *Boksburg Advertiser* there is a poem written by one of the CVAC members titled 'Save the Vlei' that expresses determination and passion to protect the vlei. Below is an extract of the poem that indicates the value of

retaining biodiversity and ecological integrity and recognition that society is driven by values of domination, power and greed.

"*It may not be an 'eye sore'*
But the "food chain" has been hurt!
The goggos, the owls, the birds, the frogs
That rely on each other for life,
Have all been affected by man's awful greed –
Yes, men have power and corruption is rife!
Boksburg is well-known
Both here and abroad –
Not for anything we're proud of
But for playing 'over-lord'!"

The developer responded to the CVAG by suggesting that if "*they want the vlei that badly*" they should buy it from him at a market related price (February 16, 1996). This indicates a power dynamic driven by economics.

The next two articles that appeared in the March 8, 1996 edition are quoted at length as they indicate an interesting conflict of values between the environmental activists and those supporting the development. The first article, box 6.1, is a letter written by a local resident and expresses values that align with those who promote such developments. The second article, box 6.2, is the chairman of the CVAG's response and communicates fundamentally different values that are representative of environmental activists.

Box 6.1: Letter written by a local resident expressing a pro-development stance (my emphasis)

Let's keep the fight clean: Also concerned of Sunward Park writes: How refreshing to hear a note of sanity coming from someone at last (Boksburg Advertiser of last week) regarding the great big Cinderella Vlei argument. Yes, why not talk about it instead of going about it in a nasty way? I saw petitioners at the Sunward Park Pick n' Pay and it amazed me that photographs of an office block recently erected in Trichardt's road were on display and were being referred in a manner. I do not wonder that the owner wants to sue the Action Group – it was ***shocking*** *to hear. What kind of people are these who are conducting such an* ***attack****? Apart from my opinion in any of these matters, let us not resort to the level of a* ***gangster street fight****. We should at least be* ***civilized*** *about it all and talk to the new owner about his intentions, as suggested last week. Much more will be gained by talking to each other. After all, don't we refer to ourselves as being '****first world****'?*

Box 6.2: Letter written by the chairman of the CVAG (my emphasis)

Editors note: This letter was referred to chairman of the CVAG Tony Dutton, who said the group was formed for the sole purpose of ***preserving*** *one of Boksburg's very* ***few remaining*** *wetlands.*

I reject with contempt statements such as 'gangster street fight'. The group has consistently conducted its business in ***a logical, professional, even-handed manner****, with the single-minded objective of preventing the* ***desecration*** *of one of* ***nature's greatest gifts****. I believe they will continue to do so no matter who wants to alter this. Mr. Ford has suggested that "if the CVAG wants the vlei so badly, let them make me a related offer". The CVAG is not in the property business and believes the vlei should* ***belong to all*** *who live in Boksburg. The* ***custodians*** *– or 'owners' – should be the Council of Boksburg, which represents all people. The photographs of the office blocks were simply used to indicate what could be. The fact that "Boerejock' de Klerk was offended that his building was associated with the potential* ***rape*** *of the vlei concerns us and we extend our apologies to him. His obvious concern at being associated with the* ***desecration*** *of this wetland does, however, encourage us, as he is the first ex-major of our city to come out in support of our objective of* ***saving*** *the vlei. Therefore we would encourage other public representatives to speak out. I visited a number of petition tables on February 3 and at none did I find a 'low-level' attack. What I found were concerned citizens who believed we in Boksburg should hand on to our* ***children*** *the* ***joys*** *of seeing* ***birds*** *in the reeds, or discovering* ***frogs*** *and* ***wild flowers****. The fact that over 2 300 people signed the petition to save the vlei tells us that CVAG is* ***talking for people****. Those are the answers, but what is real is that the wetlands are* ***dying****, not only in Boksburg but all over the world we know also die.* ***First, second, or third world*** *must* ***join hands*** *to save them and the good people of Boksburg have the opportunity of joining that lattice-work and doing something real for the* ***generations*** *that are to come. All they have to do is identify with CVAG and simply say: 'We want our wetlands to stay wetlands until the 7th generation'.*

People campaigning for the development drew on values of and connections to the economy (can buy the vlei at a market related price), civilisation and being part of the First World and argued that such areas hold the threat of attracting squatters. The language used to describe the environmental activists implied that they opposed these values: their approach is described as "*nasty*" and a "*gangster street fight*" and the question is asked: "*What kind of people are these who are conducting such an attack?*" The response by the chairman of CVAG expresses a range of values including the protection of the natural world, which is described as a gift and valued for its biodiversity: "*the joys of seeing birds in the reeds, or discovering frogs and wild flowers*". The proposed development on the vlei is described as "*rape*" and the wetlands are said to be "*dying*", which indicates that they are valued as more than a resource. The argument is also made that the vlei should "*belong to all who live in Boksburg*" rather than be exclusively owned. This compares to the developer's attitude

who suggested the environmental campaigners buy the wetland at a market related price. An attitude of partnership between people from all contexts ("*first, second or third world*") is also promoted, the future generations are considered and they are against values of greed, corruption and power. A clash of values between those advocating for the vlei's "development" and those fighting for its protection, is thus clearly evident.

The data exploration now turns to an historical examination of Boksburg Lake.

6.3.4 An historical overview of Boksburg Lake

Boksburg Lake was built in 1888 by the then government-mining commissioner, Montague White. In the early 1900s the local people expressed a clear desire to turn Boksburg Lake into a "*popular East Rand Sunday Resort*" (October 10, 1903), a "*pleasure resort*" (February 6, 1904) and water paradise. Many ideas were shared through the *Boksburg Advertiser* such as setting up a boating system, having refreshment booths, widening the promenade, etc. The municipality responded to these suggestions and Boksburg Lake quickly became highly valued for recreation, serving people from as far as Johannesburg who came down on the train. On Easter Monday, 1904, more than 1 000 visitors were said to have visited the lake. In March 1904 a number of articles described the beauty of Boksburg Lake: "*The lake yesterday fully established its claim to be the most lovely spot on the Rand, if not in the Transvaal*" (March 5, 1904) and "*Nowhere in the Transvaal is there a fairer picture than Boksburg Lake, embedded in trees of all kinds. The walks are varied and attractive, and not too public*" (March 19, 1904).

By 1925 Boksburg Lake had secured its identity as the social hub of Boksburg. Over 18 000 people are said to have visited the lake on Christmas Day, while rowing, swimming, fishing and children's entertainment were regular activities. The natural beauty of Boksburg Lake was also appreciated. An article from the August 21 edition described the "*delicate green*" of the willows, "*the fern-like delicacy of the drooping fronds*" and the exquisite colouring "*that is being appreciated more and more by the citizens of Boksburg*". The lake was also described as Boksburg's "*greatest asset*" (September 4, 1925) and "*The Mecca of the East Rand*". The following quote expressed the popularity of Boksburg Lake at this time.

> *Seldom before has the Boksburg Lake Park been so thronged with visitors as at the present time. Although even on ordinary days the crowds at the lake are large, on public holidays the number of people is enormous and officials in charge of the carnival*

> *arrangements state that while all previous records have been broken this season, the busiest time is yet to come.* (December 24, 1925)

Throughout the 60s, 70s and 80s the lake remained Boksburg's recreational centre. An article from the October 21, 1960 edition, stated: "*None will deny that the lake has turned out to be Boksburg's biggest asset and the first thing strangers think of when the town is mentioned… [It] has afforded so many so much pleasure, tranquility and a retreat 'to get away from it all' and spend a few meditative hours*".

High value is placed on the birds, especially swans, at Boksburg Lake and in a number of articles they are written about with animation, feeling and connection. In the September 30, 1960 edition an article about spring at the lake expresses values attached to the natural world and pays some attention to the plight and needs of the resident swans and muscovies. In this same year, Christmas time was an important focus. An article from the December 16 edition states:

> *Boksburg's 1960 illuminations, switched on last Friday, are the best yet according to many visitors to the town. Proof that the town is now recognised as one of the Christmas points to visit was also confirmed by the large number of outside cars which passed through each evening this week.*

However, in 1980 there were issues over the annual Boksburg Lake Christmas lights. The council argued that it did not have the money. When asked, local people were happy to pay a little extra for municipal rates to ensure the lights would go up. A gentleman described how a few years back "*it was like a fairyland at Christmas time. The highlight of my little girl's year was to go to the lake for the evening*". A senior citizen explained that her "*favourite was the beautiful swan which floated on the water like a mysterious ship. The sight of it filled with hundreds of little sparkling globes always brought tears to my eyes*".

A point to highlight is that the *Boksburg Advertiser* regularly celebrated the economic growth that continued to increase over the years, with the 60s, 70s and 80s being periods of "*surging development*" (January 8, 1960). It is therefore interesting that in spite of all this growth, the council now lacked money to spend on social and community activities such as lights at the lake, in spite of their high value to local people. What is also noteworthy about the 1980 Christmas edition of the *Boksburg Advertiser*, is that, compared to previous years, there was no mention of any celebrations at Boksburg Lake. Instead there was an article about children having fun

at a large shopping store, suggesting that the recreational centre of Boksburg was beginning to move.

Initially mining was the main threat to Boksburg Lake's water quality. As early as 1903 there was an article about the lake possibly being polluted from mine pollution in the Blue-sky shaft. A few years prior to 1925, the lake had been polluted by potassium cyanide, when the adjacent mine's slime dams burst, killing all the fish. (Slime dams are repositories of a mine's waste, producing highly toxic cocktails of heavy metals including arsenic and cyanide (Davies & Day 1998)). The municipality was assured by ERPM that this would not happen again and a catchment area north of the dump was built where the acid water could be pumped through the mine onto the western area. A point to note is the lack of expressed concern for the impact this would have on the natural environment on the western side. What was important was preventing Boksburg Lake from being polluted, which despite this preventive measure, was again polluted by cyanide in the early 1950s.

A few decades of rapid industrial growth had become an increasing threat to Boksburg Lake's condition as reflected in an article about industrial waste entering Boksburg Lake (May 29, 1970). In July 1990, there was an article about its green, polluted water and in the same year, another on "*rapid decay*" of the lake facilities.

However, until 2001, Boksburg Lake continued to be a favourite recreational centre, as articles continued to show. For example, in 1990 there was a raft regatta; in October 1992 "*mammoth*" celebrations were held to commemorate Boksburg achieving city status; and in 1998 there was an article about the thousands of visitors who came to visit the "*beautiful*" Christmas lights at the lake: "*We have a lot of visitors at this time of year and we will ensure the lake is in tip-top condition*", said Liezl Uys (garden expert at the Boksburg Parks department) (November 6, 1998). Until 1998 Boksburg Lake was therefore still managed and used for recreational purposes.

Throughout the 1990s numerous attempts to revamp the lake never materialised. In 1990 there was a proposed caravan park, in 1993 a project to upgrade the lake front, and in 1995 plans were proposed to develop the biggest flea market in the Southern Hemisphere at Boksburg Lake.

At the same time Boksburg Lake was a heavily contested racial space, which the Afrikaner Weerstands Beweging (AWB) political party was using to push their own agenda. An article from early January 1990 stated: "*New Year's Day saw the Afrikaner Weerstands Beweging once more affirm the lake as the symbol for the Far Right in*

three separate incidents". During the same year, Reiger Park residents held a protest march at the lake, to which AWB supporters gave a violent response, including public violence, damage to property and insulting protestors with abusive language.

In the early 1990s there was therefore a struggle between the value placed on Boksburg Lake as a prioritised recreational centre and growing water pollution, deterioration of infrastructure and racial issues.

By the late 1990s and into early 2000 an increasing number of articles reflected the deteriorating infrastructure and lack of maintenance of the lake grounds. In July, 1999 an article was headlined: "*Lake toilets a total disgrace*", while a local person expressed shock "*at how a city council could let public facilities deteriorate to such a state*". The response given was that the water supply had been cut off because people stole the taps. By April 2002 the toilets had to be locked because of vandalism and security issues. In November 2002 the spotlight was on the lake's water quality, which had become so polluted as to necessitate hazardous warning signs; both Boksburg Lake and Cinderella Dam downstream were closed to the public; and thousands of fish died. An investigation revealed a thick, black, tarry substance coming out of one of the storm water canals, the source of which was a collapsed sewer line that carried industrial effluent and raw sewage.

By early 2007 Boksburg Lake's deterioration and the municipal and stakeholder responses to this were regular headline news, a few of which are highlighted here. In January 2007 the municipality indicated their intention to improve Boksburg Lake's condition. A task team was formed to address the sludge build up, lack of security, poor water quality and general appearance of the lake grounds. This municipal project to improve the lake had started three years previously. On March 20, there was a five-minute programme on the pollution at Boksburg Lake, put together by SABC's Morning Live and grade 10 learners from Hoërskool Voortrekker. This "*shamed*" the metro and probably prompted them to stronger action. In an April 6, 2007, article Zweli Dlamini, spokesman for EMM is quoted as saying: "*There is no denying that the lake is in a terrible state…We want to show the residents of Boksburg that we are busy with an intervention plan to rehabilitate Boksburg Lake*". The article discussed EMM's initial investment of R1.6 million to improve the lake by buying aerators to increase the flow of oxygen, re-commission the cascades, rebuild the fountains, install high-mast lights and employ night and day guards to address the security issues. There were also plans to commission a study on the necessary de-sludging process, to building silt and sludge traps, "*maintain[ing] the lawns and grounds, remove debris from the lake and test the water quality on a daily and/ or weekly basis*" (April 6, 2007) and

prosecuting industries that did not adhere to pollution by-laws and National Acts. Five applications from investors who wanted to run the restaurant were also being processed. The metro expressed gratitude for the initial research conducted by Rhodes University and funded by Unilever that was to lay the basis for the Schools for a Sustainable Environment (SSE) initiative that began in 2009. An article from the July 13 edition described Boksburg Lake as "*one of the town's treasures"* and quoted Ace Phiri, head of the Boksburg Customer Care Centre: "*We are committed to restoring the lake to its former beauty and hope that, after the rehabilitation, it will once again attract visitors*".

In spite of the EMM's intentions and the initial investment of R1.6 million, Boksburg Lake continued to deteriorate and on May 16, 2008, an article appeared titled "*The big stink is back: More than a year since the Ekurhuleni Metro vowed to invest R1.6 million into rehabilitating BL, it has again been reduced to nothing more than a festering and toxic body of water*". Problems highlighted included the disappearance of the aerators; the colour of the water (bright green) entering the lake from the storm water canal; a thick oil covering the water's surface; and a terrible smell affecting the health of nearby residents: "*We are constantly walking around with headaches, sore throats, watery eyes and sinus attacks*". In a June 6 article Boksburg Lake was described as one of the "*city's forgotten gems*". The lake's problems were again highlighted in July 25, 2008: "*More than 50 years later, the facility lies in ruins and practising water sports has become a health risk, as well as illegal, in accordance with Ekurhuleni municipal by-laws*", and again in August 22, where the strong odour, like the "*stench of rotten eggs*", could be smelt in other suburbs. In another article on Boksburg Lake from August 22, 2008, an EMM spokesman is quoted as saying: "*The municipality apologises for the inconvenience this situation has caused to the community and commits to speeding up our efforts to resolve the matter as a matter of urgency*". By October the lake's water quality had deteriorated to such an extent that EMM put up signs that stated: "*Warning! Water is not safe*". Articles appeared in both the November 2008 and March 2009 editions about the Metro putting together a team of people, from different departments, to devise a plan of action to "*see the lake restored to its original beauty*" (March 13, 2009).

A letter written to the editor in the September 4, 2009 edition expressed some of the frustrations and views of local people around the deterioration of Boksburg Lake. They described the rapid decay of its facilities, how the previous restaurant was now "*overrun by vagrants*", the building was being "*pillaged to the point that it now looks like a disaster zone*", and the homeless who frequent the park, wash their clothes using water from "*the park's taps [which] is thrown over the once botanical type garden*

which is now nothing more than an overgrown mass of plants". These quotes indicated a disparaging view of the poor people in society.

From as early as 2008 both EMM and the local media highlighted dredging Boksburg Lake to address the problem of high sludge content, as a priority remedial action. However, by October 17, 2008, a spokesperson for EMM was quoted as saying: "*The dredging of the lake has been postponed in order to accommodate the rainy season, as well as the tender process*", and that it would only commence in 2009. During the first Boksburg Lake Day in September 2009, it was announced that EMM had bought a state-of-the-art R18 million dredging machine to address the sludge build-up. This announcement "*caused great excitement amongst community groups and other stakeholders who have for the past five years been fighting for the restoration of the lake*" (September 18, 2009). Councillor Douglas Scholtz, member of EMM's environmental portfolio stated that:

> *We expect the dredger to be installed soon and once in place steps will be taken to prevent local industries from dumping harsh and hazardous chemicals in the stormwater run-off system, which in the end pollutes the lake. I think this is a great victory for everyone who has been actively fighting for the restoration and especially the rescue of one of the city's largest water catchment areas as well as recreational facilities. I am confident that the lake will soon resemble its old splendour.*

By October 30, 2009 the Metro was once again revising its timeframes indicating that the dredging would likely be delayed until 2010 because the machine was still to be assembled; the operators needed to go on a three to four week training course and an EIA process was necessary.

By 2013, after four annual Boksburg Lake Days, much stakeholder interest and the formulation of the Boksburg Lake Forum (as explained in chapter7), the Boksburg community still awaited the dredging of the lake, it remained little used and the surrounding park infrastructure continued to deteriorate. Boksburg Lake therefore persisted as a socially and ecologically degraded social-ecological system. The remainder of this chapter explores why this was the case.

6.4 Analytical statements in a theoretical context

From the data representations presented above 94 themes emerged. These were clustered and condensed into five analytical statements that emerged from the data (in the sense of grounded theory) and provide the scaffolding of meaning to probe causality. See appendix F for the full list of themes from which the analytical

statements were derived. This provided me with a useful theoretical summary for the concluding discussion to answer goal 2: Identify generative mechanisms driving the current degradation of the Boksburg Lake social-ecological system.

1. **Economic growth and progress is fundamental to Boksburg's identity and aspirations and is supported by a competitive spirit and increasing consumer values.**

This analytical statement is backed up by a number of relevant themes that were identified from data descriptions. Six keys ones are highlighted below.

- The mine has been a celebrated, personified and highly valued feature of Boksburg, often linked to its identity. This is largely because of the economic benefits it has brought.
- Throughout the years Boksburg carried the stigma of being a sleepy village-like town and its explicit aim has been to throw this off to become one of the economic giants in the country.
- Growth of the East Rand is seen as essential to the country's well-being.
- The desire for economic growth and development is never satisfied. No matter how much economic growth has occurred, still more is demanded.
- A strong competitive spirit is expressed where the aim is to be the biggest and dominate other reef towns while a clear disregard for nearby cities' economic welfare is expressed.
- By the 1980s the social centre had moved from Boksburg Lake to a variety of commercial centres indicating that economic and social structures were becoming more tightly coupled. Throughout the 1990s the East Rand Mall promoted a growing emphasis on consumer values.

The addiction to economic growth and progress, expressed in the *Boksburg Advertiser* archives is not unique to this city, but is a fundamental characteristic of modern society (Schumacher 1998; Bauman 2000; Glasser 2007; Leonard 2007). Bauman (2000: 28) expressed how modern society is fueled by a constant need for expansion:

> What sets modernity apart from all other historical forms of human cohabitation [is] the compulsive and obsessive, continuous, unstoppable, forever incomplete modernization; Being modern came to mean ... being unable to stop and even less able to stand still. We move and are bound to keep moving … because of the impossibility of ever being gratified: the horizon of satisfaction, the finishing line of effort and the moment of restful self-congratulation move faster than the fastest of runners. Fulfillment is always

> in the future, and achievements lose their attraction and satisfying potential at the moment of their attainment if not before.

This need for constant growth and movement finds its home in the economy, which Schumacher (1998) argued plays a central role in modern life, and can be described as the hegemonic institution that dictates decisions, ethics and values, especially promoting those that support the profit motive. He stated that economic growth and performance have become the "abiding interest, if not the obsession, of all modern societies"; there is no concept of enough (Schumacher 1998: 27) and maximising throughput is viewed as a virtue (Anderson 2010). Daly and Cobb (1994: 402) described the commitment to economic growth in some detail:

> Among economists, for example, no real argument needs to be given for devoting oneself ultimately to the promotion of productivity and growth. No recitation of the horrors that this commitment has inflicted upon human beings, not to speak of the other creatures, no explanation that the physical conditions that made growth possible in the past are rapidly disappearing, no clarification of how human welfare can be met in other ways – none of this has yet sufficed to shake the conviction so deeply rooted in the discipline that growth is both the supreme end and the supreme means for achieving the end.

Leonard (2007; 2013) supports this perspective. She provided a vivid and insightful portrayal of our modern economic system in two short documentaries: 'The Story of Stuff' (2007) and 'The Story of Solutions' (2013). In 'The Story of Solutions' she compared our economic system to a game with clear goals and rules and the winners are those who can achieve the goals the quickest. In this game the goal is 'more' as measured by GDP and you win by producing, buying and consuming more. Leonard (2013) questioned this goal and suggested that a healthier goal would be 'better'. The focus moves from quantity of things to quality of life, communities and the environment. Meadows' (2008) insightful work that explores systems dynamics also highlights the importance of goals and how inappropriate system goals can lead to perverse actions and consequences. She stated that "maybe the worst mistake of this kind has been the adoption of the GNP (flows of things made and bought in a year) as the measure of national economic success… As a measure of human welfare, it has been criticized almost from the moment it was invented" (Meadows 2008: 139).

As highlighted in chapter 5, western cosmology has been shaped by mechanistic, dualistic, anthropocentric normalising ideologies, which support these goals of unlimited progress and economic growth (Golliher 1999). They have become seen as

non-negotiable necessities, in spite of economic growth being fundamentally contradictory to planetary limits (Bourdieu & Wacquant 2000; Fairclough 2000). This ideology can described as a TINA complex (chapter 1, section 1.4).

Consumerism is at the heart of the economic system, supports the mantra of economic growth and is highly valued as a public concern (Weiskel 1999: 467). Being a consumer is now one of modern western society's primary identities where much of our value is measured by how much we consume (Leonard 2007); it is seen as the route of happiness for the youth (Ashley 2006) and has become a replacement or means of identification with such human practices and values as religion, intimacy, pride in work and community spirit (Gottlieb 2009: 217).

The pervasiveness of consumerism is a recent and growing modern condition. For example, it was only 50 years ago that citizens of the USA consumed half of what they do today (Leonard 2007). Leonard explored the question of how consumerism became so dominant. She described how, after World War II, corporations were exploring ways to boost the economy. Victor Lebow, a retailing analyst provided a means that became the norm for the whole system:

> Our enormously productive economy demands that we make consumption our way of life. That we convert the buying and use of goods into rituals, that we seek our spiritual satisfaction, our ego satisfaction, in consumption … we need things consumed, burned up, replaced and discarded at an ever expanding rate. (Lebow 1955)

Eisenhower, the USA president at the time, was influenced by this and claimed that the economy's ultimate purpose was to produce more consumer goods. This consumer ideology consequently became dominant. As Schumacher (1998: 41) stated "modern economics… considers consumption to be the sole end and purpose of all economic activity, taking the factors of production – land, labour and capital – as the means". Planned obsolescence (consumer products are not made to last) and perceived obsolescence (a thing seems like waste and is therefore trashed) became two primary means to perpetuate consumerism. Soon after, the USA became a nation of consumers and the rest of the world quickly followed. This value of consumerism has become so strong that after the 911 terror attacks in the USA George Bush advised the nation to go and shop as a way to deal with the tragedy (Leonard 2007).

Bauman (2000) and Gottlieb (2009) have both indicated consumerism's addictive and expanding properties in the following expressive quotes:

> Life organized around consumption … must do without norms: it is guided by seduction, ever rising desires and volatile wishes – no longer by normative regulation. No particular 'Joneses' offer a reference point for one's own successful life; a society of consumers is one of universal comparison – and the sky is the only limit. (Bauman 2000: 76)

> The shape taken by consumerism in the modern world involves not just the multiplication of what you get, but the endless expansion of what you want. Consumerism teaches us that the central goal of human existence is the satisfaction of an ever growing, ever changing array of personal desires. (Gottlieb 2009: 217)

Some of the consequences of these modern values of economic growth and consumerism are explored in the following analytical statement.

2. Economic growth is underpinned by human and biophysical exploitation

This analytical statement is backed up by a number of relevant themes that were identified from data descriptions. The six key ones are summarised below in chronological order.

- From early in the 20th century, mining viability and racial exploitation went hand in hand and were later legitimised and legalised under Apartheid policy.
- The ERPM became the backbone of Boksburg's economy and brought considerable economic growth as well as ecological and social ills.
- Unrestrained development was promoted from the 1960s until the late 1990s.
- From the 1990s there were serious issues of water quality from industry and mining, including the increasing acidity of local water bodies.
- By the late 1990s, after decades of intensive economic growth, the social (such as increasing crime, many vagrants) and biophysical (e.g. degradation of water bodies, deterioration of public spaces and increasing litter) ills of development were becoming apparent.
- From 2002 onwards, Boksburg Lake was under the spotlight for severe water pollution.

The social and ecological degradations experienced in Boksburg mirror more global patterns. Section 1.4 attempted to give a sense of the devastating extent of global social and ecological degradations and the potentially catastrophic social-ecological risk modern society is producing.

Numerous authors make the link between modern processes of economic growth and notions of progress and human and ecological exploitation. According to Rist (2007: 488), "the essence of 'development' is the general transformation and destruction of the natural environment and of social relations in order to increase the production of commodities (goods and services) geared, by means of market exchange, to effective demand". Anderson (2010) provided many examples of ecological and social costs of economic growth and progress. He described the huge loss of migrant song birds that are declining at a rate of 1-4% per year: "My children and their children will never see what I saw in my youth: trees and bushes filled with brilliant, flashing colors, ten or twenty or fifty migrant warblers and tanagers in every tree or bush over a whole forest or mountain (Anderson 2010: 13). Anderson also described the "economic progress" based on intensely irrigated cotton that destroyed the Aral Sea, an inland salt lake in Central Asia, which used to be the fourth largest lake in the world in central Asia. The lake dried up to one tenth of its original size, water became polluted with pesticides and inorganic fertilisers, the million dollar fishing industry collapsed and clouds of toxic dust from the now dry, poisoned lake bed affected nearby towns, causing children to die from poisoning. Today in an area south of the Aral Sea, infant mortality is at 10% and in a few areas, as high as 50%. This is one of many stories of seemingly positive economic progress having devastating human and ecological consequences.

The work of a number of authors (Marx 1849; Bhaskar 1993; Bauman 1994; Westley *et al.* 2002) provides theoretical lenses to probe the relationship between economic growth and human/ecological exploitation.

Westley *et al.* (2002) explained that social systems are influenced by structures of signification, which include symbols of meaning and values. These structures of signification can also be referred to as normalising ideologies (Foucault 1981; Thompson 1990). The nature of these will have profound effects on how society is structured and relates to the biophysical world. There are influential modern western normalising ideologies identified in the literature that provide insight into generative mechanisms influencing the dynamics of Boksburg's social-ecological system. Four key ones were identified and discussed in chapter 5, namely human-ecological dualism, anthropocentrism, nature is mechanised and nature is to be controlled. These four normalising ideologies promote a type of human progress (that has become equated with economic growth) at the expense of ecological health. Because humans are integrally part of ecological systems, pursuing this form of progress will produce both social and ecological degradations.

As discussed in statement 1, consumerism drives our economic system that depends on growth. The world is cast "as a warehouse overflowing with consumer commodities" (Bauman 2000: 89). This consumerism and the quest for economic growth are having an increasingly devastating effect on the biophysical world. As Schumacher (1998: 16) indicated, this system "does not fit into this world, because it contains within itself no limiting principle, while the environment in which it is placed is strictly limited". Leonard (2007) stated that 99% of what is consumed is trashed within 6 months and that the household waste of an average USA citizen has doubled in 30 years. In addition, there are 70 units of waste produced for every unit of household waste. It is therefore not surprising that Boksburg has faced the increasing problem of litter accumulation and illegal dumping.

Bhaskar (1993) discussed how western society is founded on power$_2$ dynamics where the powerful exert their influence to the detriment of the relatively powerless and result in structures of domination and exploitation and an unequal society. This helps explain why human degradations are a part of the present form of human progress as resource extraction is for the benefit of the few. For example, the literature frequently highlights how economic growth is leading to a few getting rich while millions are worse off (Anderson 2010). There are countless examples of the disempowered and marginalised bearing the brunt of economic externalities (unaccounted social and environmental costs) (Hallowes & Butler 2002). For example, Native American Reservations are used as toxic waste dumps while rural areas in Louisana, home to marginalised black populations, have the greatest concentration of America's polluting industry and have become known as cancer alley (Anderson 2010).

Marx (1849) explained the socially exploitative nature of capitalism. He argued that the proletariat, a group of people paid minimum wages never rising much above the subsistence level, is necessary for capitalism to function. Because the proletariat is not paid the true value of their labour, the surplus value becomes profit available for the owners of capital and is a driver for the growing gap between the rich and poor. A group of persistently unemployed people is helpful in keeping these wages at a minimum. Marx (1849) referred to these as the industrial "reserve army". In Boksburg the black proletariat was a necessary condition for mining and industrialisation to succeed in the area, which almost solely benefited the white class during the Apartheid era. This points to the hegemonic interests in maintaining present forms of capitalism, as it benefits those already in economic power. Power dynamics are therefore a key driver maintaining the economic status quo and entrenching power differentials (Bhaskar 1993). This statement is moderated by the opportunities for upward mobility also inherent in capitalism, as expressed in the American Dream.

Leonard (2007) provided insight into how this system self perpetuates. She has described the linear nature of our economic system that is dependent on 'resource' extraction, mostly in the Third World and which has decimated large parts of the natural world. For example, in the last three decades one third of the planet's natural resource base has been consumed, 40% of waterways became undrinkable, 75% of global fisheries were fished at or beyond capacity and the Amazon Forest alone is losing 2 000 trees per minute (Leonard 2007).

The erosion of these environments and economies has forced millions of people who depended on local livelihoods to move to cities and enter the wage economy. Leonard (2007) provided global figures of 200 000 people a day moving from environments that have sustained their communities for generations, to cities to look for work, many of whom end up in slums. This has created a steady supply of cheap labour to maintain the system. Anderson (2010: 13) provided examples of this process. He found that rural people from Madagascar to Mexico, who had sustainable and viable livelihoods through subsistence agriculture, "are now starving and dying".

According to Bauman (1994), compared to pre-modern social structures, there are currently vast distances in both space and time between our actions and their consequences. This is evident in the Boksburg case study where the biophysical and social ills only became apparent after decades of unrestrained development. Bauman argued that global society lacks the ethical frameworks to deal with this new space-time dynamic. Without adequate ethical frameworks, the voiceless (plants and animals making up the biophysical world) and the poor will feel the brunt of the negative consequences, as is the case in Boksburg.

The following theoretical discussion around analytical statement 3 provides a deeper exploration of power dynamics occurring in the Boksburg Lake social-ecological system.

3. **The structure of the Boksburg social-ecological system is made up of relations that exist across the social, economic and biophysical domains. Each domain carries its own power dynamics with economic and social hegemonies driving patterns of victors and losers.**

This analytical statement is backed up by a number of relevant themes that were identified from data descriptions. Five key ones are highlighted below.

- In the early years of Boksburg's history white racism, the need for cultural preservation and maintaining power was explicit.
- Ideologies over racial purity and supremacy and economic goals were closely interlinked and for a while pitted against each other. Apartheid helped ensure that both won.
- Unrestrained development in the name of "vested financial interest [and] massive profits" had negative social and ecological impacts.
- The homeless and poor are given derogatory names and disregarded as people with rights/ value in society. For example, they are called vagrants and squatters.
- Environmental campaigners hold different values to people promoting development.

Bhaskar's (1998) work on structure and agency provides a useful starting point to understand the above analytical statement 3. He argued that social relations make up the social structures of society:

> All social structures – for instance the economy, the state, the family, language – depend upon or presuppose social relations – which may include the social relations between capital and labour, ministers and civil servants, parents and children. The relations into which people enter pre-exist the individuals who enter into them, and whose activity reproduces or transforms them; so they are themselves structures. And it is to these structures of social relations that realism directs our attention – both as the explanatory key to understanding social events and trends and as the focus of social activity aimed at the self-emancipation of the exploited and oppressed. (Bhaskar in Collier 1994: 10)

As Bhaskar indicated in the above quote, understanding the nature of these social relations can aid a process of emancipation for the exploited and oppressed. Westley *et al.* (2002) provided insight into why this is the case. They named three overarching structures that make up society: 1) structures of signification, 2) structures of legitimation, and 3) structures of domination. Interest here lies in structures of domination as these determine power dynamics and the flow of resources. Combining the work of Bhaskar (1993) and Westley *et al.* (2002), one can infer that some significant relations structuring society are characterised by particular power dynamics and a flow of resources that benefit the powerful, and enable the exploitation and oppression of others.

Gramsci (2000) argued that many power dynamic processes are maintained through ideological domination and coined the phrase 'hegemony' to conceptualise this. He explained that the elite inculcate their ideologies and values into societal consciousness, which then become dominant. However, hegemony also implies that power is continually negotiated and cannot be pinned down as it is always "in the process of becoming" (Jones 2006: 5). Hegemony, as defined by Agnew (2005: 1), is thus

> The enrollment of others in the exercise of your power by convincing, cajoling, and coercing them that they should want what you want. Though never complete and often resisted, it represents the binding together of people, objects, and institutions around cultural norms and standards that emanate over time and space from seats of power.

This is supported by Bhaskar's concept of power$_2$ relations in which the powerful exert their influence to get what they want, either through socialisation or excluding alternatives, to the detriment of marginalised groups (Bhaskar 1993). Agnew's work (2005) explored how the United States relationship with the rest of the world has been a hegemonic one, where the ideologies and values of the American way have become globally dominant. One of the primary ideologies is the centrality of the marketplace to social life, which he characterised as consisting of "mass consumption and living through commodities, to hierarchies of class hidden behind a cultural rhetoric of entrepreneurship and equal opportunity, to limiting the delivery of what elsewhere are thought of as public goods and sponsoring an essentially privatized version of life" (Agnew 2005: 3). He stated, "The hegemony of marketplace society… is what lies at the centre of contemporary world society".

Agnew (2005: 5) made the explicit link between the marketplace society and consumerism and explained that this economic system democratised desire and created the space for the many to consume in ways previously only possible for the rich. This disrupted "local ties and dependencies [replacing] them with longer distance ones" and resulted in "new measures of social value", based on one's degree of consumption. The focus moved to obtaining the good life and as William Leah stated: "Whoever has the power to project a vision of the good life and make it prevail has the most decisive power of all" (in Agnew 2005: 8). To summarise, the USA was the hegemonic power of the 20th century and introduced the ideology of the marketplace society and the value of the good life brought about by consumption. In this new system, power and status are linked to consumerism. The hegemonic power of the economy and the drive to secure enhanced consumer practices, which dominate Boksburg's social structure, can be understood from Agnew's work.

Hallows and Butler (2002: 59), two South African authors, have explored how power dynamics have unfolded in the modern context with its foundations in imperialism: "Imperialism initiated a long and continuous process of alienating people from their environments, both economically and psychologically, and of coercing them into a subordinate relation within the modernising economy". This has clearly happened in the South African and Boksburg context where legislation alienated native populations from their socio-economic and ecological environments and forced them into the least powerful positions within the economy. Hallows and Butler (2002: 74) made the link between power dynamics driven by the marketplace economy, and social and environmental injustices: "There are similarities between violence against people and violence against the environment. Both are about maintaining power and maximising profit. They use similar technologies within a symbolic economy that values domination, conquest and control". One of the mechanisms supporting this is the externalisation of the costs of economic growth and consumerism: the least powerful bear the costs of the wealth creation and consumption of the rich (Hallowes & Butler 2002; Leonard 2007). These externalities are clearly apparent in the social and environmental costs of development, as is evident in Boksburg's social-ecological history. Hallows and Butler (2002) identified power relations and the need to fundamentally reorganise how they are constituted as critical in changing the current system of environmental degradation and social inequalities, both in South Africa and globally.

4. **Boksburg Lake and its catchment can be viewed as a system where drivers and feedbacks direct its economic, social and biophysical trajectory.**

Boksburg Lake and its catchment can be viewed as a complex system (Pollard & du Toit 2011) that is made up of a number of variables, feedback loops and drivers. Systems dynamics is a method to model such a dynamically complex system. The most commonly used model is the causal loop diagram, which is particularly useful for communicating casual relationships between variables within a system (Pruyt 2013). Figure 6.1 is a qualitative causal loop diagram of the economic, social and biophysical components and relationships of Boksburg Lake and its catchment and follows the methodology used by Pruyt (2013). It has been developed using the software package Vensim specifically designed for creating causal loop diagrams. Figure 6.2 is a conceptual heuristic of the same system.

Meadows (2008) stated that a consistent pattern over a long period of time is evidence of the possibility of a feedback loop. Consistent patterns in the Boksburg social-

ecological system are the persistent development, increasing deterioration of the biophysical environment (including Boksburg Lake) and the growing social problems.

Three main drivers can be identified from the results, namely the value attached to economic growth, the value of consumerism and political change. The high value of economic growth and progress has been a driver of the system from Boksburg's early years. It increased in dominance after the two World Wars when industry became a new economic activity and catapulted Boksburg into becoming one of South Africa's biggest industrial sites. Economic growth and progress have been supported by the increasing value of consumerism that is now pervasive. These two values have been important drivers for the unrestrained development that happened from the 1960s until the present, with some restraint from the late 1990s into the 2000s. This restraint has been partly due to pressure from civic groups responding to the increasing biophysical deterioration. The system diagram (figure 6.1) indicates that unrestrained development and urbanisation have played an indirect role in reducing the value of Boksburg Lake as a recreational asset. Reinforcing loops have developed that reduce the number of visitors to the lake and keep it in a degraded state.

The development of the multi million rand East Rand Mall in 1992, which prompted numerous additional type developments, quickly became the recreational centre of Boksburg and drew away many potential Boksburg Lake visitors. It also had an almost immediate effect on the CBD, which experienced a rapid decline in value and many of the shops were threatened with closure. It is important to note that Boksburg Lake is situated within the CBD, which began to cater for a poorer income group.

A key driver at the time was a change in political power. The ANC was elected as government in 1994, which was the culmination of a rapid shift in power dynamics from the early 1990s. Apartheid and its laws began to be dissolved and public spaces previously barred from large sectors of the population were made accessible. Boksburg Lake, which had been a racially contested space and open only to white sectors of the population, was now freely accessible and fences were taken down.

Vagrants and other impoverished segments of society began to visit Boksburg Lake. This increased the occurrence of vandalism and consequently the deterioration of lake infrastructure (such as toilets, lighting, equipment), which reduced the number of lake visitors. This set up a reinforcing feedback loop, where fewer visitors increased the occurrence of vandalism, which would further reduce visitor numbers. The increase in illegal dumping and litter that became rife throughout the 1990s, contributed to deterioration of the lake grounds. Through stormwater runoff, much of the

accumulated litter within the catchment would end up at Boksburg Lake. With the change in power, political priorities shifted from, for example, maintaining recreational, open spaces such as Boksburg Lake, to poverty alleviation. Maintenance of the lake's infrastructure and grounds decreased, which also contributed to their dilapidation. As these deteriorated, visitors who were previously attracted to the well maintained grounds and infrastructure that catered for the young and old (including a putt-putt course, lights and a mini train) stopped coming. This developed another reinforcing feedback loop; as the infrastructure and grounds deteriorated, fewer people visited the lake. This reduced the political incentive and consequently resources to maintain the infrastructure and grounds, which led to fewer visitors.

The poorer income groups, who began to populate the CBD, influenced the reputation of Boksburg Lake as a hotspot for crime. This set up another reinforcing feedback loop, where this growing reputation reduced the visitors to Boksburg Lake, which created favourable conditions for crime to occur (theft, rape and murder are reputed to have become common at Boksburg Lake).

As can be seen from figures 6.1 and 6.2 unrestrained development and urbanisation have influenced the deteriorating water quality of Boksburg Lake (it is now affected by over 300 000 tons of accumulated toxic sludge) (Gordon 2008). The proliferation of industrial development from the 1950s has added industrial effluent to the system, while the ERPM's mine dump (Cason dump), consisting of toxic sediment, is situated only half a kilometre from the lake. Since its development in the late 19th century this mine has been a notable polluter of Boksburg Lake (see section 6.3.2). In 1999 the mine closed and consequently there were large dust storms due to the dumps no longer being wetted. Rapid urbanisation has also contributed to the flow of pollutants that ends up in Boksburg Lake. Reinforcing this is the fact that Boksburg is situated in one of South Africa's primary watersheds characterised by many springs and wetlands. Development has occurred on these wetlands, thus damaging ecological processes that would have functioned to use excess nutrients for growth, thereby absorbing pollutants (Davies & Day 1998). Illegal dumping and litter also negatively impact the lake's water quality, both directly and indirectly and are partly an effect of the increasing value of consumerism coupled with and supporting unrestrained development and urbanisation. The deteriorating water quality hampered recreational activities such as swimming (no longer happening from about the 1970s), fishing and boating and consequently fewer people visited Boksburg Lake.

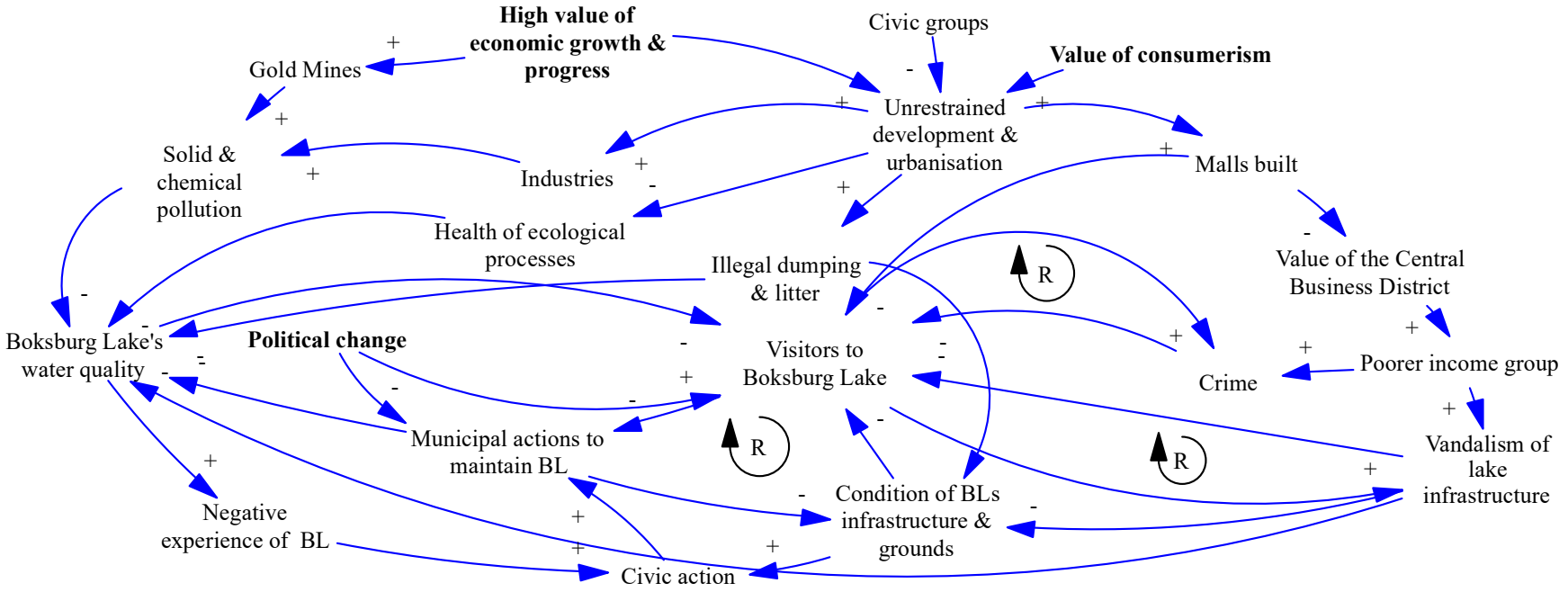


Figure 6.1: Causal loop diagram (Pruyt 2013) of the Boksburg Lake system indicating the economic, social and biophysical components and relationships of Boksburg Lake and its catchment. Key drivers, derived from emergent analytical statements (section 6.4) are represented in bold, R signifies a reinforcing feedback loop, + indicates an increase while – indicates a decrease.

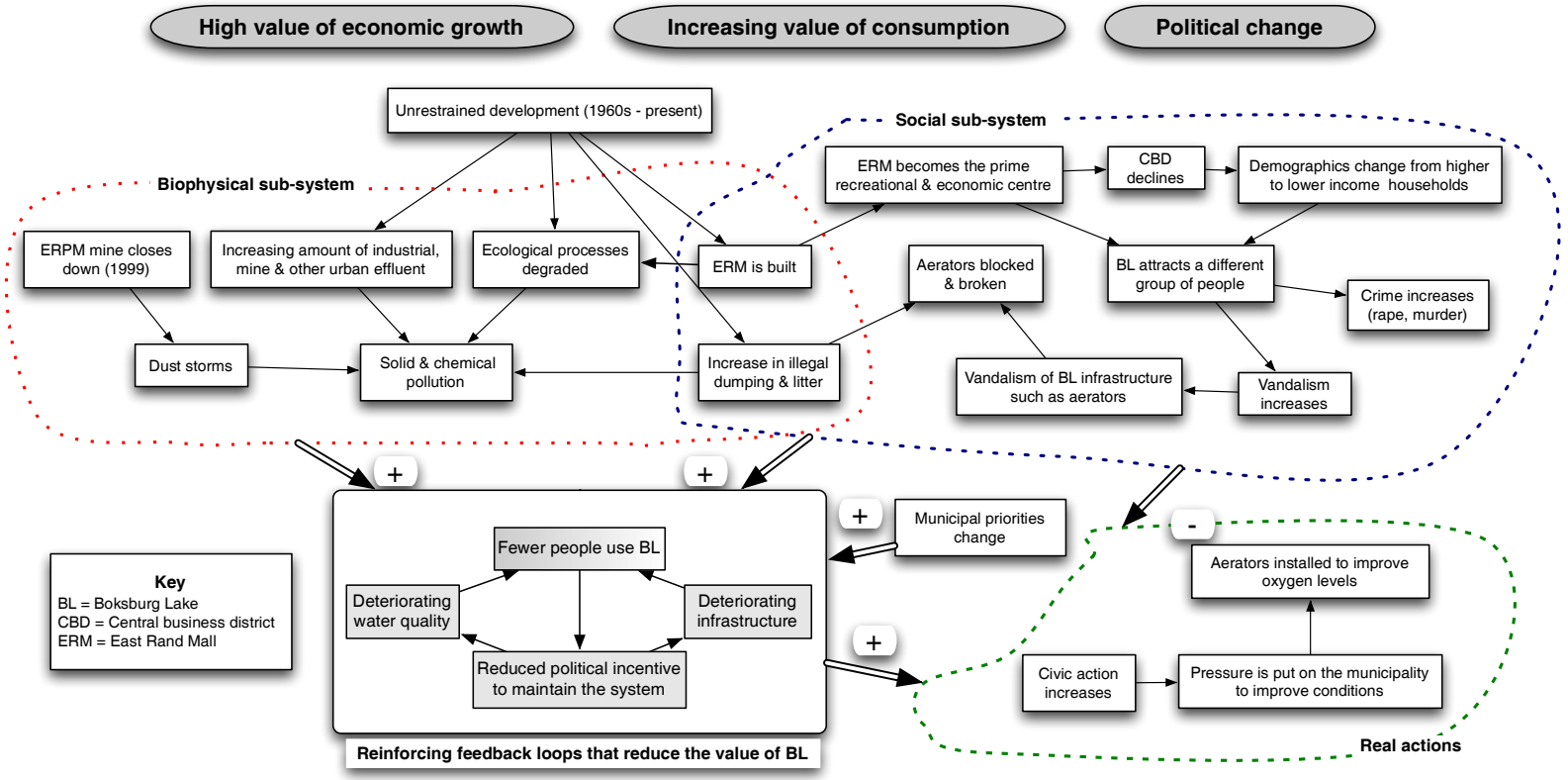


Figure 6.2: A conceptual heuristic of the Boksburg Lake (BL) social-ecological system including: drivers impacting the system (high value of economic growth, increasing value of consumption and political change); sub-systems and their inter-relationships (biophysical, social and real actions) and factors (fewer people, deteriorating water quality, reduced political incentive & deteriorating infrastructure) locked in reinforcing feedback loops that reduce BL's value. Single arrows indicate a one-directional relational causality; double lined arrows indicate the causal relationship between the 3 sub-systems and the 4 factors locked in reinforcing feedback loops; the + symbol signifies increasing impact while the – symbol signifies decreasing impact.

Civic action increased in response to both the deteriorating water quality and infrastructure. This response has been strongest when declining conditions are directly experienced. For example, between 2007 and 2008 there were multiple fish kills and a foul odour could sometimes be smelt kilometres away. Numerous articles were consequently written about Boksburg Lake's declining conditions and considerable public pressure was placed on the Metro. The Metro consequently put some intervention measures in place. However, their ability to reverse the deteriorating conditions has been neutralised, partly due to the social context of the municipality. For example, aerators were installed to ameliorate the lack of oxygen in the water, due to high amounts of anaerobic bacteria. However, these were soon dysfunctional due to damage from vandalism and blockages from the litter.

From 1903 to 2013 Boksburg Lake has changed from being one of Boksburg's biggest assets (recreationally and socially) and is now a key part of the city's degraded condition, both socially and ecologically. A set of reinforcing feedback loops has developed that locks Boksburg Lake into a particular state and neutralises actions for change. Analytical statement 5 explores this further.

5. **From being one of Boksburg's biggest assets (recreationally and socially) and closely linked to the city's positive identity, Boksburg Lake has flipped into a degraded state, both socially and ecologically.**

A number of themes identified from data descriptions support this analytical statement and are summarised below in chronological order. Five keys ones are highlighted below.

- Between the early 1900s to the 1980s Boksburg Lake was the town's social hub and had high value.
- The positive identity of Boksburg was closely linked to Boksburg Lake.
- Boksburg Lake was managed as a recreational site until the early 2000s.
- Rapid deterioration of infrastructure and water quality occurred in the late 1990s into 2000s.
- By 2007 Boksburg Lake had developed a reputation for social (e.g. rape, vandalism, murder) and ecological ills (e.g. toxic water quality, fish kills).

Theorists working within the resilience discourse have offered concepts to understand why the Boksburg Lake social-ecological system has changed from a highly valued to a degraded state. Scheffer *et al.* (2002), Walker & Meyers (2004) and Scheffer (2009)

have described how social and ecological systems can have two or more alternative stable states that display different characteristics and operate under different feedback mechanisms, i.e. have different structures, functions and suite of ecosystem services. A system moves from one state to another when one or more controlling variables (fast and slow changing) have crossed a critical threshold, which result in a change of feedback mechanisms (Armitage *et al.* 2012; Biggs *et al.* 2012). This process is called a regime shift (Walker & Meyers 2004) or critical transition (Scheffer 2009). Controlling variables in the Boksburg Lake system would include the number of people visiting the lake, the ecosystem health of the system, and the extent of social ills, such as crime and vandalism.

Resilience is a useful concept in understanding regime shifts as the system's resilience determines its vulnerability to crossing a threshold. According to Scheffer (2009: 101), resilience is "The magnitude of disturbance that a system can tolerate before it shifts into a different state (stability domain) with different controls on structure and function". Feedbacks play an important role in this process. Reinforcing feedback loops become the basic mechanism that drive a system to move to an alternative stable state, while the regime shift is characterised by a change in the dominant feedbacks that impact the system (Scheffer 2009; Biggs *et al.* 2012). A typical example of a regime shift is the change from clear to turgid water that has occurred in some shallow lakes when the nutrient load has crossed a certain threshold (Scheffer 2009).

The Boksburg Lake social-ecological decline can be regarded as a regime shift where the system now functions in an alternative, degraded state with different reinforcing feedbacks operating. This includes the increase in crime and vandalism and the lack of municipal actions to maintain the lake, which have decreased the value of Boksburg Lake causing it to be infrequently used. A ball and valley diagram (figure 6.3) provides a useful representation of this process. The two valleys represent different regimes and the movement of the ball indicates a shift from the previous state of the system to a new one as a result of the critical threshold being breached. This could be the result of an external shock or gradual drivers that slowly erode the resilience of one regime and cause the feedbacks that maintain the system to become weak. In Boksburg Lake a key driver has been the steady increase of pollutants from industrial effluent, sewage spills, mine dust, and urban runoff contamination, which have reduced the system's ecological health and resulted in poor water quality. Drivers impacting the lake's social value, include the reduction in ecological health, shopping malls becoming centres of high recreational value, an increasing threat of crime and declining infrastructure at the lake's grounds. The basin of resilience

becomes shallower and shallower until the valley disappears and even a minor perturbation rolls the 'ball' into the alternative state (Scheffer 2009). In the Boksburg Lake social-ecological system the alternative state is one of declining ecological health and social value and it is now little used.

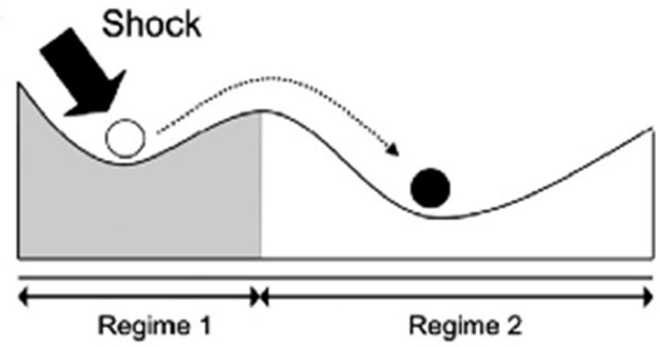


Figure 6.3: Ball and valley diagram indicating that systems can cross a critical threshold, thereby shifting from one state with particular characteristics to a different state with new characteristics (Crepin *et al.* 2012)

An important consequence of regime shifts is the difficulty in switching back to the previous state, largely a result of feedback mechanisms having changed. It is rarely enough to go back to the social and environmental conditions that existed prior to the regime shift. What is required is the cultivation of conditions that existed further back in time (Scheffer *et al.* 2002; Biggs *et al.* 2012). Reclaiming Bokburg Lake as an ecologically healthy and socially valued system is therefore highly challenging. Chapter 7 discusses the process and consequences of an attempt to do so.

6.5 Conclusion

This chapter has presented an historical contextual analysis of the Boksburg Lake social-ecological system. Data was presented in four main categories, namely:

- An historical overview of Boksburg's economic and developmental trajectory;
- An historical overview of Boksburg's environmental deterioration;
- An historical overview of civic groups and their action campaigns;
- An historical overview of Boksburg Lake.

From this data representation, five key analytical statements were derived. Analytical statement 1 expressed how Boksburg's identity and aspirations are linked to economic growth and progress, supported by a competitive spirit and increasing consumer values. Analytical statement 2 examined how economic growth is underpinned by

social and biophysical exploitation. Analytical statement 3 examined the power dynamics that exist across the social, economic and biophysical domains with economic and social hegemonies driving patterns of victors and losers. Analytical statement 4 expressed how Boksburg Lake and its catchment can be viewed as a system where drivers, multiple flows and feedbacks direct its economic, social and biophysical trajectory. Analytical statement 5 described how Boksburg Lake has flipped from being one of Boksburg's biggest assets to becoming a socially and ecologically degraded system. For each analytical statement, theory is drawn on to better understand the processes and generative mechanisms at play.

Part of the aim of the concluding discussion, chapter 8, is to answer the primary question: What generative mechanisms constrain and enable the development of resilience in the modern social-ecological system of Boksburg Lake? This is achieved by addressing each research goal (1, 2 and 3) through a summary of the applicable conceptual and empirical findings. It is in the concluding discussion that the generative mechanisms driving the degradation of the Boksburg Lake social-ecological system are postulated (research goal 2).

The next chapter explores learning mechanisms that support transformation of the Boksburg Lake social-ecological system, considering the 'identities with', 'knowledge about' and 'agency for' that locals, particularly learners, have expressed in relation to Boksburg Lake (research goal 3).

Chapter 7:
The Boksburg Lake Social-Ecological System: Learning and Change

7.1 Introduction

This chapter explores learning and change in the Boksburg Lake social-ecological system to address research goal three: Identify learning mechanisms that support transformation for greater resilience of the Boksburg Lake social-ecological system.

In chapter 5 it was suggested that the closer a cultural system is coupled to ecological realities, the healthier and more valued these would be by local people. This in turn influences the resilience of the integrated social-ecological system. The role of patterns of identifying, knowledge and agency in shaping processes of coupling with the ecological world was emphasised. These three concepts of patterns of identifying, knowledge and agency were adopted as broad categories for analysing how participants became engaged in the complexities of bringing about positive change in the degrading Boksburg Lake social-ecological system.

Literature indicates that patterns of identifying, knowledge and agency are closely interlinked and reinforce each other, as represented in figure 7.1. Mingers (2006: 197) for example, highlighted the close relationships between knowledge and action where they "are much less separable than is commonly presumed". He critiqued the Cartesian view that knowledge and action are separate domains: "knowledge and action are not merely linked, but are indissoluble – two sides of the same coin. Action is the enactment of knowledge and knowledge is the sedimentation of action". In a learning context, the combination of knowledge and action is an important means to bring about deeper understanding: obtaining knowledge about something enables one to act, yet people learn by doing (Jensen & Schnack 2006; Wiek *et al.* 2011), which reinforces knowledge. Conradie (2011) supported a need to foreground identity. He pointed out that many people know about environmental problems yet fail to act on them, indicating a potential disconnect between knowledge and action. This gap can often be attributed to people's worldviews and values, which determine patterns of identifying. There are also many things we know we can do, partly due to a growing knowledge and/or technological base, but the question is should we do it (Max-Neef 2005). The answer to this question will be determined by our values and patterns of identifying. This normative process provides a link between knowledge and patterns

of identifying that is guided by a critical reflection of one's values and ethics to inform contextually relevant decision-making and action.

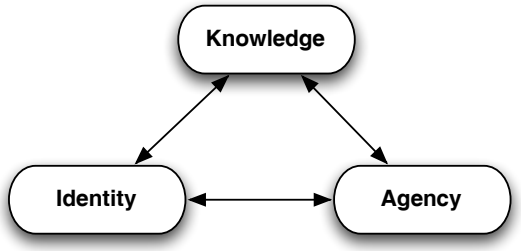


Figure 7.1: Knowledge, identity and agency in an interlinked framework where double arrows indicate a two-way directional relational causality

The competency framework, developed by Wiek *et al.* (2011), consists of five competencies necessary to bring about more resilient social-ecological systems. These are systems thinking competence, anticipatory competence, normative competence, strategic competence and interpersonal competence. Systems thinking competency is important as it gives humans knowledge to better grasp the complexity both of the problems and possible solutions to achieving desired social-ecological states. Developing normative competency opens up possibilities for re-imagining more desirable ways of being while an anticipatory competency develops futures thinking and enhances reflexivity of current actions. Strategic and interpersonal competencies are necessary to achieve desired visions in an attitude of collaboration. I identify links, (see below) between these competencies and the three concepts of identity, knowledge and agency, to add to their depth and strength:

- **Identity** relates to an anticipatory competence (identifying with certain visions and scenarios – either negatively or positively), normative competence (ethics, values and what is regarded as the status quo) and interpersonal competence (what do we relate with and how do we relate).
- A systems thinking competence encourages the development of social-ecological systemic **knowledge**.
- **Agency** relates to strategic competence (doing things to bring about desired ends).

In chapter five, four normalising ideologies (Foucault 1981, Thompson 1990) were identified as underpinning the hegemonic western social-ecological worldview. These are anthropocentrism, human:ecological dualism, the mechanisation of nature and nature is to be controlled. These metaphors promote alienation from the ecological world and human progress at the expense of ecological integrity. The concept of totality, developed by Bhaskar (1993), highlights the importance of viewing a system

as a whole and adds weight to the idea that we are intimately connected to the ecological world. If ecological systems decline, so will the embedded social systems. However, due to the complexity of social-ecological systems the process is likely to be non-linear (Cilliers *et al.* 2013).

Social structures and institutions encourage particular patterns of identifying with, knowledge about, and agency in social-ecological systems and may perpetuate or challenge these alienating concepts. Individuals embody the social structures in particular ways, and reproduce or transform them through their agency (Archer 1995). This reflects processes of morphostasis or morphogenesis with the hegemonic patterns remaining or changing respectively (Archer 1995).

Religious and educational institutions play a formative role in shaping worldviews, normalising ideologies (Foucault 1981; Thompson 1990) and patterns of identifying, types of knowledge and forms of agency within social-ecological systems (Weber 1930; Bourdieu & Passerson 1990; Kellert 2007). History indicates that they are highly effective institutions at maintaining the status quo (morphostasis) (Stevenson 2007; Durkheim 1956). In modern society this is characterised by capitalism (Gottlieb 2009), industrialisation (Gottlieb 2009), economic growth (Schumacher 1998; Leonard 2007), the unquestioned notion of progress (Weiskel 1989; Norgaard 1994) and anthropocentrism (Daly & Cobb 1994). There is also evidence that schools and churches can be institutions effective in bringing about morphogenesis, i.e. social change (Gottlieb 2009). These two institutions, both of which have strongly influenced western culture, have held ambivalent perspectives regarding human relationships with the ecological world. This chapter explores the consequences of involving Boksburg schools and churches in processes of working towards transformation of the Boksburg Lake social-ecological system. The characteristics of modern schools and Christian churches are now examined in more detail.

7.1.1 Schools

Schools, as institutions for mass education, developed in the 19th century with the aim of socialising children (Soysal & Strang 1989). They have traditionally been institutions where the dominant beliefs and values of society are transferred to the next generation: “their intended function was not to promote social change or reconstruction” (Stevenson 2007: 144) but rather to foster and perpetuate social stability (Durkheim 1956). Schools have therefore largely prepared children for uncritical participation in society when they are adults. The negative impact of some

dominant values on social-ecological systems indicates the importance of transforming these values. Stevenson (2007: 145) stated that this is the "revolutionary purpose" of contemporary environmental education where values need to be changed from present values that support environmental and human degradation to those which support social-ecological resilience. This presents a contradiction between the goals of environmental education and traditional patterns of schooling (Uzzel 1994).

The traditional educational approach is being challenged, as an increasing number of educational theories recognise the importance of developing critical thinkers who effectively participate in society as change agents (Uzzel 1994). This is reflected in a variety of conventions and policy statements. The Tbilisi declaration stated that learners should "be actively involved at all levels in working toward resolution of environmental problems" (Tbilisi Declaration, 1977: in Stevenson 2007: 18). The United Nations Convention on the Rights of the Child (United Nations, 1995) has been influential in "encouraging an increase in children's participation in democratic societies, placing an emphasis on children's involvement in environmental decision-making" (Hacking *et al.* 2007: 531). Hacking *et al.* (2007) highlighted a number of authors (e.g. Hart 1997; Hacking *et al.* 2006) who were researching how children can be engaged in participatory environmental action, environmental citizenry and community development. These developments are influenced by firstly, the growing recognition that children are environmental stakeholders and therefore have a right to be involved in environmental decision-making (Hacking *et al.* 2007) and secondly, the increasing recognition that children's political and environmental experience has a positive effect on developing pro-environmental behaviour (Chawla & Cushing 2007).

Hacking *et al.* (2007) indicated that, although children's participation in environmental issues is increasing, there is still a lack of their widespread and systematic involvement. Uzzel (1994) argued that the present character of schools prevents them from being truly effective in changing society. For children to have the effect advocated in environmental education discourse, schools will have to adopt a new identity of becoming "active agent[s] in the creation of change rather than … passive transmitter[s] of information or values" (Uzzel 1994: 6).

7.1.2 Churches

Hitzhusen (2007) argued that a religious perspective has had limited space in environmental theory. However, the moral dimension of the environmental crises provides just reason for the involvement of religions (Simkins 1994; Conradie 2011).

As Conradie (2011: 7) argued, moral formation typically occurs within faith communities and consequently "ecological transformation of religious traditions is critical to the emergence of an ecological ethos". Anderson (2010: 45) explained that for many traditional societies, "Environmental management is almost always regarded as a divine charge, enforced by supernatural beings". He provided compelling reasons for the value of religion in tackling modern social-ecological risks. This includes: the wider social universe beyond one's immediate circle that religion encourages (in many cases this includes the non-human world); the religious teachings on love; the ethical systems religions create and enforce through developing the conscience of the believer; the solidarity created by religion; and the hope and strength religion can give people.

There is growing consensus, as expressed at the international Earth Summit (Rio, 1992) by its Secretary General Maurice Strong, that some spiritual foundation to our environmental relationship is essential. Strong stated that the Rio decisions require "deep moral, spiritual, and ethical roots if they are to be successfully implemented" (Sider 1995). In 1990, a group of renowned scientists, including Carl Sagan, signed an 'Open letter to the Religious Community' urging religious people to join the movement to save the environment (Sider 1995). In their statement, the scientists acknowledged that the ecological threat is so massive that disaster cannot be avoided unless the religious community joins the struggle. The role that churches can potentially play in social-ecological resilience is also being increasingly voiced in the literature (e.g. Ashley 2006; Hitzhusen 2006). Hitzhusen (2006), for example, argued that ecotheology provides a rich source of environmental values and ethics that can contribute to environmental education in a variety of contexts.

However, the church has been critiqued for its lack of environmental involvement. Achtemeier (1992: ix) stated, "Few subjects have been more neglected by the pulpit in this country [USA] in recent years than an explication of the relation between nature and God". While investigating the environmental awareness within churches in South Africa in 1991, Jacklyn Cock (a sociologist) discovered that there is a "blind spot" and "deep silence" on environmental issues within the South African church (Conradie 2011). Berry (1993:114-115) is scathing of the Christian church's role in supporting the damaging economic status quo: "It has, for the most part, stood silently by, while a predatory economy has ravaged the world, destroyed its natural beauty and health and divided and plundered its human communities and households".

A number of ideologies have been identified that uphold the frequent disregard for environmental concerns by churches. Anthropocentrism and the related attitude that

humans are at the centre of the universe is often identified as an ideology characterising Christianity (Dobel 1977; Conradie 2011; Gottlieb 2009). Supporting anthropocentrism is a spiritual:natural dualism where the spiritual (human) is of supreme importance and the natural is viewed with little regard (Conradie 2011). It is commonly believed that humans are the only animals with a soul and are thus the bearers of moral value (Gottlieb 2009). With nature objectified, the non-human world becomes the backdrop of humanity's drama (Gottlieb 2009) and a place to subdue and conquer in meeting one's needs and desires, promoted by the dominion mandate (Rajotte & Breuilly 1992; Gottlieb 2009). An otherworldliness and preoccupation with human salvation from the earth can also characterise some Christian ideologies (Conradie 2011).

From within the Christian tradition there is, however, a wealth of ideological resources that challenge those described above and modern Christian religion is increasingly advocating respect for the earth, love for non-humans and becoming reflexive about social and economic practices and priorities (Gottlieb 2009).

An examination of western history indicates that the anthropocentrism now rife, is more a consequence of the secularisation of western society than religion. As Bauman (1994: 23) stated, the ambition of the Renaissance "was nothing less than to found an entirely human order on earth, and one that would be erected entirely with the help of human capacities and resources alone". Humanity consequently replaced God as the centre of the universe (Bauman 1994). Ashley (2006) explored how Judaeo-Christianity can offer an alternative environmental ethic to anthropocentrism that is rooted in a theocentric position, where God is placed at the centre. The real distinction is no longer between humans and the rest of creation, but rather God and creation. This affirms a sense of humanity belonging to a "community of creatures" (Daly & Cobb 1994: 405). Within Christian theology there is also recognition of the particular stewardship role humanity has within the rest of creation where we are to be representatives of Christ's love, expressing "the imago dei, not for ourselves but for creation" (Breuilly 1989: 57). Archbishop Desmond Tutu is quoted as saying: "We… acknowledge that the living out of our beliefs concerns most deeply the care and nurture of all living things and the environment upon which they depend" (Mash no date). A theology that focuses on the immanence of God supports a narrative that moral value extends beyond the human and also challenges spiritual:nature dualisms, as creation is no longer viewed as separate from God (Peacocke 1983; Polkinghorn 1986).

Encouragingly there is a growing international and national eco-church movement as

Christians realise the richness of environmental teaching in the Bible, as well as the importance of environmental sustainability. For example, in June 1994, almost 500 Christian leaders signed the declaration named: 'On the care of creation: Evangelical Declaration on the Environment', thus expressing the importance of environmental care to their faith (Gottlieb 2009). This is a two and a half page document that expresses ecological concerns, strong pro-ecological values and intentions for action. A growing number of South African churches are joining the environmental movement and organisations have been established to support this. Examples include the Johannesburg Anglican Environmental Initiative (JAEI), which has established five eco-congregations in Johannesburg, SAFCEI (Southern African Faith Communities Environment Institute), A Rocha, and the Evangelical Environmental Network. A Rocha, a Christian conservation organisation working for the protection of fragile ecosystems in co-operation with local people, began in South Africa in 2004 (Goddard 2008). SAFCEI is working on setting up eco-congregations across South Africa and is currently developing an eco-congregation handbook. This reflects and supports the growing South African eco-theological movement.

The chapter moves on to discuss the importance of learning, if schools and churches are to play a transformative role for increased social-ecological resilience.

7.1.3 Learning as a meta-narrative for transformation

Glasser (2007: 47) stated, "it is only through learning … that we acquire our values, attitudes, and concerns along with our conceptions of reality". For schools and religious institutions to challenge and transform the status quo new kinds of learning are therefore required that will bring about different patterns of identifying, types of knowledge and forms of agency.

There is a growing recognition of the importance of learning at a societal level (Bawden *et al.* 2007) as an adaptive response to the social-ecological crises facing modern society and as a means to build social-ecological resilience (Bawden *et al.* 2007; Wals & van der Leij 2007; Tschakert & Dietrich 2010; Biggs *et al.* 2012). As Glasser (2007: 38) argued, learning is becoming the "meta-narrative and vehicle for bringing about a more sustainable and desirable world for all".

Bawden *et al.* (2007: 139) emphasised that modern society will have "to learn more quickly, more effectively, and much more critically than societies in the past" because of the speed of and globally interconnected nature of social and ecological changes

that are currently being faced. Wals and van der Leij (2007: 17) connected the importance of "powerful learning processes" to changing unsustainable "assumptions, behaviors and values". In the UN decade for Education for Sustainable Development (2005-2014) vision UNESCO suggested that "we must learn constantly – about ourselves, our potential, our limitations, our relationships, our society, our environment, our world" if we are to achieve the critical goal of increasing the quality of life for all while also respecting the earth. Individuals and organisations across all sectors are therefore encouraged to engage in critical reflection and learning (Bawden *et al.* 2007) that is innovative, far-reaching, social and transformative (Wals 2007b) and that facilitates adaptation to complex, fast-changing social-ecological systems (Holling & Gunderson; Biggs *et al.* 2012).

Authors (e.g. Reed *et al.* 2010) point to the importance of effective social learning processes for challenging ecologically damaging practices. This reflects the recognition that multiple perspectives, values and interests are needed when tackling social-ecological problems (Lotz-Sisitka 2012). Social learning discourse lacks a common theoretical perspective and accepted definition, pointing to its multifaceted use by a variety of both natural and social disciplines and theoretical spaces (Reed *et al.* 2010). Reed *et al.* (2010: 6) provided a comprehensive definition that is adopted in this thesis: "Social learning may be defined as a change in understanding that goes beyond the individual to become situated within wider social units or communities of practice through social interactions between actors within social networks". Glasser (2007) argued that most learning is social due to humans being inherently social. He made the useful distinction, particularly relevant for my thesis, between passive social learning that has the potential to entrench the status quo and active social learning that can challenge the status quo through reflexive processes. Passive learning is the most common form of social learning and is based on absorbing the prior learning of others, without direct engagement. It is based on trust, accepting the information uncritically and generally involves adopting "the values and assumptions that are encoded in the transferred knowledge" (Glasser 2007: 50). Passive social learning has limited effect in transforming social structures and can help perpetuate modern unsustainable behaviours and hegemonic normalising ideologies (Glasser 2007).

In contrast, active social learning is "inherently dialogical" where two or more living beings engage in conscious interaction (Glasser 2007: 51). It encourages critical reflection of existing knowledge and the development and application of new knowledge and therefore has the potential to bring about positive change of the status quo (Glasser 2007). This relates to the work of Wals (2007b) who uses the metaphor of 'frames' to highlight the processes needed for effective learning, where frames

refer to an individual's particular way of perceiving and interacting with the world that is informed by hidden assumptions. By consciously engaging with diverse others with the intention to learn, individuals can become aware of their frames through exposure to the framings of others (Wals 2007b). Effective social learning occurs when people have challenged their own frames and constructed different ones together (Wals 2007b).

Bandura (1977) developed a social learning theory that had four aspects:

- Attention: the model behaviour must grab the learner's notice.
- Retention: the learner must be able to learn the observed behaviour.
- Reproduction: the learner must be able to replicate the observed behaviour.
- Motivation: there must be a consequence that increases the likelihood of the learner reproducing what they have learned.

Glasser (2007) examined the possibility of ecoculturally sustainable behaviours becoming more normative through processes of social learning. He employed Bandura's framework to show why these behaviours are infrequently adopted through passive learning processes: attention is diminished as they are seen as less appealing than normative behaviour; retention is unlikely as they are frequently unfamiliar; they are more difficult to reproduce because they are often more complex to enact; and motivation is reduced as they are often more expensive, less fashionable, more inconvenient and time consuming. Two additional factors are advertising campaigns that show people enjoying the results of unsustainable behaviours with no sign of the negative effects, and that these effects are often located far from the perpetrator, both in time and space (Bauman 1994; Glasser 2007). This points to the importance of more aggressive active learning social processes to offset the detrimental effects of passive learning on social-ecological resilience.

This introductory section has provided context to the focus of the chapter and explored the role that schools and churches can play in transforming social-ecological systems.

The remaining structure of the chapter is as follows:

- An overview of the methodological framework with a detailed examination of the process of data analysis.
- Data representation including a description of community learning and change and an examination of the emergent patterns of identifying, forms of knowledge and types of agency amongst school participants.

- A theoretical discussion, based on four analytical statements that emerge from the data.
- The conclusion.

7.2 Methodological overview

The methodological framework was discussed in detail in section 4.2. This section highlights the methodologies and methods used to examine learning and change within the Boksburg Lake social-ecological system and examines in greater detail the analytical process adopted.

Three methodologies underpin data presented in this chapter, namely action research, case study research and interpretivism. See section 4.4 for a detailed discussion of these methodologies. The methods adopted were diverse and included participant observation (Lindlof 1995), 38 semi-structured interviews with teachers and role players (Lindlof 1995; Gillham 2000), 19 semi-structured focus groups with learners (Fontana & Frey 1998) and document analysis of learner's writing, the minutes of meetings attended and email correspondence (Nachmias & Nachmias 1990). Section 4.4.6 provides greater detail of the data collection methods. Table 7.1 is a list of acronyms used throughout this chapter and includes schools and churches that participated and data generation methods.

Table 7.1: List of acronyms specifically used in chapter 6 when referring to data sources

Schools	Acronym	Churches	Acronym	Methods	Acronym
Boksburg High	BH	Anglican	A	Essay	E
Diakomea School	DS	Catholic	C	Focus Group	FG
Dawn Park Primary	DPP	Methodist	M		
EG Jansen High	EJH	Presbyterian	P	Interview	I
Goede Hoop Primary	GHP	Word & Life	WL	Solitaire Activity	S
Hoërskool Voortrekker	HV	South African Faith Communities Environment Institute	SAFCEI		
Leswabe Primary	LP				
Reiger Park High	RPH				
Reiger Park Primary	RPP				
St Michaels Primary	SMP				
Summerfields Primary	SP				
Sunward Park High	SPH				
Witdeep Primary	WP				

The results of five years of intensive data collection, using a wide range of methods generated a large and complex data set. The challenge was to order data and make

sense of the processes of change over time, evident from emerging perspectives and practices. A series of organisational and analytical steps were developed to achieve this.

Once the main body of data was transcribed, it was collated into an archive file, ordered according to date and classified as schools, churches or the broader community. This was read through iteratively, following a grounded, inductive approach (see section 4.4.7 for more detail) to reacquaint myself with the data, see it as a whole and get a sense of possible codes, as is recommended by Lindlof (1995). The next step was purposive reading where the data was coded line by line, which is a recognised grounded theory technique (Lindlof 1995). Fifty-nine concepts were identified in this first round of analysis and the data was sorted accordingly, using a cut and paste technique (see appendix G for a list of these concepts). Throughout this process, a theoretical perspective on the role of patterns of identifying, knowledge and agency in affecting the resilience of a social-ecological system developed. As this theoretical perspective was strengthened it became clear that the three main categories ("identifying with", "knowledge about"; and "agency for" Boksburg Lake and its catchment) provided a meaningful way to organise and analyse the complex data. In the next round of analysis, data was categorised according to patterns of identifying, knowledge and agency where individual quotes were pasted under the applicable category. The reordered data was once again read in an inductive process to allow 33 new concepts to emerge in relation to identity, knowledge and agency. See appendix H for a list of these concepts. The final step reduced these concepts to two or three under each category of identity, knowledge and agency. Throughout this process, the data categories were becoming more comprehensible and manageable. Fifty-nine concepts were thus reduced to the following (figure 7.2):

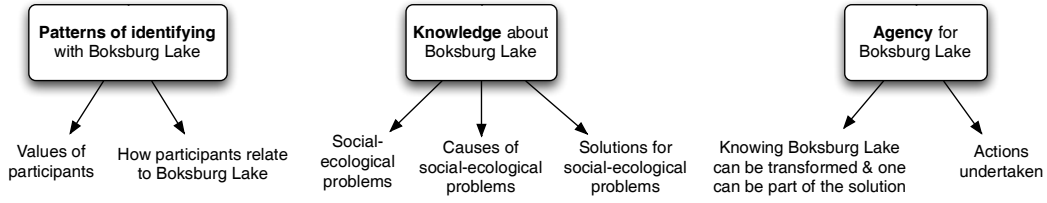


Figure 7.2: The three final categories that emerged from data analysis (patterns of identifying, knowledge and agency) with their associated concepts

The data related to each of the final seven concepts was then summarised both qualitatively (where themes were identified and representative quotes selected) and quantitatively (where the identified themes were counted to obtain percentage amounts of a particular perspective).

The three categories (patterns of identifying, knowledge and agency) with their associated concepts (figure 7.2) were used to structure the representation of data. The RRREIC schema was then followed, as explained in section 4.4.4, to structure my results and discussion. The theoretical discussion forms the foundation for identifying learning mechanisms that support transformation for greater resilience of the Boksburg Lake social-ecological system (research goal 3). This foundation is then synthesised in the concluding discussion (chapter 8) to directly answer research goal 3.

7.3 Results

7.3.1 A narrative of stakeholder agency and system inertia within the Boksburg Lake social-ecological system

From 2009 the Schools for a Sustainable Environment Initiative (SSE) was established. See section 3.5 for a detailed description of this initiative and its characteristics. It was a collaborative effort involving a range of role players, from municipal, government, school, NGO, industry, business, community and faith-based representatives. Much emerged from this initiative and collaboration. The unfolding story from 2009 to 2013 is documented below.

After a year spent undertaking a contextual analysis, establishing networks, designing the provisional initiative and inviting role players to participate, 2009 was focused on solidifying the networks, collaborating with partners on the direction of the initiative and launching it at the first annual Boksburg Lake Day, held on 11 September. In the build-up to the day, a stakeholders' planning meeting was held on the 23 July in which a range of stakeholders participated, including teachers, municipal and Unilever representatives and additional role players. This proved to be another important step in the local community owning the initiative.

The Boksburg Lake Day (see section 3.6.3 for details of the day's events), in which 280 learners from ten local schools participated, became the linchpin of the initiative and the primary means of developing a community of practice with a growing culture of action for Boksburg Lake. It gave the initiative a face through extensive media coverage in the local newspaper; provided Ekurhuleni municipality with much-needed support, momentum and a better name (up until then they had largely been in the press for negative reasons around Boksburg Lake); set up a culture of stakeholders working together (including different departments within Ekurhuleni, Unilever and local

NGOs); and learners were invited to be agents of change in a locally relevant learning context. Good responses were received from teachers as the following quotes indicate: "[the] *children absolutely loved it; they can't stop talking about it; and the grade 5s now can't wait to be in grade 6 so that they can be part of it*" and "*That the day was absolutely marvelous. The children enjoyed it thoroughly*". Figure 7.3 provides a visual representation of aspects of this emerging community of practice.

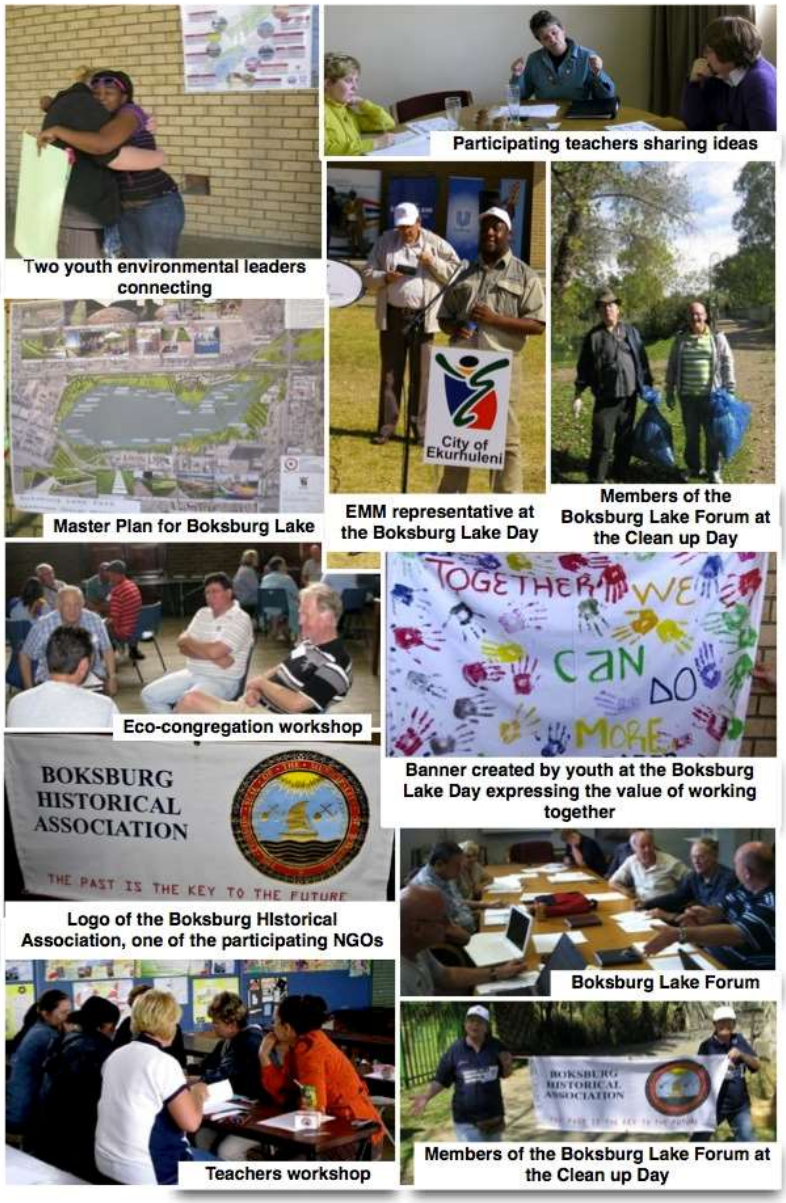


Figure 7.3: Visual representation of aspects of the emerging community of practice

Throughout the initiative, the role of key individuals proved invaluable and steered the initiative in particular directions. If they left, for example through a change of jobs, a

vacuum would be left, and in time was often filled by another key player who would guide the process in a different emergent direction. In 2009, three individuals stood out: Jane, Samuel and Heidi. Jane from Unilever played an increasing essential role as the initiative developed. At the end of 2008 she took over as the Unilever representative, acting in a volunteer capacity, over and above her Unilever paid work duties. She was a visionary, giving excellent input into the initiative's direction, was unwavering in her commitment, always found time to attend meetings, and secured important funding for the Boksburg Lake Day. Samuel was the primary municipal representative in 2009 and helped establish the growing partnership, between Ekurhuleni municipality, Unilever and the Unilever Centre for Water Quality, to reclaim Boksburg Lake. He was also invaluable in obtaining essential resources and other input from the municipality that ensured the success of the Boksburg Lake Day. Heidi was a columnist for the *Boksburg Advertiser* newspaper and had grown up in Boksburg. She had a particular passion to see Boksburg Lake restored and ensured that the lake received much media attention, both as a severely degraded system as well as a place people were trying to restore. Throughout 2009 she kept Boksburg Lake in the limelight and gave the Boksburg Lake Day good media coverage.

In 2009 evidence indicated that EMM had strong intentions to see Boksburg Lake restored. Attendance at meetings, involving role players from different departments and a number of interviews revealed the following:

- An interdepartmental forum (Water and Sanitation, Metro Parks, Water Quality, the Environment Department) had been established to discuss issues around Boksburg Lake and plan the way forward.
- A master plan had been developed for Boksburg Lake that entailed its complete revamp at a cost of about R25 million.
- In 2008 R1.6 million had been put aside for rehabilitating the lake.
- A R18 million dredger had been bought and plans were underway to address the toxic sludge build up by dredging the lake in 2010.
- Aerators had been bought to aerate the water column and the cascades on the south-eastern side of Boksburg Lake were going to be made operational.
- There were plans to put in a silt and litter trap costing R6 million; have a monthly clean-up of the Boksburg Lake shoreline with a budget of R200 000; review and update the storm-water management drains so that they would bypass the lake; and build a capture dam so that the storm water could flow into this and be naturally filtered before entering Boksburg Lake.
- A survey was going to be undertaken of all the industries in the area to determine which industries were there and what they were doing.

- The sewer system upstream from Boksburg Lake had been examined to identify sewage blockages and their causes.
- A water quality analyst had undertaken a complete chemical and biological test of Boksburg Lake's water quality.
- R100 000 had been put aside to analyse the sludge and develop a sludge management plan.
- Metro Parks was upgrading Boksburg Lake's facilities.
- A security company had been hired and the closing time of Boksburg Lake was going to be earlier to reduce the threat of crime and vandalism.
- R900 000 had been allocated to fence the last portion of Boksburg Lake.
- A number of municipal-led environmental education programmes were running, including the EYE programme and environmental camps with youth. Environmental forums had also been established in the townships.
- The SSE initiative had been included as a community awareness campaign on the Boksburg Lake Catchment and received 100% commitment from the municipality.

Two key activities stand out in 2010. Firstly, the second annual Boksburg Lake Day, held on the 17 September, was again successful and continued to build a community of practice around reclaiming Boksburg Lake. Secondly, there was a focus on involving local faith-based communities in the initiative as they represented the community and brought a moral stance to issues. A local evangelical church agreed to do a Green God preaching series with a focus on environmental concerns and Boksburg Lake, and a sermon was given at the Anglican Church on similar themes. Collaboration with local church leadership led to an Eco-Congregation workshop held on the 23 October 2010, hosted by the local Catholic Church and led by Kate Davies from SAFCEI. Kate Davies is the mastermind behind the concept of an Eco-Congregation and finds her inspiration from the Eco-Schools programme. The idea is to inspire churches to adopt environmental practices in three main areas: "worship, celebration and spirituality; management of resources; and work in God's world" and share these practices through a growing community of practice (Davies 2010). The workshop was well attended by over 20 participants from a variety of faith-communities including Catholic, Anglican, Presbyterian and Methodist congregations.

Unilever continued to play a considerable role in the initiative, largely through Jane's continued vision and commitment. Contact with the municipality, however, decreased in 2010 largely through the departure of Samuel, who had been the main liaison person.

In terms of municipal commitment to the reclamation process, the intentions were still clear to remediate Boksburg Lake, the R25 million Master Plan had been approved and they continued to commit resources and personnel to the Boksburg Lake Day. However, complications with the EIA process caused delays with dredging Boksburg Lake and it was postponed to 2011.

2011 was showing itself to be a year of promise – after two successful Boksburg Lake Days, Unilever in full support through Jane, EMM expressing a clear intention to reclaim Boksburg Lake, schools setting up environmental action projects, the community getting increasingly involved, particularly through faith-based communities, and the establishment of partnerships between important role players, such as the Boksburg Historical Association, WESSA and Rand Water. An important goal was to establish clear community ownership of the process, where I increasingly handed over the reins to emerging leaders.

The year started with a well-attended open community meeting in late January 2011 where representatives from EMM and Unilever shared progress on Boksburg Lake. This was a consequence of the Eco-Congregation workshop held in 2010 where the need had been expressed for more information on Boksburg Lake. Paul, the pastor of the local Presbyterian Church who had attended the Eco-Congregation workshop, was instrumental in organising and hosting this. As a follow-up, a stakeholder-planning meeting was held on 3 February to discuss the way forward. Fourteen people attended, including two representatives from EMM, four learners from Reiger Park High, two teachers, one councillor, two members of the Boksburg Historical Association, and three faith members. The following goals were agreed upon as well as the organisations and individuals responsible for their realisation.

- Complete the EIA (EMM).
- Establish a Boksburg Lake Forum consisting of stakeholder representatives that meet once a month (Councillor representative and EMM representative).
- Keep the local community informed about the municipal progress on Boksburg Lake as well as educate regarding good environmental practice.
- Publish a monthly informative and educational article for the Advertiser (Councillor representative) and Ekurhuleni newsletter and water statement (EMM representative).
- Once a quarter, organise an informative Community Public Meeting on progress being made for Boksburg Lake. This would receive media coverage. (Churches would provide leadership, offer venues and invite people).

- Encourage and support participating schools in the Boksburg Lake project to become Eco-Schools (teacher representatives, myself).
- Increase the number of participating schools (myself).
- Learners from Reiger Park High committed to educating their community about the importance of a clean natural environment.
- Organise the third Boksburg Lake Day through a committee.
- Have regular clean-up days with a strong educational focus, organised by a committee.
- Establish eco-guides in Boksburg (EMM representative).
- Organise an Easter Sunrise Service at Boksburg Lake (St John's Presbyterian and Methodist churches).
- Establish local Eco-Congregations.

From this stakeholder planning meeting, the Boksburg Lake Forum emerged, with its first meeting on the 2 March 2011. It met monthly throughout 2011 and 2012 with the aim of supporting the Metro's reclamation of Boksburg Lake. Representatives on the forum included EMM, schools (both educators and learners), business and industry (most notably, Unilever), local churches and other civic organisations. The forum created a platform for the local community to express ownership of the process of reclaiming Boksburg Lake. A clean-up sub-committee was constituted with the aim of mobilising the broader community to get involved in direct action to improve Boksburg Lake. A Boksburg Lake Day sub-committee was also constituted. In early 2011 the forum was particularly active with a wide stakeholder representation and lots of plans in the pipeline. The dredging and master plan were prominent in discussions and there were promising signs of their implementation being imminent.

Particular individuals made important contributions to the Forum's success. Steve (a previous DA councillor and especially active citizen) was unanimously elected as the chairperson. He sat on a variety of committees, such as the Ward Committee, the Beautification of the City committee and City Improvement District, had in-house knowledge of EMM, so was able to give regular updates of municipal progress in restoring Boksburg Lake and took the forum seriously enough to write up its draft constitution. Luke attended the Eco-Congregation workshop as a representative of the Anglican Church. He then attended the open community information meeting and from there became a member of the Forum. He was elected vice-chairman, played an invaluable, active and supportive role and took the lead in organising the three clean-up days that happened in 2011 and 2012. The first clean-up was held at Boksburg Lake on 14 May (more than 100 people participated), the second on 22 October 2011

and the third on 17 March 2012. Appendix I is an article submitted to the *Boksburg Advertiser* about the clean-up day held on 14 May. In 2012 Luke took over as chair after Steve stepped down, as explained later. Patricia, representing EMM, played an increasingly important role. She was responsible for sending out email remainders about the forum meetings and was essential in organising both the 2011 and 2012 Boksburg Lake Days, increasingly taking over my responsibilities. Jane, from Unilever, who had been pivotal to the initiative's success thus far, left mid-2011 for another job. Her exit considerably affected Unilever's involvement and commitment to the process. Paul was an active agent and had an influential voice in the beginning of the forum, spearheading involvement of faith-based communities in the initiative and their vision to become Eco-Congregations. He was responsible for organising the inter-denominational Easter sunrise service held at Boksburg Lake on the 24 April. Mid-2011 he was reassigned to a different city and his departure significantly reduced faith-based communities' direct involvement in the initiative.

The Boksburg Lake Day was held on Friday 2 September 2011, intentionally close to Spring and Arbour Day to emphasise the connection of the SSE initiative to broader environmental objectives. Ten schools once again participated. The Boksburg Lake Forum, led by Patricia, played an increasingly important role in organising the day and this led to a growing sense of camaraderie and community of practice.

Ekurhuleni Metropolitan Municipality continued to express commitment to the lake's improvement. At the first Boksburg Lake Forum meeting on the 2 March 2011, the Master Plan for the lake was displayed and it was indicated that the clearing of unusable structures on the lake grounds had begun. R500 000 was also available to begin renovations and a Parks Department representative requested input from the forum about the areas to initially focus on. The ablution facilities had been upgraded and the Parks Department representative encouraged local people and schools to reclaim the lake. The Parks Department also offered Unilever the lake's boathouse as a venue for their functions and the Unilever representative stated that some of the funds saved from booking venues could be used for renovations, fencing and security. Installing the sediment trap had gone out to tender and a contractor had been appointed to keep the lake's waterline clean. EMM had committed a large amount of money for dredging and the dredging plan was complete. The EIA process had begun and as soon as authorisation was given, the dredging would start. It was indicated that the consultant would hold a public participation meeting on the dredging process and Steve was asked to make sure that there was an advertisement placed in the *Boksburg Advertiser* so that broader public participation would be achieved. In early June it was reported at the forum meeting that the dredging project was behind schedule and

consultants needed to amend the EIA because of recent changes in legislation. This delay postponed the public meeting scheduled for 11 June. By the October forum meeting, it was apparent that the EIA process would have to be restarted, significantly delaying the dredging process. In the November forum meeting it was announced that the silt trap would be installed and dredging commence in the latter part of 2012. The delay was caused by GDACE not accepting the EIA due to questions about where to dump the toxic silt.

The objectives for 2012, as stated by the Boksburg Forum's vice-chairman, included the "*dredging of the lake… the installation of the silt trap… further improve communications regarding the lake… hold regular clean-up days… hold another Boksburg Lake day… [and] regularly interact with sponsors and other stakeholder towards amending existing initiatives and adopting new initiatives*" (Email to Carnival City, 2012).

Throughout 2012, the Boksburg Lake Forum had monthly meetings. At the February meeting it was reported that the installation of the silt trap and the dredging was still likely to happen later that year. The EIA was with GDACE (now GDART) who were considering the drying process for the silt/sludge. By May it was highlighted that the dredging would only realistically happen in 2013 as it was an involved, complicated process. In the same month, Aqua Global approached the forum about the viability of their products, called Eco-Tabs, in restoring the water and decontaminating the sludge. By August 2012, a proposal had been written about the viability of Eco-Tabs to address the sludge problem in the lake. A new contract had also been put forward to upgrade the boathouse and improve the toilets. From mid to late 2012, there was considerable discussion among forum members about the feasibility of draining rather than dredging Boksburg Lake.

The clean-up sub-committee organised a Clean-Up Day on the 17 March in which between 60-70 people participated, including both children and adults. The day received good coverage from the *Boksburg Advertiser*.

The fourth annual Boksburg Lake Day was held on Saturday 1 September. The move to holding the event on a Saturday, as opposed to Fridays as in the past, was aimed at making the day more accessible to the general public, churches and civic organisations, whilst still encouraging learners from local schools to participate. Members of the forum, led by Patricia, organised the day and I played a more limited role. The lead-up to the day had a number of setbacks. Firstly, Steve, who was going to undertake many of the actions necessary for the day's organisation stepped down as

chairperson. Secondly, the Steyns, who led the Boksburg Historical Association and had played an important role in the organisation of the 2011 Boksburg Lake Day, left Boksburg in 2012. Consequently the Boksburg Historical Association did not participate in the event. Thirdly, a number of other key people had time-consuming work commitments. Fourthly, sponsorship had been uncertain, as Unilever was no longer as involved and attempts to expand the sponsorship base through partnering with Carnival City had been unsuccessful. Because of these factors and the day being moved to a Saturday, the event was not as well attended by schools (only two schools participated), there were not as many presenters and the day received less of a profile as compared to previous years (due to the absence of role players such as Miss Earth SA and poor media coverage). As a forum member stated,

> I think we'll be quite disappointed by how many people come. I think the Advertiser let [Luke] down big time…[they] only put a tiny thing in What's Up. [They] could have put in a photo, did an interview. The media at the moment is not emphasising the lake. In the past the media's interest in the lake created excellent opportunities for community mobilisation. The *Boksburg Advertiser*, Benoni, Brakpan – all these local newspapers now run out of Caxton – so [they] have become more generic rather than local. (Forum member, I, 2012)

In early 2013 Steve died and the sentiment was expressed to continue working hard to see Boksburg Lake restored in his honour. At the March forum meeting the agreed objectives for the year were as follows: water remediation; organise the fifth annual Boksburg Lake day; set up a trust; broaden the sponsorship base; and organise a clean-up campaign.

In early 2013 there was a growing frustration about the lack of improvement to Boksburg Lake, some members stopped coming to meetings and at the April forum meeting, in the light of the lack of progress, the question was asked whether the forum remained relevant. It was agreed that improvement to water quality had to be a priority and better co-ordination was needed amongst the Ekurhuleni departments. The unsuccessful plan was to get senior delegates from relevant departments around one table. The last official forum meeting was held in February 2014. Due to the dilapidated and hazardous condition of the lake grounds and the complete lack of response from EMM to any of the Boksburg Lake Forum's approaches, the forum decided to suspend all activities.

Throughout the years, a range of role players, including those representing EMM, expressed considerable hope, passion, commitment and promise. However, by early

2014 the forum looked like it had ended, the Boksburg Lake Day had not happened and the lake's grounds remained dilapidated and the water was toxic. An important question is why? The chapter moves to an examination of the patterns of identifying, knowledge and agency that emerged amongst learners and teachers of the participating schools. This further deepens the question of why the system was so resilient to change in spite of what had positively emerged from the SSE initiative.

7.3.2 Patterns of identifying with the Boksburg Lake social-ecological system

Introduction

In this section I explore patterns of identifying with the Boksburg Lake social-ecological system. The data is structured according to the two categories that emerged from the last round of data analysis, namely participants' values and relational positions adopted with respect to Boksburg Lake, as reflected in figure 7.4. The way participants felt implicated in Boksburg Lake's degradation, their strong emotional responses to the lake's condition and deep empathy and connection experienced with the lake and its animals, are discussed. These factors influenced the three main ways respondents began to relate to Boksburg Lake; namely as change agents, as persons who adopt a positive attitude to the lake and as persons who feel a sense of oneness and belonging with it. These are now examined in detail.

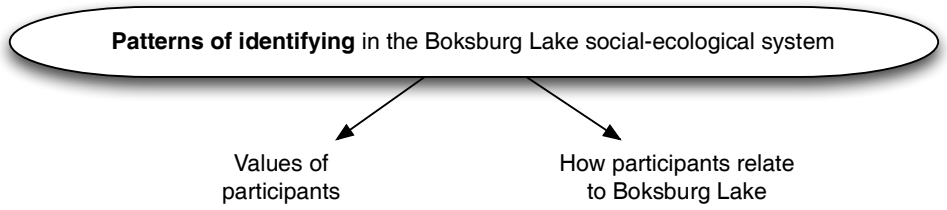


Figure 7.4: Two concepts (values of participants; how participants relate to Boksburg Lake) explored under the category: patterns of identifying in the Boksburg Lake social-ecological system

Values of participants

Learners and teachers attached a diversity of values to Boksburg Lake and the natural environment: the lake was valued for its history and connection to Boksburg's identity, its recreational and wildlife potential, and affective and aesthetic benefits. The natural environment was valued for its inherent value and because it is vital for human survival. Both Boksburg Lake and the natural environment were given spiritual value. These values are examined in turn.

A dominant theme throughout the four-year research process was the strong collective memories of Boksburg Lake. It is remembered, by both locals and nationals, as a place of important recreational and social value and people would often reminisce about the Christmas lights, carols by candlelight, the Chinese restaurant, picnics, playing putt-putt and feeding the ducks and swans, to mention a few of the activities previously enjoyed. Nine quotes indicate how Boksburg locals strongly identified with this lake of the past, pointing to its high historical value and close association with Boksburg's identity. A learner wrote: "*Boksburg Lake is a part of our history for many years*" and this is the reason given for why "*we have to save it for the future generations*" (HV, E, 2010). It is described as: "*one of the very few milestones that we do have of Boksburg*" (I, 2009); "*a monument and symbol of Boksburg*" (BH, FG, 2009); "*Boksburg's gold*" (BH, E, 2010); and as a teacher poignantly said in an interview in 2009, "*As a child we used to go to Boksburg Lake for picnics, we had Christmas there. My children grew up swimming around the lake, feeding the ducks. So to see it in the state that it is in now, it is almost as if a piece of your past that is being destroyed. I think it really impacts on you".* This expresses a deep identification with the lake of the past and can be interpreted as the destruction of a part of the individual.

This relationship with the historical Boksburg Lake influenced the value given to it as a potential recreational site, reflected in thirty responses. It was seen as a social space to be enjoyed by families; a safe and fun place for children; a tourist destination, and an environment where one could engage with and enjoy nature: A learner reminisced "*[What] I loved to see was that the Boksburg Lake was at a stage a holiday resort. I would love to see that again. All the things going there, all the events going on. I really liked that fact*" (DS, FG, 2009). Another learner wrote:

> *I want people to have their honeymoons there again. I want the flowers to bloom and light up the atmosfeer [sic] like they always did. It has to be safe again for the kids to run around and have picnics on Sunday afternoons. I want it to be the place where the fairies build their homes in the bushes.* (EJH, E, 2010)

Affective values (22 responses) express the emotional benefit of nature, particularly of Boksburg Lake. The main emotional benefit was a feeling of peace, quiet and calm (17 responses):

> *Boksburg Lake is so quiet. That is what I really like about it, there is peace.* (GHP, FG, 2011)

> *'Calm down' it [Boksburg Lake] tells me. 'Don't be jumpy' they [animals at the lake] tell me.* (SMP, S, 2010)

The emotional benefits of having a natural place nearby are expressed in the following quote:

> *The only time I have to just be in nature, I either have to travel hours, where I can just be surrounded by trees, water and animals, so if you don't have the finances to go for example a place where [sic] surrounded by mountains, water, trees or just nature as a whole, so won't get the experience to be in nature, because Johannesburg [sic] only surrounded by infrastructure. So if a lake like this where you can sit for a few minutes, where you just hear the wind blow [sic] no one disturbing you, it help[s] mentally.* (RPH, FG, 2012)

Additional emotional benefits included feeling enlightened, inspired, hopeful, embraced by the earth's kindness, free, refreshed and invigorated (one response each).

Eighteen respondents mentioned Boksburg Lake's aesthetic value: it was described as beautiful, captivating, romantic, lovely and treasured. Two quotes expressed how Boksburg Lake of the past was one of the most beautiful places and few attractions of Boksburg, "*It's sad to see something that was once so beautiful and wonderful, so ugly and untidy*" (SP, E, 2010). Seven quotes expressed its present beauty, marred by pollution, "*It's so unique, antique, beautiful but very dirty, damage[d*]" (BH, S, 2009); while one quote reflected on the high aesthetic value the lake would obtain if restored "*I feel that if restored the lake will be a place of endless beauty*" (BH, S, 2009).

Boksburg Lake was valued as a potential wildlife refuge as reflected in eleven quotes. There is recognition that the lake did not currently have this value; the statements were future oriented, expressing a desire to see wildlife at the lake, particularly birds and water creatures: "*An unpolluted environment where ducks and fish, all these lovely creatures that live in the lake can relive and dream that's their environment*" (WP, FG, 2009).

Dependency on the natural world (21 responses) was a strong value. Respondents realised the fundamental connection between their existence and well-being and environmental health. A learner stated: "*We can't live without nature*" (RPH, FG, 2010), echoed by another: "*We owe our existence to you [nature]"* (BH, E, 2010). Learners from Witdeep Primary sang the following words at the 2011 Boksburg Lake Day that expressed recognition of human dependence on the natural world: "*Don't kill*

the world our means of life but heed to nature's cry. Don't kill the world she's all we have".

Seventeen quotes expressed the inherent value of nature with learners expressing some poetic responses about the non-utilitarian gifts provided by nature: "*Sounds of the beautiful wind blowing. The sound of hidden sweet secrets that whisper themselves into your ear. The sound of natural nature in the air. The breeze that makes you just want to listen to what nature is saying*" (SP, S, 2010). During the same activity another learner from Reiger Park High wrote, "*The sound is like nature bringing fresh air to us*".

Spiritual values (five responses) expressed how nature is a gift from and habitation for God as well as part of the bigger spiritual community: "*We never understood the saying 'cleanliness is next to Godliness' but after the project we understood that God is in nature, so if we pollute it means we [sic] taking God way from nature. Cleanliness is not a just but a must*" (RPH, FG, 2011). Another learner passionately wrote:

> *Mother Nature I hear you're calling*
> *And I know what I must do*
> *I won't let them kill the lake*
> *We owe our existence to you*
> *We won't dam the rivers*
> *We don't need any more concrete walls*
> *The plants and mammals are our brothers and sisters*
> *We will save them all!* (BH, E, 2010)

How participants relate to Boksburg Lake

This section explores how participants viewed themselves relating to Boksburg Lake in the present and future.

A recurring theme was the recognition that Boksburg Lake is a degraded system and a number of respondents realised the implication of human beings (20 responses) and themselves (16 responses) in this degradation. As a learner wrote in an essay, "*We have used our precious lake as a junk yard. Dumping papers, waste material and everything that we can find to destroy the lake and its ecology. But in the end, us 'Homo Sapiens' are going to be suffering the actions we are taking, which [is] destroying the lake*" (WP, 2010). A notable way respondents thus related to Boksburg Lake was recognising their implication in its degradation.

There were strong emotional reactions to the lake's degradation. Eighty-eight of these were in reaction to the lake's general condition, with the overwhelming emotion being sadness and heartbreak (40 responses). Additional emotions included fear (9), disgust (7), unhappiness (7), disappointment (4) and shock (4). Eleven emotional responses, predominantly anger (4), were directed at those who had caused the degradation, while ten emotional responses resulted from learners' own sense of responsibility for the lake's condition, including embarrassment (3), feeling bad (3), ashamed (2), disappointment (1) and regret (1). As a learner wrote (SP, S, 2010), "*I am disappointed. I can't believe people like me did this to what used to be a beautiful lake".* Seven emotional responses indicated a lack of agency in the situation, including feelings of despair, depression, anxiety and being downcast and overwhelmed. In contrast, nine responses were much more positive and focused on the desire to help see an improvement as well as hope that this is possible: "*The moment I saw the river being polluted like that I just felt like I could do something*" (DP, E, 2011).

Learners and teachers also expressed a strong connection with Boksburg Lake. A primary way was through animals. Thirty-seven responses, from nine schools, made direct reference to animals and in many instances the learners meaningfully identified with animals. An emotive and frequent argument (19 responses) was that lake pollution must end as it negatively affects animals. Seventeen of these learners stated their wish for change in littering/ polluting practices within the community, schools and themselves and/ or their desire to clean Boksburg Lake because of the negative impact litter has on animals. Two examples follow:

> *They have to teach the learners that if they litter and the wind blows, the papers can end up in a river or lake where some living organism can lose their lives.* (RPH, E, 2010)

> *I also used to litter but since they showed us the picture of the animals dying in the water every thing's changed. I don't litter anymore.* (RPP, FG, 2010)

Knowledge related to animals was a primary way that the impact of litter was highlighted and prompted a desire to change one's way of relating to Boksburg Lake, while empathy was a notable emotional response (11 responses) to the harm inflicted on animals:

> *It really* ***broke my heart*** *to see that there wasn't actually fish or any nice animals that are there.* (WP, FG, 2009, my emphasis)

> *We need to clean our lake and make it a place for everyone to enjoy themselves so that the swans and all the other animals won't feel that we are* ***abusing them****.* (RPH, FG, 2011, my emphasis)

> *I feel like I can be a magician so I can change all of this dirt. I'm* ***hurt*** *because the creatures that live here don't have any safe environment.* (HV, S, 2009, my emphasis)

Learners' responses express that humans aren't the only important beings and identifying with animals goes beyond utilitarian values. Concern is felt because animals as animals are getting hurt and not because of a direct loss to human beings:

> *I learned that when you [throw] a paper on the ground that you are destroying the environment because the paper may not affect you, yourself or family, it can/ may kill animals, insects, aquatics because they are not able to live with human 'filth'. Therefore, if you pick up a paper you are not helping me but you are helping the ecosystem and Boksburg Lake.* (SP, E 2010)

Another learner described plants and mammals as "*our brothers and sisters*". These are inclusive words into a shared community of value and concern. Empathy was also felt for Boksburg Lake itself, which was most commonly described as a sad (4 responses) and lonely (3 responses) person. Additional phrases and adjectives included: "*depressed*", "*angry*", "*abandoned*", "*quite as if it's suffering*", and "*neglected and abused*". A number of learners expressed how they suffer because the lake suffers: "*It really* ***hurts*** *to see how dirty the lake is, when it was once so clean. It is like there is no hope*" (DP, E, 2011, my emphasis). There was also a sense that humans had betrayed the lake and nature: "*When we man came into the world nature took time to accommodate us. It* ***gave us a safe environment*** *to live in and [we] just* ***stabbed it in [the] back*** *and polluted earth*" (BH, FG, 2010, my emphasis). Consequently learners (3) expressed how they wanted Boksburg Lake to be "*loved*", "*taken care of*" (HV, E, 2010) and "*treated with the kindness and respect it deserves*" (BH, E, 2010).

The realisation of being implicated in Boksburg Lake's degradation, the strong emotional responses to the lake's current condition and the deep empathy and connection participants felt with the lake and animals influenced the three main identified ways respondents had begun to relate to the lake: namely, as change agents, as persons who adopt a positive attitude to the lake and persons who feel a sense of oneness and belonging with it.

The majority of participants adopted the role of change agents (165 responses) in improving Boksburg Lake (138 responses) and the general environment (27 responses). Cleaning (92 responses); making a difference (23 responses); saving (13 responses); improving (11 responses); helping (10 responses) and educating/ influencing others to care for the lake (7 responses) were the most commonly communicated means to do so. A number of quotes expressed how the youth believe they can and should make a difference to the lake and want to give their all in this endeavour. A few learners mentioned that, if they could, they would go to Boksburg Lake everyday to keep it clean, while one learner was already doing this. There was no indifference expressed to the lake's condition, indicating that the culture that developed around the Boksburg Lake Day was one of participation and action. Four representative quotes have been chosen to indicate how learners wanted to relate to the lake as change agents. They express:

- A passionate attitude of care and desire to see Boksburg Lake improved: "*God the Father knows how desperate I am for this lake to look like and how I and my friends care about Boksburg Lake. And looking up it [sic] we bring grace to the youth of Boksburg Lake. We ask the Ekurhuleni municipality to support us improve the lake*" (RPH, E, 2010).

- Changed perspectives on how humans can relate to the earth: "*Quite exciting to learn about how you can actually save the environment and not harm our Boksburg Lake because it[s] been there for quite a long time*" (BH, FG, 2010).

- The belief that the youth can bring about change and the importance of relating to the earth beyond one's own concerns: "*I think you're never too young to make a change. We mustn't litter. Life is not always about doing what you want to do. [sic] Must always look at the consequence of what's going to happen like the littering. If you do it, you can always enjoy it and feel proud of yourself, and [sic] something you'll never forget*" (WP, FG, 2011).

- The desire to be servants for Boksburg Lake, acting for its own best interests: "*... cause we as servants cleaning the lake. Cause we want to make a change*" (RPH, FG, 2011).

A group of learners from Reiger Park High sang the following song at the 2011 Boksburg Lake Day that expresses a strong and passionate desire to be protectors

rather than destroyers of nature. A personal identification with the different components of nature is also communicated.

> *Let's work together to make it a never. This nature of ours will never ever die, look at the birds, let them fly, look at the trees let them grow but you'll never, never, never harm them anymore.*
>
> *No more rhino poaching, no more tree destroying, no more litter in the lake, no more filth around us. But you'll never, ever, ever harm them anymore.*
>
> *Let's work together to make it a never. This nature of ours will never ever die. Look at the birds let them fly. Look at the trees let them grow. But you'll never, never harm them anymore.* (See appendix J for the video)

A notable number of quotes on being change agents were from Reiger Park High indicating how a group of learners had developed a culture of taking responsibility for positive social-ecological transformation.

A significant number of participants adopted a collective identity in improving Boksburg Lake, as expressed in forty-two quotes. The adverb **together** was used in 30 of these quotes:

> *We as Boksburg should join hands and come **together** as one to fight for the health of the lake in order to ensure the survival of the small ecosystems that live in and around it. So let's come **together** and be part of a team so that we can help save the environment and pre-long our lives. **Together** everyone achieves more.* (BH, E, 2010, my emphasis)

This is a useful quote that sums up many of the sentiments expressed: that change happens when people work together, the importance of working as a team, and the power of unity in affecting positive change. It is evident that the youth involved in the initiative placed high value on "*working together*" to achieve social and ecological change.

The second way learners related to Boksburg Lake was in adopting a variety of positive attitudes that ranged from care (35 responses), love (9), respect (4) and kindness (1). Two representative quotes have been chosen.

> *We the image of God are responsible for protecting, sustaining, loving and nurturing these bounties. The question is, have we been living up to our duties? When the world*

was made, we were put in charge of making sure that all animals and plants and the environment were kept safe and clean and that they were treated with ***kindness*** *and* ***respect****, but up until now we haven't done a very good job.* (BH, E, 2010, my emphasis)

... feed the lake with ***love****, help be responsible for the lake.* (RPH, S, 2009, my emphasis)

The third way learners expressed how they relate to Boksburg Lake can be grouped under the theme oneness/ belonging. This is a more intimate way of relating to and identifying with Boksburg Lake as compared to the previous two positions that can be described as a more external perspective. One main quote has been selected, and is supplemented by seven extracts.

Never thought wind could feel so loving
As it gently kisses my skin.
Never thought I'd ever want flies to sit on my hand
Because they irritate when they fly.
Is this what nature feels like?
If it is then I want to live here like a duck
I want to be here for all the days of my life. (SMP, S, 2010)

This poem was a spontaneous response to the effect of Boksburg Lake, expressing the new, surprising and positive experience of nature where it has become personal: the wind is loving and "*gently kisses my skin*". The learner's desire to live at the lake "*like a duck"* and "*for all the days of my life*" is telling, indicating s/he had begun to feel at home and part of nature. Another learner stated: "*By naming the earth we are naming ourselves*" (GHP, E, 2010), indicating the close connection and lack of separation s/he felt with the earth. The following two quotes continue this theme of connectedness and self-identification with nature:

We are the world and that the earth is a little bit sick now and we are the medicine so we must heal the earth. (GHP, FG, 2009)

I feel at ease here at the lake. Like I form part of this nature. (BH, S, 2010)

During a solitaire activity (2009) held at the lake it was written that the breeze and coloured leaves "*bring back a sense of belonging and nature. It makes you feel as if you're at home and it's where you're supposed to be*" reiterated by another learner

who described how it's where they feel "*at home*". When asked during a focus group how learners wanted to relate to the lake the reply was "*heart to heart*" (GHP, 2011).

Participants thus adopted a variety of positions in relation to Boksburg Lake. They saw themselves as change agents, servants, ones who reflect the image of God, saviours, magicians, healers and educators. These roles position participants as separate from, but identifying with, the lake and desiring to make a difference for it. Others adopted an emotional stance, expressing their love, care and respect for the lake and compassion for it being destroyed. A smaller, but notable number had a sense of the lake and natural world and themselves being one. They were connected to the lake and natural world, not only in what they could do for it, but also in a sense of belonging to, of feeling at home with, and of seeing little separation between themselves and the natural world.

Summary of results on learner's patterns of identifying with the Boksburg Lake social-ecological system

Boksburg Lake is highly valued by respondents for its historical value and close connection to the identity of Boksburgians, its recreational and wildlife potential and affective, aesthetic and spiritual benefits. Participants also realised their absolute dependency on the natural environment and its intrinsic and spiritual value. The initiative created a space to articulate and strengthen already developed values around the lake as well as cultivate new ones as learners gained knowledge of the lake's historical condition and ecosystem processes. An interesting question is why these values are not powerful enough to change the status quo where economic concerns are hegemonic to the detriment of the natural world.

Many participants clearly identified with Boksburg Lake, both in the strong emotions felt at its deteriorated state as well as their sense of culpability for this condition. A strong point of identification was seeing the litter at the lake. They saw its immediate impacts and realised their responsibility. Empathy and compassion was expressed, particularly for the animals negatively affected. Learning about the lake's history and how healthy and valued it was, as well as the current negative impact on animals provided two meaningful moments of identifying. Identifying with the way the lake used to be, their culpability in its present condition, and the consequent harm done to animals, fueled a desire to see positive transformation.

The dominant way participants wanted to relate to Boksburg Lake was as change agents and this became the sphere of concern for many. There was a clear recognition

that Boksburg Lake needs a collective effort to be improved. Many learners thus expressed the desire for a collective identity and unity in seeing it restored. This challenges the individualism that characterises modern society (Bauman 2001). Learners also adopted a respectful attitude of care in relating to the lake, while a few expressed a new sense of belonging and oneness with the earth. This is particularly notable as it goes against the dominant dualistic separation of humans and nature that is one of the four normalising ideologies, as discussed in section 5.3.4 and 5.3.7, which support human progress occurring at the expense of ecological integrity. Two additional normalising ideologies identified in chapter 5 (anthropocentrism and nature is mechanised) were also challenged by emergent patterns of identifying. For example, in some instances learners wanted the lake and animals to be protected for their own sake, rather than with any reference to the benefit to human beings (thus challenging anthropocentrism). In other instances, the lake was attributed a personality and animals were related to with deep care and compassion, thus challenging the view that nature is mechanised.

7.3.3 Knowledge about the Boksburg Lake social-ecological system

Introduction

This section explores the knowledge that participating learners have expressed about the Boksburg Lake social-ecological system. Three main concepts are explored, as indicated in figure 7.5. Firstly, the knowledge participating learners have of the social-ecological problems at Boksburg Lake is summarised. What problems are perceived, how these problems are described and which ones are most significant, are discussed. Secondly, learners' understanding of the causes of these social-ecological problems is described. Thirdly, the solutions learners provide to these problems are examined. This follows Jensen's (2004) identification of three dimensions necessary for action-orientated knowledge, which are knowledge about the problem, knowledge about the causes of the problem and knowledge about how we change things.

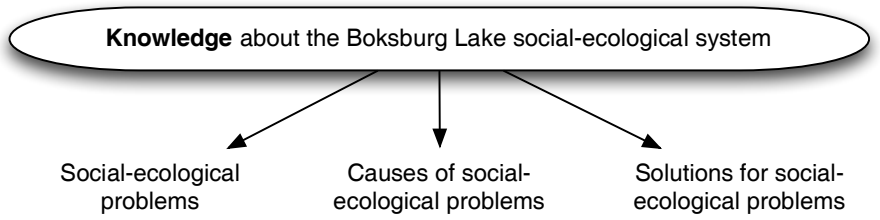
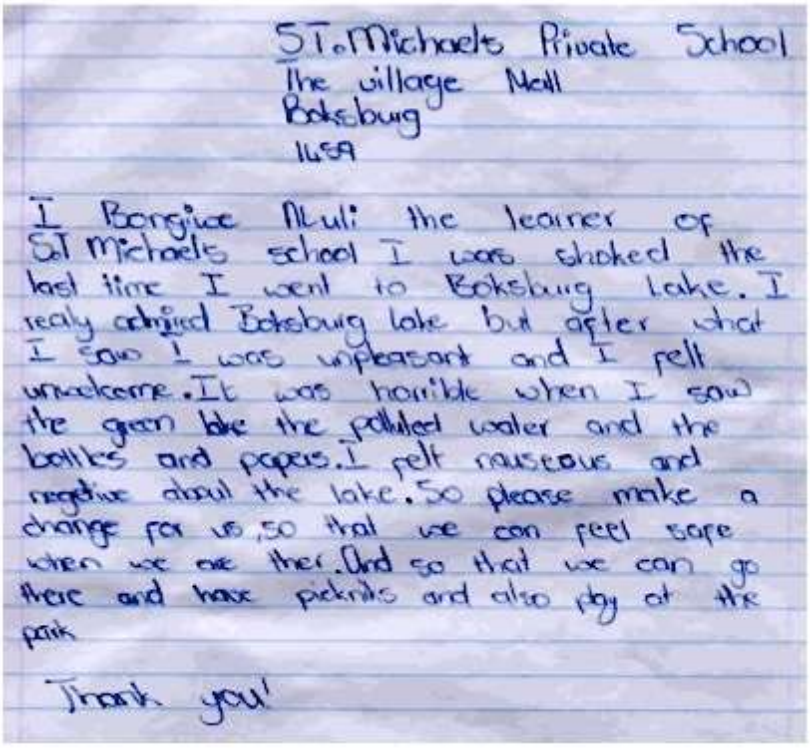


Figure 7.5: Three concepts (social-ecological problems; causes of social-ecological problems; solutions for social-ecological problems) explored under the category: knowledge about the Boksburg Lake social-ecological system

Social-ecological problems

A collation of 376 applicable quotes indicated that respondents identified six main problems affecting Boksburg Lake, namely the poor condition of the lake's water quality, the negative impact on animals, the smell of the lake, the poor condition of the lake's grounds and shoreline, Boksburg Lake's change from a place of beauty to one of degradation and the social ills.

The main problem, identified by 85 respondents (23%) was the poor condition of the lake's water. Figure 7.6 is a letter written by a learner from St Michael's primary school to the municipality expressing concern about the poor water quality. A second and related issue was animals being negatively impacted by the lake's condition, as expressed by 81 respondents (21%): "*We saw that there are hardly any insects or bugs in the lake meaning that the lake is so polluted that not even insects can live in the water*" (SP, E, 2010). Learners reflected on how animal populations, including birds, insects and fish, were dramatically reduced since Boksburg Lake's deterioration: *"What was terrifying is that a lake like that should sustain so much life but we could only find parasites*" (BH, FG, 2009).



ST. Michaels Private School
The village Mall
Boksburg
1459

I Bongiwe Ntuli the learner of St Michaels school I was shoked the last time I went to Boksburg lake. I realy enjoyed Boksburg lake but after what I saw I was unpleasant and I fell unwelcome. It was horrible when I saw the green like the polluted water and the bottles and papers. I felt nauseous and negative about the lake. So please make a change for us, so that we can feel safe when we are ther. And so that we can go there and have picknics and also play at the park

Thank you!

Figure 7.6: Letter written by a St Michael's Primary learner to Ekurhuleni Metropolitan Municipality expressing concern about the water quality of Boksburg Lake

The third issue, also relating to poor water quality, was the terrible smell coming from the lake, as expressed by 81 respondents (21%). A learner from Reiger Park High passionately expressed this during a focus group (2010):

> *It was the smell of the lake when we went [sic] the path of the library side when we were on the other side when the traffic cops were following us. And when we walked past the flat it was smelling really bad. I was embarrassed actually. I couldn't really take the smell. I was in short tempered [sic]. I could close my nose.*

The fourth issue, as expressed by 67 respondents (18%) was the poor condition of the lake's grounds and shoreline, which were negatively impacted by pollution, including littering and faeces. A consistent theme was the recognition that littering is an environmental problem. The fifth issue mentioned by 44 respondents (12%) was Boksburg Lake's change from a place of beauty, value and ecological integrity to its present deteriorated state: "*One of the very few attractions in Boksburg is the Boksburg Lake. It's sad to see something that was once so beautiful and wonderful, so ugly and untidy*" (SP, E, 2010). In some cases the historical change in the lake's condition elicited a strong emotional response, especially when learners realised it had not always been like this: "*I feel quite upset the way our lake looks and when I saw how it looked before I was very upset*" (RPP, S, 2009). The last main issue, as mentioned by 18 respondents (5%), was a recognition of the social ills that characterise the lake: that hoboes live there, it is unsafe, a place one can be killed, scary, and a place for drug taking: "*There's people living and sleeping there and now we don't feel safe to come to the lake*" (SMP, S, 2010).

Causes of Boksburg Lake's social-ecological problems

Littering, highlighted in 87 responses (54%), is the most frequently mentioned cause of problems at the lake:

> *I feel sad because the lake is not as fun as it used to be. I never knew how just one piece of paper could lead to such a devastating place like this. I encourage everyone to throw their papers in the dustbins and not on the floor.* (HV, S, 2009)

The most common reason given for why littering is the cause of Boksburg Lake's problems is its harmful impact on animals, expressed in the following quote:

> *My school can do much more difference in the lake. Our school leaders can talk to the rest of the school about litter. They have to teach the learners that if they litter and the*

wind blows, the papers can end up in a river or lake where some living organism can lose their lives e.g. fishes and even other plants. (RPH, E, 2010)

Other reasons included that litter collects in storm water drains that feed our water sources; the litter will eventually end up in the Vaal dam, which is for drinking water; litter takes a long time to decompose; and litter creates a smelly, unhealthy and unsafe environment.

The second most frequently mentioned cause of the lake's problems is the attitudes and values of people (26 responses -16%). Two perceptive comments were that there was a lack of value attached to nature and that the community spirit had become individualised, while the main attitude identified is that people don't care (18 responses - 69%).

Water pollution is the third most frequently cited cause of problems at Boksburg Lake (24 responses - 15%). Eight responses mentioned industrial pollution, while the two most insightful comments highlighted the problem of sewage pipes breaking and polluting chemicals being poured into storm water drains. Pollution is a less obvious cause as it is more difficult to see and depends more on learning from knowledgeable others than direct experience.

Social problems at the lake and lack of community awareness were each mentioned in 3% of applicable quotes. Only 2% of responses made any mention of the consumerist lifestyle that drives so many of the destructive environmental practices and none referred to unrestrained development that is common in the area. One learner did mention that natural filtration systems such as wetlands have gone, which could be referring to the results of development. This was the only learner who alluded to ecosystem processes being destroyed.

Solutions for Boksburg Lake's social-ecological problems

Five hundred and forty-eight responses expressed knowledge about solutions to Boksburg Lake's problems. Ideas were wide ranging, innovate and creative and addressed both the immediate, visible problems such as litter to deeper issues, such as people's values, and more entrenched social dynamics such as impoverishment in the area. The majority of responses, however, addressed the more immediate problems rather than the deeper structural causes. See table 7.2 for a list of solutions to the problems at Boksburg Lake. A few of these will be discussed in more detail.

Table 7.2: A list of solutions to the problems at Boksburg Lake as identified by learners

Action	No. of responses	%
Address the litter problem	145	27
Community awareness/ education	85	16
Recycling, reducing, reusing initiatives	81	15
Greening the area (plant trees/ vegetables)	40	7
Team work	16	3
Save water	15	3
Fundraisers/ get sponsorship	14	3
Address water quality problems	13	2
Industries/ businesses pollute less	12	2
Start an environmental group/ club	12	2
Maintenance, improvement of and increased safety at the lake grounds	12	2
Social activities at the lake	11	2
Better consumer practices	11	2
Attitudes/ character traits of e.g. care, love, responsibility, patience, determination	10	2
Limit access to Boksburg Lake (security fence, entrance fee)	9	2
Improve impoverished people's lives	4	1

Addressing litter was a priority, expressed in 145 responses (27%): "*The one thing I think we should actually start with that is really important is actually stop littering, because all the litter that is on the ground lands in the storm drain and this ends up in Boksburg Lake and that is how it ends up with all sorts of pollution*" (WP, FG, 2009). Ideas ranged from organising clean-ups, to more bins, to implementing a fine system. An enthusiastic learner wrote the following: "*My second step is to call all the youth and other children in my street which are my friends, even in my community to start by clean [sic] the lake on Fridays after school and on Saturdays and school holidays*" (RPH, E, 2010).

Community awareness/ education was the second most frequently mentioned solution (85 responses - 16%). An innovative idea was to connect the lake's water to household taps so that people directly experience its pollution. Additional ideas included marching, putting up posters, handing out pamphlets, teaching young children and having environmental days like the Boksburg Lake Day. A learner gave an insightful observation about the power of sensual experience to rouse interest: "*I do remember reading an article on the lake in the Boksburg Advertiser. It was very informing, but once the smell of the lake stopped there was a massive decrease in the amount of people caring about the lake*" (BH, E, 2010). While I was observing a lesson at

Witdeep Primary in 2010, a learner explained that the way to address the litter problem is to gather the community and show them what the area used to look like. The power of a historical reference point is a consistently expressed theme throughout the data.

The idea of implementing recycling, reducing and re-using initiatives was the third solution highlighted (81 responses -15%). As a learner noted:

> *We can fix the lake by re-using and recycling. Would fix it because we would have less things in our dustbin which means less plastic bags ending up in the Boksburg Lake, polluting the environment when you put it down. Less would be the garbage things that they have to burn up that cause pollution, so better to re-use and recycle because that way you are actually saving money and you are actually still protecting the environment.* (WP, FG, 2009)

Interesting and insightful ideas were shared about addressing the poor water quality, mentioned by 13 respondents (2%). Ideas included connecting to the wetland further up, removing the sludge, putting in aerators, litter and sediment traps and using jet skis to oxygenate the water.

Only 1% of respondents mentioned employing and communicating with the homeless to address local impoverishment. In contrast, some learners wanted to implement strategies, such as added security and a fence, to keep out these unwanted people so we "*won't have funny people staying at the lake*" (BH, FG, 2010).

Summary of results on learner's knowledge about the Boksburg Lake social-ecological system

Six main problems were identified as impacting Boksburg Lake, namely the polluted water quality, the negative impact on animal life, the terrible smell, litter, the change of recreational and ecosystem health from the past to the present and social ills. These problems reduce the lake's usability and value which, as examined in section 6.4 and figures 6.1 and 6.2, are the main social issues affecting Boksburg Lake. Learners have therefore shown a good grasp of knowledge of the problems.

Drawing on Critical Realism's ontology (section 2.3.2) it is clear that learners grasped some of the empirical (littering), actual (industrial pollution) and deeper generative mechanisms (attitudes/ values of people, social ills, consumerist lifestyle). Learners expressed insight into the system dynamics of littering, both how it moves through the system as well as its many impacts. However, the consumerist lifestyle was mentioned by few participants while none referred to the high value of economic growth and

progress that has resulted in unrestrained development and the consequent destruction of ecosystem processes. In chapter six, consumerism and the value placed on economic growth were identified as the primary drivers behind the lake's degradation. This indicates a need to further develop systems thinking and normative competencies to provide a deeper understanding of these problems and a greater ability to critique the status quo.

Some insightful solutions were provided, particularly on addressing the poor water quality. These expressed a good understanding of ecosystem processes and were similar to expert plans to address the problems. They included implementing sediment traps, removing the sludge and connecting the canal to a wetland further up. This could indicate the educational role of the media, which regularly highlighted EMM plans to address Boksburg Lake's problems.

Learners gained knowledge from a variety of sources including undertaking the water quality exercises, the media, expert knowledge and direct experiences of the lake. An historical vantage point has been especially important as it provides a reference point to compare the present social-ecological system with that of the past and carries considerable emotive value.

7.3.4 Agency in the Boksburg Lake social-ecological system

Introduction

This section explores agency for Boksburg Lake and is informed by two main concepts (figure 7.7). Firstly, the strength of belief that things can change for the better and that one can be part of the solution is examined as the extent of these beliefs should influence how learners participate in action projects. Secondly, the emergent actions (particularly the change in littering habits and recycling practices) are examined. The section then discusses agency that emerged in three schools. Figure 7.8 visually expresses some aspects of participants' developing agency.

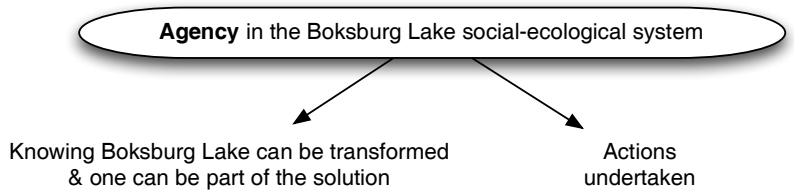


Figure 7.7: Two concepts (knowing Boksburg Lake can be transformed & one can be part of the solution; actions undertaken) explored under the category: agency in the Boksburg Lake social-ecological system

Figure 7.8: Visual representation of aspects of participants' developing agency

Knowing Boksburg Lake can be transformed and one can be part of the solution

There was a clear belief that Boksburg Lake could change for the better as voiced in 24 responses. Learners expressed hope and faith that human beings could devise a solution. A learner wrote: "*I feel that we as people destroy the lake and can rebuilt [sic] the lake and make it beautiful because we as the people of Boksburg destroy it. Some of us know and most of us will know we can make the difference*" (HV, E, 2010).

A dominant theme was participants' belief that they could be part of the solution, as expressed by 51 respondents: "*No matter how bad it looks we can make the difference and make it useable*" (RPH, FG, 2011). In 24 of these quotes, the youth were highlighted as the ones who could bring about change and play a role in solving the

lake's problems. In 17 responses the word "*we*" was used. A learner commenting on a banner said: "*I like it that all our handprints and fingerprints on there showed everybody that us little people can make a big difference*". Only two learners said that they would make a difference when they are older.

Actions undertaken

A change in littering habits was the most obvious impact on participant's actions, as reflected in 41 responses. Twenty-three of these expressed that they no longer litter. This is changing a deeply entrenched practice where learners reflected on how they "*used to litter everywhere*" they went, not caring (GP, FG, 2009). A common reason was because everyone litters: "*I didn't think of it as littering. I just thought everybody does it so I can also*". Learners were confronted by the consequences of their littering habits when they attended the Boksburg Lake Day "*but then I learnt on that Friday, I learnt that littering is bad for the environment around us, and if we litter and pollute there will be no future left*" (SMP, FG, 2009). They saw the extent of litter along the lake's shoreline and learnt that litter dropped further up the catchment is carried by stormwater to Boksburg Lake. This affected respondents' consciences: as one learner said, "*Sometimes you can feel guilty when you drop a paper, oh no I did something wrong. Then go back and fetch it. [I] get a guilty conscience when [I] do something like that. [I] know it's wrong*" (WP, FG, 2011). However, the desire to change was strongly reinforced when learning about Boksburg Lake's history. This activity, run by the Boksburg Historical Association at the Boksburg Lake Day, was identified as the most impactful in terms of learning and inspiration for change. It provided a reference point for how the lake could be, something countless learners expressed they wanted to restore: "*And the fact of knowing what the lake used to look like, makes you eager to make a change on what the lake looks like now*" (WP, FG, 2011). As a consequence, after "*that day I never littered, never ever*" (WP, FG, 2009). Six respondents stated that they started picking up litter around them: "*After my experience of the Boksburg Lake Day, whenever I see a paper or something, walking past it, I feel guilty, I just have to pick it up*" (WP, FG, 2011), while fourteen explained that they now tell others not to litter: "*It has impacted my habits because at home now when my sister throws something there I would shout [at] her. Shout [at] her because I don't like that. Because this earth, God gave it to us so we can't just go around littering*" (GP, FG, 2009).

Reiger Park Primary provided an inspiring example of how a school began to change its littering perspectives and habits. Interviews with a teacher and focus group discussions with participating learners elicited the same consistent message that littering habits were changing. A teacher (I, 2010) explained that the Boksburg Lake

Day "*really had an impact… They came back so excited… about this whole programme*". She went on to describe the "*huge*" influence it had on the grade 7s:

> *… because they could come back and explain to the learners what was said there and what was experienced. It's like an eye opener because you see the lake, you see that it's dirty, and you as an individual you don't know what to do about it. Eventually as this programme is running the learners are realising it's because of me. It's because of myself that is why the lake is dirty. Because I don't take my paper and throw it in the bin where it's supposed to be... So that is what the learners are finding out now.*

The learners from Reiger Park Primary who participated in the Boksburg Lake Day were given classroom opportunities to share what they had learned, which spilled over into the playground and entered normal dialogue. A learner explained that,

> *When we came back to school the children asked us about the day… And we told them what's happening at Boksburg Lake; how the fishes are dying; how the birds aren't there anymore. Because it was a very peaceful place but now it's very dirty… So we told them what it was about and if they get a chance to pass the lake with their parents they can just go and check on it and see what they can do.* (FG, 2010)

Both learners and teachers had been affected:

> *Everybody picks up now; the prefects tell them to pick up and they listen. But you get hardheaded people who don't listen.* (FG, 2010)

> *After we came from Boksburg Lake a lot of the teachers started caring about the lake. Asking us every day after first and second break to pick up papers.* (FG, 2010)

This change of attitude had a positive impact on the cleanliness of the school grounds, which had a reinforcing feedback:

> *It's much better. It's cleaner, the learners enjoy going out and sit[ting] on the grass and just eat[ting] their lunch… everything is just cleaner… at the tuck shop it used to be so dirty... They used to throw their papers all over the place. But you can take a walk now, it is clean... It made a difference in the learner itself. [A] cleaner child that's aware of his own environment, especially where he sits. He doesn't want to see a paper there at his feet. He will take it and pick it up and throw it in the bin.* (T, I, 2010)

The other significant change was participants' recycling practices. Learners had, for example, started encouraging their families to adopt this habit, while St Michael's

Primary started a "collect a can" campaign. Recycling bins were placed around the school in which learners were encouraged to put their tins. It was led by a team of young people who attended the Boksburg Lake Day: "*Seeing all the rubbish around us and all the littering, we just thought we could help make the place a better place by collecting cans*" (SMP, FG, 2009). A teacher explained that the recycling initiative was also inspired after doing Economics Management Sciences at school. The theme was recycling and learners made the link between what they were learning at school and their experience of seeing many tins in Boksburg Lake. The attitude became one where "*We're not going to pollute anymore, we're going to recycle*" (T, I, 2009).

Three schools provided inspiring examples of action-orientated initiatives, namely Goede Hoop Primary, Reiger Park High and Witdeep Primary. Each had a unique story, recounted below.

Goede Hoop Primary

Chantelle is an inspiring teacher, passionate about and highly committed to the environment and was almost single-handedly instilling a culture of environmental action and non-littering in her school. As Goede Hoop Primary is a feeder school for some of the local high schools her influence has been extensive.

Before the SSE initiative, Goede Hoop was involved in a municipal-driven environmental project called the EYE (Ekurhuleni Youth Environmental Club) programme (described in section 3.6.4), which Chantelle led. An EYE environmental club was started with grade 7s. Members would meet twice a week to strategise on reducing littering, reducing water usage and improving the school's general environment. They raised awareness about littering and monitored other learners' behaviour, taking them to teachers for punishment if necessary. During break members formed a chain and everyone who came past would have to drop a paper in the bins provided. The club's popularity led to the development of an Eco Club for the grade 6s whose main role was to adopt and mentor grade 1s who became the Eco-Buddies.

Chantelle was responsible for establishing a garden, linked to the EYE programme; she hoped to get permission from the principal to plant grass in an area outside her classroom; and had put up environmental signs, in both English and Zulu, throughout the school with various messages, such as "*Please use your hands to pick up your rubbish*"; and "*The environment is everyone's business*". Interestingly learners from both Goede Hoop Primary and Reiger Park High commonly quoted this second

slogan. Chantelle described how once when she was not there, learners took the signs, had them photocopied and stuck in places she had missed.

An invitation to be part of the SSE was enthusiastically welcomed by her and built on the foundation laid by the EYE programme. She incorporated aspects of the resource pack into her lessons and used the SSE as another avenue to instil a culture of pro-environmental behaviour. The impact of these different initiatives is hard to separate as they reinforce each other. The most substantial impact is on many of the learners' littering habits. The following quote indicates how a learner developed a conscience about littering: "*When I'm coming from home to school, when I eat chips, when I want to throw the packet down, my mind says don't throw it down, [be]cause someone will say pick it up. Even when I want it to leave my hand, it can't*" (FG, 2011).

Ernest, who became an influential role model, stated:

> *It had a very big effect because I saw that before I became a [member of the] EYE club I never thought that the world was in danger. I just litter anywhere. I see my friends they litter also. Then I became a [member of the] EYE club, then I got some information on how endangered is our world. I thought if I litter what will the next person do. The next person will also litter because I litter. So everything starts with you. Because if they saw you not littering, they will say hey let me be like him and not litter also.* (FG, 2009)

He went on to become the head boy of Goede Hoop Primary and then joined Reiger Park High and the environmental group that had formed there (as explained in the section on Reiger Park High). In 2011, while at Reiger Park High, he wrote a song about the environment, which he rapped to everyone at the Boksburg Lake Day and received loud cheers (see appendix K for the video recording). The chorus is as follows: "*Save the environment, clean the environment, stop the pollution, don't waste the water, it's time to skip to action*".

Chantelle described how young children would pick up litter when they saw her coming. She would stand on their skipping ropes and say you're not playing until you've picked up your rubbish. Now,

> *... you should see the little ones, if I ask them to pick up these, then I have the whole school coming and we go around with the boxes and they're all picking up. And yet people complain about the kids [that] they don't listen. I just say, watch this and I call a couple of kids to pick up the papers.*

She would also stand with a dustbin during break time and within moments a group of learners would have responded. They would take the dustbin around the playground asking learners to pick up rubbish. Chantelle believes that there has been an improvement both in the culture (as the above quotes express) as well as the condition of the school grounds: "*before hey the papers were all over. Now you can see it is a lot better… I think it made a big influence*".

The Boksburg Lake Day was a space for learners to express initiative and agency. For example, in 2009 learners from Goede Hoop Primary spontaneously made up a song that they sang for classes back at school. In 2011 Chantelle explained the considerable impact of the day. She can see the difference in learners who participated where they are now the ones involved in her environmental initiatives. Some learners' marks have improved, in one case from the 50 to 70 percentile.

There are challenges. A learner described how they have seen little change because "*the children are hard headed. We are trying to set an example but [it] goes in one ear and out the other*" (FG, 2010). Another explained that some of the older learners actively rebel. In one example, they signed a contract not to pick up papers in active rebellion to the environmental initiatives. In 2009 learners in a focus group had some passionate things to say about this lack of learner co-operation: "*I think we should make it like this. If you don't pick up a paper we will throw you in a dustbin. You must feel how it feels to be dirty*".

A year after the 2012 Boksburg Lake Day, learners were still involved in the gardens and keeping the school grounds clean but tellingly, many of the environmental projects had stagnated, including both the EYE programme and Eco-Buddies. Chantelle gave the following reasons for the lack of environmental progress. Firstly, learners who were primary drivers of the environmental projects left the school. Secondly, the new curriculum (described by her as a "*sausage-machine*" and "*jam-packed*") increased the workload, causing teachers and learners to feel overloaded. "*Maybe I also didn't motivate it enough because you're marking 400 books a day, something impossible like that. I'm always marking, there's not a day that I'm not marking*". Thirdly, she described the school as dysfunctional as it tried to cope with 1 600 learners in a structure designed for 700. There were, for example, 50 learners in each of the foundation classes. Fourthly, the school received no external environmental support in 2013, which the SSE initiative had previously provided. Chantelle indicated that this made a difference, as the school benefits from an external catalyst and support base to help co-ordinate environmental activities and create opportunities for participation in programmes broader than what the school offers. She

explained that having an external catalyst "*kept us motivated and we could motivate the kids... things have [since] died*". A related point is that the Boksburg Lake Day didn't happen in 2013: "*We miss it. It leaves a big gap because it was something to look forward to; the songs, the information, painting the banners, the new information learners are exposed to*", and the opportunity to make contact with other schools. The chance to participate in this event had always been a motivation for learners to do well in other activities. Chantelle expressed her desire to pick things up in 2014 focusing on the grade 6s that she described as an environmentally enthusiastic group of learners.

A substantial number of the most environmentally active learners at Reiger Park High came from Goede Hoop Primary and were inspired by Chantelle, as described below.

Reiger Park High

The environmental dynamics at Reiger Park High were influenced by a charismatic group of learners committed to making a difference in their school, many of whom were influenced by Chantelle. A learner called Vuyo proactively led the group and had tremendous agency, determination and courage in implementing environmental projects in the school, at home (she was involved in bottle recycling) and getting involved in the SSE initiative. She was not intimidated, expressed no need to conform and inspired many of her peers. She described how she would like to be known:

> *For the good that I do in the community and schools [that] I've touched many people's lives and I like to really make a difference. I don't like to be someone else. I just like to be myself. Before I teach other people, I need to discover myself inside. Because I live in integrity, independence and respect. If I can respect myself, I should respect the environment.* (FG, 2012)

She was one of the first learners involved in Chantelle's projects before she left for Reiger Park High. In 2010 she heard about Goede Hoop Primary's participation in the Boksburg Lake Day and wrote a letter to Chantelle requesting access to her environmental resources and that Reiger Park High get involved. By the time Chantelle contacted her, she had organised a meeting with her principal requesting Reiger Park High's involvement and recruited thirty learners to participate in the Boksburg Lake Day, which they consequently did with great enthusiasm, as expressed in the following quote "*When I planted the tree it was really fun there. At the same time* ***we couldn't hold ourselves****. While the other children were planting one tree, me and Kagilso and Setsiphos were by the other tree, planting the other trees*" (FG, 2010, my emphasis). In reference to the march at the end of the Boksburg Lake Day a learner explained that "*we were the ones there right in the front, we were dancing and*

everything" (FG, 2010). This eagerness to be involved in environmental action was a defining characteristic of this group of learners who often attended and gave meaningful input at the monthly Boksburg Lake Forum (see section 7.3.1 for a description of the forum). During a focus group in 2010, learners explained how they would tell their peers to pick up papers and described the negative response they often received. One learner poignantly expressed the challenge of this: "*They say they're going to hit me and everything. Don't tell me what to do, you're not my mother. I have to give up because they're not respecting me*" (FG, 2010).

When asked how they would like to be known, three core members of the environmental team said, for the good things that they have done. This partly explains the strong motivation to make a positive difference to their community and natural environment, as the following representative quote expresses:

> *I wouldn't like to be known for what I have, for my good looks… what I'd like to be known [for] is the good things I'm doing, like the project I'm doing now, that I'm actually leaving a legacy for the future generations. To be a good leader, to stand up and say this is wrong, this is right. That is how I want to be known.* (FG, 2012)

By 2012 Vuyo and her team had started a school environmental project to address their school's litter problem. This was after writing two proposals to the principal to get his buy-in. Vuyo explained that she had been thinking about and working on such a project for the last five years, ever since being inspired by Chantelle. Vuyo was given the opportunity to stand up in assembly and tell the learners about the project, this being the first time a learner addressed the school. During a focus group interview this moment was recounted: At first the whole school went "*boo*" but Vuyo replied saying "*Unfortunately we're not asking you, we're telling you*", which lead to loud clapping and cheering. The team explained that about 25% of the learners are with them while 75% are against them, sometimes actively so.

The principal and many of the teachers were impressed with the team and fully endorsed the project. For example, when learners requested a change in uniform the principal didn't agree, saying, "*You're so proud and clean you want to change your uniform, how about you change the playgrounds*". The punishment for learners who now arrive late is that they have to pick up papers. Teachers' role in the project is to stand at the school entrances after break time and allow learners in only if they have brought litter. They also agreed to give detention or a parental summons to learners who didn't co-operate. A teacher used a Physical Education lesson to pick up papers,

while others picked up litter with the learners before entering class. One of the team members mentioned the project's positive impact, as the school is much cleaner.

In 2013 the team had written a proposal to get Unilever and Green Office involved in their project and Vuyo called me for their contact details. She said that things are really moving: they had painted all the dustbins and planted gardens in front of the classrooms.

One of the teachers actively involved with the group said that many learners had responded positively to the team's project: the team had managed to raise enough money from learners to buy twelve dustbins and there was a "*remarkable improvement*" in the cleanliness of the school grounds and environmental ethos.

Witdeep Primary

Katy, head of science at Witdeep Primary, championed the school's environmental cause and responded with enthusiasm to the SSE initiative, including being a school representative on the Boksburg Lake Forum. She showed much initiative in her use of the resource pack and developed a recycling project involving the whole school. She was passionate about litter prevention and would stop a stranger in the street if they dropped a packet. At every line-up she encouraged learners not to litter and allocated each class an area they were responsible for keeping clean. Katy also used prefects as litter monitors who were responsible for an assigned area and teaching other learners to pick up litter every break time. A daily clean-up also happened after school. In a school newsletter Katy wrote a piece on reducing, re-using and recycling because, as she explained, it has to go further than the forty learners who attended the Boksburg Lake Day: it is when the whole school is involved that the impact will be felt.

Throughout the initiative, Katy consistently used and adapted the resource pack with the grade 6s and 7s. She was able to link it to her syllabus, particularly the aspects on pollution and ecology and used five or six of the activities provided (one was included in an exam) as well as the catchment game. The focus was on understanding ecosystem processes, particularly in river systems and wetlands, and the problems at Boksburg Lake, coming up with solutions and helping children realise that they can make a difference.

The recycling project consisted of an environmental game involving the whole school. Katy created a game sheet (see figure 7.9) similar to a snakes and ladders board with various levels, requiring increased environmental action as one moves up, including classes regularly bringing in different kinds of recyclable waste, switching off lights

and involving one's family in recycling. In the first year especially, the game was received with much enthusiasm and even the office staff were getting involved. A Mondi bin would be filled in a week and a lot of tin and plastic was collected. (See figure 7.9 for the waste depot). Katy communicated with different recycling groups and received support from a company called YES who provided information. By 2010 the project had geared down, because of time demands. As Katy stated, "*I'm not as zoomed in as I was last year*".

Figure 7.9: Visual representation of Witdeep Primary's recycling initiative

Katy had a considerable impact on many of the learners by creating a conducive space for them to act and learn. Although no learner stands out, those from Witdeep Primary expressed some of the deepest understandings of the problems and many changed their practices in small but meaningful ways. The most common was a change in littering habits. As two learners said in focus groups in 2009 and 2011 respectively:

> *If it wasn't for this Boksburg Lake thing that you guys did for us, some of us would have no sense in us. Most of us would have still thrown papers on the floor.* (WP, FG, 2009)

> *After my experience of the Boksburg Lake Day, whenever I see a paper or something, walking past it, I feel guilty, I just have to pick it up, because I just left that paper there.* (WP, FG, 2011)

All the learners in the 2009 focus group expressed some change in littering habits, while one learner described how he had begun to encourage his family to start recycling.

By 2013 the recycling game had stopped running. Katy explained that time was the major constraint: "*Our lives are so busy. The environment is the thing that takes the back seat*". This had been especially since the new syllabus as there was one less administrative period, which previously had been used to sort the waste. Katy also planned to use her environmental club to manage waste but unfortunately the club ended because she had to run remedial lessons and participate in a Thursday meeting at the only available time they previously met. Katy stopped attending the Boksburg Lake Forum meetings because of this Thursday meeting and hadn't made any progress on becoming an Eco-School. The demise of her environmental club was an important factor as it had been used to spearhead environmental activities at the school.

Katy continued to ask learners to pick up litter and run her programme equipping prefects to be litter monitors. She also integrated environmental themes into her classes and planted a school indigenous garden during one of the school vacations in 2013. When asked "*where to from now?*" she stated that she would develop creative plans to regain environmental momentum. Soon after our interview, on 23 October, she sent the following email, expressing a serious intention to refocus on environmental themes: "*I am busy thinking on how to inspire children more about the environment and how to get my game I created back on track in a different way. When I test the plan I will let you know*".

Summary of results on learners' agency in the Boksburg Lake social-ecological system

There was an optimism that things could change and conviction that they (the learners) could be part of the solution. These attitudes may have provided the foundation for both the collective and individual agential changes that were expressed, particularly littering habits and recycling practices. These are practices that learners can feasibly engage in, and their main sphere of influence is school and family cultures.

The theme of littering, realising that its wrong, and that individual and collective practices need to change, was one of the dominant themes from the data. It was where

learners realised their own culpability in the lake's problems. It also provided them with a realistic space to effect change in which they expressed a strong desire to participate.

New practices emerged from the initiative. For example, Katy was inspired to create a recycling game that involved her whole school while a learner-led clean-up project happened at Reiger Park High. This example shows the enthusiasm learners can express when invited to participate in real-world actions for positive change.

It is noteworthy that the most involved schools were generally catering for underprivileged backgrounds, including Goede Hoop Primary, Reiger Park Primary and Reiger Park High. In 2012, Dawn Park Primary and Leswabe (two under-privileged schools) became involved and also expressed enthusiasm for environmental action. In such schools, however, there was a tension between those making a difference and those rebelling against the system and actively going against these positive initiatives.

The importance of particular individuals, both teachers and learners, to inspire others to act, was apparent. Evidence indicated that the SSE initiative didn't create these environmental champions but provided a space for their values and visions to flourish and with this, they inspired others to come alongside them.

7.4 Analytical statements in a theoretical context

From the data representations presented above 81 themes emerged. These were clustered and condensed into four analytical statements that emerged from the data (in the sense of grounded theory) and provide the scaffolding of meaning to probe causality. See appendix L for the full list of themes from which the analytical statements were derived. This provided me with a useful theoretical summary to draw on in the concluding discussion to answer goal 3: Identify learning mechanisms that support transformation for greater social-ecological resilience of the Boksburg Lake social-ecological system.

1. **The initiative has deepened participants' knowledge about the problems at Boksburg Lake, their causes and possible solutions; has surfaced and promoted strong values for the lake and a clear identity of being agents of change, ones who view the lake with esteem and ones who belong to the**

lake; and has created a space for agency for the lake and general environment to emerge.

This analytical statement is backed up by a number of relevant themes that were identified from data descriptions. Five keys ones are highlighted below.

- Through the SSE initiative, learners realised Boksburg Lake's serious ecological and social problems, identified some of the important causes as well as creative solutions.
- Learners expressed identification with and empathy for Boksburg Lake.
- Learners adopted emergent patterns of identifying with Boksburg Lake that challenges three normalising ideologies of western, modern society that promote human progress at the expense of ecological integrity, namely nature/ human dualism, anthropocentrism and nature is mechanised.
- Learners wanted to relate to Boksburg Lake through attitudes of care and compassion.
- There was substantial change in individual behaviour and school practices.

One of the important factors for the impact of the initiative on participants' patterns of identifying, knowledge and agency has been the real world and local context in which learning took place. The Boksburg Lake Day in particular, gave participants an opportunity to experience the lake's condition first hand and both learners and teachers expressed the value of such learning opportunities. Literature points to the value and impact of learning in a real world context where abstract concepts can be related to concrete experience (Uzzel 1994; Rogoff 1990; Abram 2010). According to Rogoff (1990) the most important kind of learning is not book learning and propositional knowledge, but rather more experiential learning situated in a real context. This increases learning relevance and consequently learners' engagement and attention. It was also significant that learning happened in a space of meaningful action. This compares to conventional education, which Uzzel (1994) describes as a system removed from authentic action. Vygotsky (1978: 86) coined the concept 'zone of proximal development', defined as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers". This highlights how children and the youth learn by interacting with peers and adults in a meaningful space. Rogoff (1990) also highlighted the value of situating school learning in a community context where children learn by engaging with adults.

Vygotsky's theory of mediation (1978) is useful in understanding the impact of the SSE initiative. He argued that tools such as language and other symbols derived from one's socio-cultural and historical context mediate all human psychological and mental processes (Karpov & Haywood 1998). In this case study Boksburg Lake is a symbol of local identity and holds a significant place in the city's collective memory. Learning has therefore occurred around a meaningful local symbol that is tightly linked to Boksburg's socio-cultural identity. This has facilitated processes of mediation, knowledge internalisation and how meaning is made.

Weston (1996) introduced the concept of self-validating reductionism, which is useful in understanding the considerable impact the historical activity had on learners' patterns of identifying, knowledge and desire to act. His theory is that the cognitive act of dis-valuing a person, animal or landscape leads to its devaluation, which consequently creates a space for exploitation, diminution and justification of the initial dis-valuation. This sets up a reinforcing feedback loop where the person, landscape or animal becomes increasingly diminished. Weston called this process "self-validating reduction". Although Boksburg Lake has not been disvalued in this sense, Weston's theory helps understand how the lake's deteriorating condition can become self-reinforcing: the initial deterioration sets up a process of devaluation which then perpetuates itself. At the same time it points to how easily the condition of something becomes normalised and how quickly its past state is forgotten. The power of the historical activity was that it created a reference condition in the learners' minds and helped them realise that Boksburg Lake was not always in its current state. Realising this prompted a desire to see Boksburg Lake restored and belief that this was possible.

There is a growing recognition in western discourse that the world is personal (Jenkins 2004; Abram 2010). The strongly held western dogma that animals are fundamentally different from humans, particularly in their sentience and communicative abilities, and are therefore not considered part of a fellow community of concern, is changing. Abram (2010: 129) stated: "Sentience was never our private possession. We live immersed in intelligence, enveloped and informed by a creativity we cannot fathom". These are sentiments commonly held by indigenous peoples where native people from North America, for example, describe animals as their brothers and sisters (Descola & Palsson 1996). If there is indeed a kindred connection between us and other animals (as the theory of evolution points to) in a personal world, it helps explain the strong identification learners had with the animals impacted by the lake's degradation, which was a consistent theme instilling a

compelling desire to change practices that harm animals. It was also a point where knowledge gained was made meaningful. The connection felt with animals thus played a significant role in shaping learners' knowledge about, identity with and agency for Boksburg Lake.

2. **Youth respond with enthusiasm, initiative and meaningful action when invited to contribute to positive change in a real world context.**

This analytical statement is supported by a number of applicable themes that were identified from data descriptions. Five keys ones are highlighted below.

- Youth responded enthusiastically to opportunities of being involved in real world change.
- Youth who participated in the initiative believed they can be part of the solution of transforming Boksburg Lake.
- Youth adopted an identity of change agents in relation to Boksburg Lake.
- Many youth spontaneously changed their deeply entrenched habits of littering when they realised the negative impact it has on Boksburg Lake.
- Youth expressed considerable leadership, passion, initiative and action in relation to being involved in transforming Boksburg Lake.

The modern day assumption that one must be an adult to effect meaningful change is being disproved by an increasing number of examples. In environmental education discourse, there is a growing recognition of the benefit of involving youth in active citizenry to address social-ecological problems (Uzzel 1994; Wals 1996; Hart 1997). Uzzel (1994: 6), for example, wrote a lengthy document detailing the value of engaging youth in environmental change practices. He noted that children respond positively when given a sense of ownership and responsibility for processes of social-ecological change and "can act as important catalysts for change in both the home and the community". Schuslera *et al.* (2009: 121) highlighted the beneficial feedback loops that can occur as learners engage in environmental action. Two important feedback loops are: the increase in capabilities to engage in further participation in environmental issues and the potential for "community level impacts" where children's environmental action has transformative effects on the community.

Hart (1992; 1997) is a strong advocate of empowering children to take an active role in society and involving them in participatory environmental action and has documented the variety of ways that children have participated in bringing about real change in

their schools, communities and environments. He produced a ladder (figure 7.10) of young people's participation that has eight rungs, with the lowest representing young people being merely manipulated to the highest rungs where young people lead and initiate action and share in decision making with adults (Hart 1992). In the SSE initiative the youth were given room to lead and initiate action and share decision-making through an open invitation to attend the Boksburg Lake Forum. The youth involved in the initiative responded enthusiastically to these opportunities for high levels of participation.

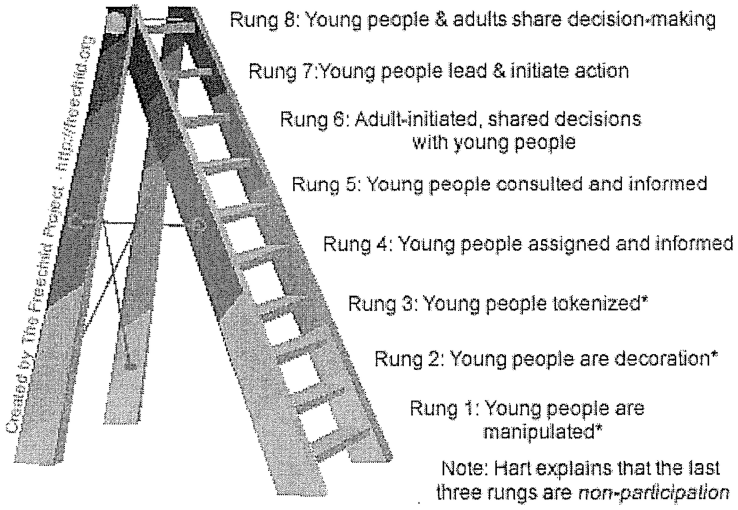


Figure 7.10: Ladder of young people's participation where the higher rungs reflect greater participation (Hart 1992)

The benefit of involving the learners in a community of practice is understood through participatory learning theory, which argues that the creation of meaning and understanding is relational, and is receiving a growing credence in the environmental education literature (Lotz-Sisitka 2004; O' Donoghue & Lotz-Sisitka 2006). It is seen as a means to deepen democracy and strengthen meaning making to better address social-ecological risk (Lotz-Sisitka & O' Donoghue 2008). This is supported by Vygotsky (1987) who stated that children's motivation increases when they have opportunities to learn together with others in meaningful ways. Uzzel (1994: 7) explained the value of this approach: "long-term change and development will only come about through informed community action in which adults and children work together with the guidance of experts".

3. **Key individuals and social structures have constraining and enabling influences on trajectories of social-ecological transformation.**

This analytical statement is backed up by a number of applicable themes identified from data descriptions. The five most powerful recurring themes were:

- Individuals can considerably change momentum and the initiative's trajectory and success through their participation or withdrawal.
- People's enthusiasm is contagious.
- An external catalyst can be an important agent of change.
- Particular individuals played significant roles in whether change happened or not.
- Members of faith communities played important roles in the initiative.

Social structures and agents have long been seen as the two primary components constituting society (Mingers 2006). Archer (1995) and Bhaskar's (1998b) work on structure and agency are viewed as the most advanced to date. Their theories are useful in exploring the notable impact key individuals had on the trajectory of the initiative.

Social structures are here defined as relatively enduring patterns of relations and their accompanying roles, institutions, rules and resources (Danermark *et al.* 2002; Mingers 2006). Examples include marriage and the economic system. Agency refers to the individuals who act within these structures. Harvey (2002) explained that agency refers to the capacity of a person to change an existing state of affairs denotes the capacity of persons to transform existing states of affairs. Although social structures are embodied and sustained by agents and emerge from their practices they have distinctive properties of their own and occur on a different ontological level (Danermark *et al.* 2002).

There has been much theoretical work on understanding the relationship between social structures and agents as a means to make sense of social change. 'Downwards conflationists' such as Emile Durkheim, believed that power lies only in structures; 'upwards conflationists', such as Max Weber, argued that power lies only in agents while 'central conflationists' such as Giddens (1984) recognised the causal efficacy of both structures and agents in his structuration theory, but collapsed agency into structure thus inadequately distinguishing between them. This compares to Archer (1995) and Bhaskar (1998b) who recognised the causal efficacy of both structures and

agency and conceptualised them as two distinctive aspects that occur on different levels of stratified social reality and interact along a time dimension (Olvitt 2012; Mingers 2006). Archer (1995) coined the term 'analytical dualism' to express this.

Bhaskar (1998) developed the Transformational Model of Social Activity (TMSA) that accommodates the causal affects of both structure and agency and portrays their dynamic relationship (Figure 7.11). As the model indicates, social structures enable and constrain human action while human agents reproduce (morphostasis) or transform (morphogenesis) social structures.

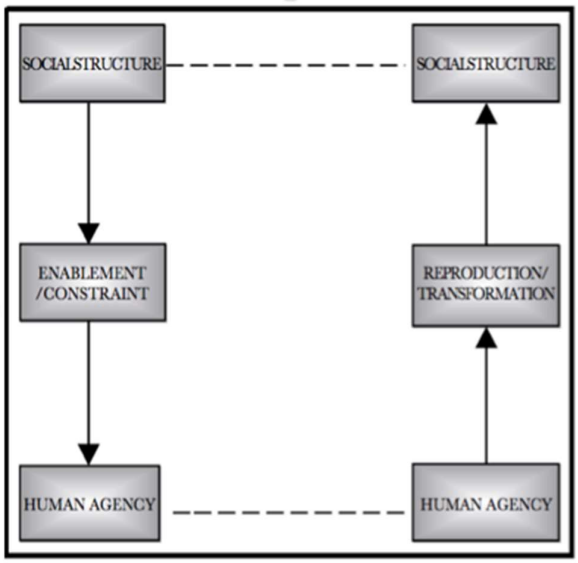


Figure 7.11: Bhaskar's (1998) transformational model of social activity that indicates how social structures enable and constrain human agency, while human agents reproduce or transform social structures

Archer (1995) further developed this model in the morphogenetic cycle (figure 7.12) in which she identifies three main stages in this process:

(a) ***Structural conditioning***, where agents are born into social structures that influence but do not determine;

(b) ***Socio-cultural interaction***, in which agents interact and act for the realisation of specific needs and interests which leads to;

(c) ***Structural elaboration*** (morphogenesis) caused by a change in relations making up the social system or ***structural reproduction*** (morphostasis) when the relations remain the same.

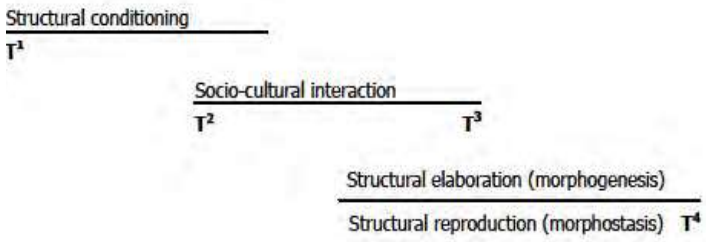


Figure 7.12: **The three phases of Archer's morphogenetic and morphostasis cycle. T1 – T4 signify intervals of time (Archer 1995: 157)**

Time is an important addition in this model that recognises that agents are born into an already existing society with structures that have particular constraints and enablements. Such an understanding of the role of time allows one to better understand change or stasis by distinguishing analytically between pre-existing structures, presently acting agents (who either reproduce or transform structure) and the structural elaboration or stasis that occurs after agents have acted.

Linking Bhaskar (1998) and Archer's (1995) theory on structure and agency to the analytical statement, the key role players were acting in already-existing structures, such as the particular economic system affecting Boksburg and institutions such as schools, industries, faith communities and EMM. These social structures enabled and constrained particular practices and ways of being that had direct or indirect effects on the health and value of Boksburg Lake. For example, faith communities have a moral angle and much influence over people's practices. However, their general focus on people, to the neglect of the natural world, was constraining local churches from taking up meaningful action around Boksburg Lake. This can be referred to as "structural conditioning". However, agents have the power to either reproduce or transform social structures in a process of "social interaction" according to their interests, needs and emotions. Paul, one of the local pastors, had a passion for nature and, after prior engagement with me and interaction in the Eco-Congregation workshop, began influencing local faith communities to take up practices that would benefit Boksburg Lake and the natural world. Because he left in 2011 his efforts were aborted and morphostasis of the structure remained. However, partly through his influence, as well as other key role players, the Boksburg Lake Forum was established and a new social structure emerged. A number of people from faith-based communities took up important roles on the forum and a process of morphogenesis began. A strong sense of comradeship and thus positive emotions developed and the growing team was encouraged to engage in meaningful actions to transform structures preventing the lake's remediation. However, too many key individuals left for various reasons and the dredging process had many delays, thus discouraging agents. With

time, meetings became fewer and consequently social interactions decreased. In early 2014, the forum looked as though it had disbanded and the larger social system remained in stasis. Analytical statement 4 expresses, in detail, the resistance of these social structures to morphogenesis (change).

4. **Boksburg Lake has continued to deteriorate in spite of years of vision, passion and commitment expressed by a range of stakeholders and much effort (financial, time, organisation, planning) expended to restore it. This points to the resilience of this social-ecological system to real transformation.**

This analytical statement is backed up by a number of themes that were identified from data descriptions. The six most important recurring themes were:

- Over the years local people have expressed much passion, commitment and vision to see Bokburg Lake restored and many resources have been given to this goal.
- A community of practice has developed around transforming Boksburg Lake.
- The Boksburg Lake Forum was created as a space for stakeholders to partner with EMM in seeing the lake restored.
- In spite of promises from EMM to, for example, dredge Boksburg Lake, install litter traps and improve the lake grounds, these remain unfulfilled.
- The Boksburg Lake Forum has been disbanded.
- Boksburg Lake remains in a degraded social and ecological condition.

As explained in analytical statement three, social systems can go through a process of morphogenesis or morphostasis (Archer 1998). The consequent social change or stasis affects the character of ecological systems. In the example of Boksburg Lake, there has been little evidence of positive ecological change. This points to the fact that the dominant social systems influencing Boksburg Lake have been reproduced rather than transformed. Social factors perpetuating the decline in the lake's condition thus persist. Three examples would include:

- The dominant economic ideologies that promote economic growth, the accompanying unrestrained development and the consequent deterioration of ecosystem processes that would help sustain the lake's health;
- The social centre of Boksburg moved from Boksburg Lake to consumer centres such as the East Rand Mall.

- The municipality is structured according to a reductionist philosophy where departments operate under a silo mentality, communicate infrequently and work at cross-purposes. This contradicts the complex situation of the Boksburg Lake social-ecological system that requires a holistic and interdisciplinary management approach.

Literature on social-ecological resilience provides an additional useful vantage point to understand why transformative change has not occurred in spite of much effort to the contrary. In chapter 6 this literature was drawn on to explain why Boksburg Lake became a degraded system (analytical statement 5 in chapter 6). A number of these ideas are essential in understanding the resilience of the present state to change.

Boksburg Lake has operated under two alternative stable states (Walker & Meyers 2004; Scheffer 2009) and has clearly experienced a regime shift (Scheffer *et al.* 2002). The past state is one where the lake had high social value and was a prime recreational site for both locals and visitors. The second, present state is one where the lake is socially and ecologically degraded and is rarely used for recreational purposes. In section 6.4 under analytical statement 5, it was explained that feedback mechanisms play an important role in this process and make it particularly difficult for the system to shift back to its alternative state. In Boksburg Lake the principal reinforcing feedback mechanisms were identified as the increase in crime and vandalism and the lack of municipal actions to maintain the lake. These feedbacks have decreased the value of Boksburg Lake and caused it to be ill frequently used. They are driven by a large and variable number of factors as depicted in the system diagram (figure 6.1) in chapter 6 that lock the system in this state. Reverting the system back to its previous condition requires a mammoth effort to minimise these factors and the social structures (such as economics, politics and industry) that drive them. The initiative's focus on schools was impactful at a small scale and new agency and social structures (such as the Boksburg Lake Forum) emerged that had the potential to impact larger scales. However, this social structure did not have enough internal power to maintain itself, partly due to the demands on its members to participate in other social structures. For example, a lack of time was a commonly expressed sentiment that limited members' capacity to fully commit to the Forum's goals. Over time the Forum began to lose resilience. A significant factor was the exit of key role players, including myself, who played the role of an external catalyst, and had the time and resources to maintain the forum. Another factor was the increasing discouragement at the lack of progress. If the role players knew the extent of the challenges they may have persisted and, in time, key social structures such as EMM could have been transformed, leading to morphogenesis of the lake's system.

7.5 Conclusion

This chapter has explored learning mechanisms that support transformation for greater social-ecological resilience of the Boksburg Lake social-ecological system. Data was represented under two main sections. The first section examined the broad community of practice and is a narrative of stakeholder agency and system inertia within the Boksburg Lake social-ecological system. The second section examined patterns of identifying, types of knowledge and forms of agency that emerged through the SSE initiative. The focus was particularly on schools and learners.

From this data representation, four key analytical statements were derived. Analytical statement 1 expresses the positive impact of the SSE initiative on learners' emergent patterns of identifying with the lake, their knowledge about the Boksburg Lake social-ecological system, and the forms of agency that have occurred for the lake. Analytical statement 2 describes how the youth respond with enthusiasm and meaningful action when invited to contribute to positive change in a real world context. Analytical statement 3 examines how key individuals and social structures have constraining and enabling influences on trajectories of social-ecological transformation. Analytical statement 4 describes how Boksburg Lake has continued to deteriorate in spite of years of vision, passion and commitment expressed by a range of stakeholders and much effort (financial, time, organisation, planning) expended to restore it. Theory is drawn on to better understand processes of causality (generative mechanisms) underpinning each analytical statement. In the following concluding discussion a summary of the findings of this chapter is presented to address research goal 3: Identify learning mechanisms that support transformation for greater resilience of the Boksburg Lake social-ecological system.

Part of the work of the concluding discussion, chapter 8, is to answer the primary question: What generative mechanisms constrain and enable the development of resilience in the modern social-ecological system of Boksburg Lake? This is achieved by addressing each research goal (1, 2, 3) through a summary of the applicable conceptual and empirical findings.

Chapter 8:
Concluding Discussion

This concluding discussion has four main aims, each of which will be addressed in turn:

- Summarise the main findings of applicable chapters to address each research goal and thereby answer the primary research question.
- Examine the relationship between research findings based on the Boksburg Lake social-ecological system and insights into modern social-ecological processes. Particular theoretical perspectives have been supported.
- Provide a critical reflection of my work as a reflexive practitioner.
- State my vision of a transformed social-ecological totality.

8.1 Summaries of research goals to answer the primary research question

Research goal 1: Based on a multi-theoretical perspective of social-ecological literature, develop conceptual tools that have explanatory power to probe generative mechanisms operating in the Boksburg Lake social-ecological system.

A key defining feature of humans, in relation to the ecological world, is our ability to develop structures of signification (Westley *et al.* 2002). This enables us to symbolically represent the world (Westley *et al.* 2002) and thereby detach from it. Authors have coined different concepts to express the nuances of symbolic representation. For example, Lakoff and Johnson (1980) talked about the power of metaphor to guide our relationship with each other and the ecological world, while Foucault, Bourdieu and Gramsci used concepts that reflect the relationship between symbols and the power dynamics of society. 'Bio-power (Foucault 1981), 'symbolic violence' (Bourdieu 1984), 'hegemony' (Gramsci 2000) and 'ideology (Thompson 1990) are four concepts that reflect how structures and values that maintain the domination of the powerful and their ideas become normalised. I have coined the concept 'normalising ideologies' to refer to symbolic representations of reality that have become integral to a social fabric and determine meaning, while maintaining the domination of the powerful. This relates to Bhaskar's (1993) discussion of $power_2$ relations. $Power_2$ relations are negative, where the powerful exert their influence (e.g. through symbolic and economic power) to the detriment of the relatively powerless. This includes both marginalised individuals and groups and the ecological world and

creates a society built on inequality. Bhaskar (1993) argued that power$_2$ relations have been entrenched in western society due to dominant philosophical thought built on three main foundations: ontological monovalence, ontological actualism and the epistemic fallacy (discussed in section 2.4.2). These concepts act to normalise the status quo and prevent any real change to a society built on power$_2$ relations.

I have coined the concept 'symbolic systems' to refer to forms of symbolic representation that have causal influence. I find it a useful term as it highlights how symbols can coalesce to form a system with its own structural dynamics, feedback loops and interactions. In some cases these symbolic systems may be highly resilient to change and override/ and or silence the effect of other symbolic systems. An argument presented in this thesis is that the kind of symbolic systems developed (representing humans and human-ecological dynamics) determine patterns of identifying with, knowledge about and agency in social-ecological systems and have causal influence on the degree of cultural-ecological coupling and consequent resilience associated with well-being.

Social imaginary is a useful concept that undergirds ideas such as symbolic systems and ideologies. It refers to "the interweave of meanings and practices that constitute a particular society, is how we imagine our lives together" (Dalton 2010: 57) and is the common understanding making possible common practices and a widely shared sense of legitimacy (Taylor 2004). A social imaginary is shared by large groups of people, if not the whole society, can change over time and influences what one sees, the questions one asks and the moral principles one lives by (Taylor 2004). It also reflects what has been ignored by the community imagination (Taylor 2004).

Through the literature four symbolic and value laden concepts have been identified that underpin western social-ecological dynamics, namely 'human-ecological dualism' (Schumacher 1998; Abram 2010), 'anthropocentrism' (Bauman 1994), 'nature is mechanised' (Merchant 1983) and 'nature is to be controlled' (Cheney & Weston 1999). In chapter 5 I argued that they combine to form a particularly influential symbolic system that supports the progress and welfare of the elite at the expense of ecological integrity and social equality. I also argued that this symbolic system underpins western, and increasingly global, society's exploitative and highly damaging economic systems.

These four interlinked concepts express particular patterns of identifying with the ecological world. The identity expressed in human-ecological dualism is one of being separate from the ecological world; anthropocentrism expresses an identity where

humans are the most important; nature is mechanised expresses an identity in which non-human beings have little moral consideration; and nature is to be controlled expresses both how nature is dangerous and can be moulded for our use. These four patterns of identifying inform and are informed by the types of knowledge we develop. For example, the dominance of a detached, objective knowledge position over other ways of knowing reinforces human-ecological dualism. These patterns of identifying also inform agency: how we act in the world, for what purposes and the kinds of technology that are developed. They encourage agency that increases control, security and the seeming well-being of humans at the expense of ecological integrity.

The popular concept 'social-ecological system' expresses the integrated relationship between humans and the ecological world. However, my concern is that social-ecological carries some of the implicit values of the hegemonic western symbolic system mentioned above. To me the concept suggests that it is our sociality that distinguishes us from ecological systems. I argue that this distinction supports the 'nature is mechanised' concept. I feel that a new term is necessary that both challenges the four above mentioned concepts and foregrounds the danger of cultural systems being decoupled from ecological ones through the symbolic systems developed. A possible option is 'cultural-ecological'. However, this concept comes with its own inherent biases and implicit values. Descola and Palsson (1996:8) raised the useful question of whether we even need a dualistic concept between people and nature and challenge whether the present dualistic concepts account for non-western realities as well as "the actual practice of modern science". They stated that "some constructs are less adequate than others for understanding the world, and when they fail to illuminate and are shown to be contrary to experience they should be revised or abandoned" (Descola & Palsson 1996: 9). Hornborg (1996) argued for a more monist perspective, reflecting the ways many traditional people view themselves in the world. However, at this stage in our human history it could be useful to have a concept that both reflects our similarity and integrated nature with the ecological world as well as the dangers of detachment and consequent disembeddedness. Maybe a solution is to create a concept with more than two juxtapositions that takes us out of dualistic thinking. Possibly useful ideas to express this include symbolic systems, relationship, dependence, meaning and totality. The difficulty in articulating this concept indicates that we presently lack the language to adequately reflect human-ecological dynamics in a single transformative concept.

The synthesis on social-ecological literature identified some further potentially useful symbolic systems to guide our human-ecological relationships which, if they became normalised, would have the power to positively transform social-ecological relations.

These are highlighted in the final section when I discuss my vision of a transformed social-ecological totality.

Research Goal 2: Identify generative mechanisms driving the current degradation of the Boksburg Lake social-ecological system.

Bhaskar and Danermark's (2006) concept of a laminated system is used to structure this section. They argued that generative mechanisms occur at different levels and identified seven applicable to the disability research they were undertaking at the time. These are physical, biological, psychological, psycho-social, socio-economic, cultural and normative levels. I have adapted these levels to help identify generative mechanisms that have causal influence on the degradation of the Boksburg Lake social-ecological system, and are based on findings represented in chapters 3 and 6. The levels I examine are the physical-chemical-biological, socio-economic, psycho-social, political-institutional and normative (see figure 8.1). Each will be examined in turn. However, it is useful to note that generative mechanisms occurring at different levels are often connected. For example, physical-chemical-biological manifestations can, in many cases, be linked to norms that operate in society.

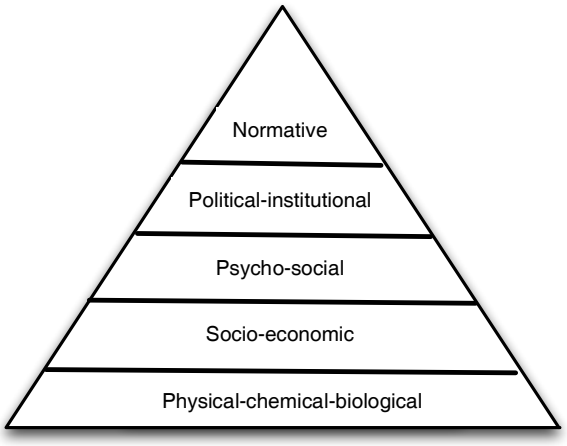


Figure 8.1: Laminated system indicating how generative levels occur at different emergent levels, namely physical-chemical-biological, socio-economic, psycho-social, political-institutional and normative

Physical-chemical-biological generative mechanisms

Over time the Boksburg Lake catchment has fundamentally changed its physical characteristics. It is situated at the headwater of the Vaal watershed, one of South Africa's major watersheds and was an area renowned for its many water bodies, such as springs, wetlands and pans. This was a consequence of the underlying geology, flat area and consequent high lying ground water. Wetlands have been identified by the

International Union for the Conservation of Nature (IUCN) as the third most vital life support system on the earth (Davies & Day 1998). This is because they contain high biodiversity, are very productive lands, purify water by removing dissolved particulate pollutants, attenuate floods and store water (Davies & Day 1998).

Boksburg Lake now occurs in a heavily built up urban catchment that has a relatively high percentage of hardened surfaces and many of the water bodies have been changed in ways that produce risk. There is a relationship between the degree of urbanisation within a catchment, which increases surface imperviousness, and loss of ecological functions and services, as recent studies have shown (Dallas & Day 2004), with negative consequences for Boksburg Lake.

The ERPM mine dump is situated half a kilometre from Boksburg Lake and the lake is downstream from the Anderbolt and Boksburg East Industrial Parks. A concrete canal, acting as a storm water drain, runs through the Anderbolt industrial park to Boksburg Lake, carrying industrial pollutants. Dallas and Day (2004) explained the negative effect of canalisation, which results in a removal of riparian vegetation, a loss of habitat, an increase in water temperature, turbidity and suspended solids and consequently the elimination of most ecological processes that previously occurred.

Urban runoff provides a significant non-point source of pollution, often much more considerable than treated sewage effluent (Dallas & Day 2004). These pollutants can be a combination of physical (e.g. temperature), chemical (e.g. pH), organic (e.g. faecal matter), inorganic (e.g. nutrients) and toxic (e.g. trace metals) elements (Dallas & Day 2004). Storm water, moving primarily over concrete surfaces, carries pollutants higher up in the catchment to Boksburg Lake. The lake has therefore become a sink for industrial, mining and general urban pollutants that includes large amounts of litter. Adding to this pollution are sewage leaks from ageing pipes. Organic enrichment from sewage leaks results in reduction of dissolved oxygen and an increase in turbidity and suspended solids, temperature and bacterial contamination (Dallas & Day 2004) and the lake has on numerous occasions experienced anaerobic conditions from these leaks. These changes will have notable impacts on the community composition and reduce species diversity (Dallas & Day 2004).

Socio-economic generative mechanisms

Generative mechanisms operating at the socio-economic level have degraded both the social and ecological value of the Boksburg Lake social-ecological system. Power$_2$ dynamics (Bhaskar 1993) seem to have influenced Boksburg's socio-economic trajectory. For example, in racial terms the exploitation of non-white ethnic groups

and the natural environment underpinned the economic viability of mining and the consequent wealth of Boksburg's white elite. As the data indicates, in chapter 6, the economic feasibility of mining was dependent on a cheap labour pool with people being paid near 'starvation rates' (*Boksburg Advertiser*, January 2, 1904). Marx (1849) described how the wealth of the powerful is dependent on this exploitation, where the masses are not paid the true value of their work, but rather subsistence rates. A large unemployed labour pool ensures that the masses remain locked into extremely low wages. Apartheid was partly legislated to create such a labour pool to ensure the economic prosperity of the white elite, who controlled the mining and industrial sector (Durning 1990; Sparks 1990). The socio-economic fabric of Boksburg has therefore been built on power$_2$ relations and is postulated to be a generative mechanism contributing to degradation of the Boksburg Lake social-ecological system.

From the 1950s till the present, Boksburg's socio-economic trajectory has been influenced by substantial, often unrestrained urban development, underpinned by power$_2$ relations. Development has been largely to support the economy and consumerism and is characterised by largeness of scale, hardening of surfaces, expansion of industrial parks and consumer centres, concrete, wide highways and the dramatic reduction of open, supposedly 'vacant' land. This has changed the physical appearance of the Boksburg catchment and negatively affected many ecological processes, as described above. It has also influenced Boksburg's social dynamics, by causing a substantial increase in population, a large percentage of which is made up of the working class and low-income groups. Large townships (including Vosloorus, Reiger Park and Dawn Park) have been built to accommodate the "reserve army" necessary to support the industries. In accordance with Boksburg's socio-economic trajectory the East Rand Mall was built in 1990. This caused the consumer centre to move from the CBD to the East Rand Mall and had an impact on the socio-economic condition of the CBD. A poorer mix of people moved into the area, the CBD became more run down, with negative impacts on the social value of Boksburg Lake.

Psycho-social generative mechanisms

Data indicates that from the early 1900s Boksburg Lake was highly valued and for most of Boksburg's history, has been at the heart of its identity and the pride of Boksburg locals. Values supporting this were a strong sense of community within the white ethnic group and an appreciation for the aesthetic and recreational benefits of natural spaces, such as Boksburg Lake. However, Boksburg's socio-economic trajectory had psychosocial effects where the identity of Boksburg shifted from being home to Boksburg Lake to being the consumptive mecca of the East Rand and heart

of South Africa's industrialisation and economic growth. There was a parallel shift in recreational and social spaces. They became associated with economic centres rather than public, open spaces such as Boksburg Lake, as was historically the case. The social value of Boksburg Lake consequently diminished.

Exacerbating this was vandalism and more serious crimes such as rape and murder that began to occur at Boksburg Lake from the 1990s. It can be postulated that these were the psychosocial consequences of the increase in poverty in the area. This reinforced the declining social value of Boksburg Lake.

Political and institutional generative mechanisms

Political and institutional generative mechanisms have influenced the degradation of the Boksburg Lake social-ecological system. The lake's increasingly obvious degrading social and ecological condition coincided with the change in political power in 1994 when the ANC (African National Congress) took over the country's leadership. Local people regard this change in political power as a key event reinforcing Boksburg Lake's degrading trajectory. It can be postulated that the change in political leadership resulted in a change of values and priorities. Boksburg Lake was renowned as a white man's playground from which other ethnic groups had been excluded. This was particularly so during the Conservative Party's reign from 1988 to 1994 which reintroduced many of the Apartheid laws. Boksburg Lake was a prime target that was managed exclusively for white South Africans. When the ANC gained power it can be assumed that different priorities and values were brought into the mix. For example, poverty upliftment and providing basic services to the majority were prioritised over maintaining a public space strongly associated with the white population.

There is also a growing amount of evidence pointing to mismanagement and dysfunctionality in many of South Africa's municipalities (Siddle & Koelble 2012). This is evident in EMM where, in spite of numerous promises to the public that Boksburg Lake is a priority they have expressed an inability to effectively manage it. This points to dysfunctional aspects within the municipality. Contributing to this, it is well known that municipal departments work separately in silos with inadequate communication channels. This is at cross-purposes to solving the degradation facing Boksburg Lake that results from a complex, integrated mix of factors.

South Africa's political-institutional landscape is structured in a way that community led forums, such as the Boksburg Lake Forum, have the mandate to be a channel for local concerns but lack the power to effect any real change. The Water Research

Commission is trying to address this issue by calling for researchers to examine what institutional change is required for such forums to have effective agency.

Normative generative mechanisms

Based on the discussion related to research goal 1 it is pertinent to identify the symbolic system(s) that support the degradation of Boksburg Lake's social-ecological system. Drawing from the results presented in chapter 6, Boksburg Lake's most influential symbolic system includes the following normalising ideologies: economic growth is imperative, industrial, urban development is valued; consumerism is encouraged, and a competitive, rival spirit towards neighbouring towns supports Boksburg's success.

A brief historical overview provided some insight into the emergence and strength of this symbolic system. Boksburg was birthed as a mining town and for most of its history mining has been central to the city's identity. In spite of the strength of the mining sector Boksburg carried the stigma of being a sleepy village for many years. From this stigma there was a strong imperative to grow with the aim of one day being granted city status and becoming the biggest and best. Growth of the economy and urban, industrial development were perceived as the means to achieve this and were consistently celebrated throughout the years. Over time Boksburg became an increasingly consumer based society with locals attaching high value to shopping, as was expressed in the *Boksburg Advertiser* archives. In 1992 when Boksburg achieved city status and the East Rand Mall was built, Boksburg became the consumer mecca of the East Rand and it was felt that Boksburg could finally throw off its stigma of being a dreary, sleepy place. A symbolic system built on the normative concepts highlighted above, which had become increasingly strong over the years, was entrenched. This symbolic system has had a causal influence on Boksburg Lake's trajectory of degradation.

I suggest that this symbolic system was supported by a deeper one, built on the four normalising ideologies that influence globalising modern social-ecological relations, namely a human-ecological dualism, anthropocentrism, nature is mechanised and nature is to be controlled, as identified in the literature and discussed in detail in chapter 5. I have argued that these four interlinked, reinforcing concepts support human 'progress' at the expense of ecological integrity and social equality. The type of development that occurred disregarded ecological processes and led to a change in physical characteristics as described above. This reveals an attitude that nature is to be controlled, that humans are separate from ecological processes, that nature has little moral value and that humans are the centre of concern. Through this kind of

development many catchment ecological processes were destroyed, social inequality increased and Boksburg Lake became a sink for much of the catchment pollution.

From the 1990s a different symbolic system developed that was based on values for the oppressed, future generations and ecological systems and which challenged Boksburg's dominant symbolic system. There were vehement protests and action campaigns challenging unrestrained development. The story of Nicole Barlow, a local activist who challenged the development of a Sasol petrol station on a wetland, and won, was rallied throughout Boksburg's community. However, the power of the dominant symbolic system negated many of the positive affects of civic action and unrestrained development continues. Glasser (2007) provided insight into why this may be the case. He highlighted the mechanics of passive learning (the most common of the social learning types) that tends to perpetuate the status quo. Passive learning is based on trust, accepting information uncritically and generally involves adopting "the values and assumptions that are encoded in the transferred knowledge" (Glasser 2007: 50). Using Bandura's framework he showed how the countercultural, ecoculturally sustainable behaviours, like those advocated by Boksburg's civic groups, are infrequently adopted through passive learning processes. This has been elaborated on in section 7.1.3. The power$_2$ dynamics that have underpinned Boksburg's socio-economic trajectory provide further insight. Social inequality has been a result of this trajectory with a consequent large proportion of poor people. Some have become vagrants and squatters who are regarded as the undesirables in society. They tend to squat on open land and pose a perceived security risk and decrease the land's aesthetic value. The land consequently becomes devalued by wealthier groups of people and this further legitimises urban development. In section 6.3.3 the example of the Cinderella Vlei Action Group was given. Arguments challenging this group included the fact that squatters use the vlei and therefore make it undesirable as an open space.

This summary has shown the complexity, interconnectedness and laminated nature of the generative mechanisms that have causal influence on the degrading trajectory of the Boksburg Lake social-ecological system. Questions of how to bring about transformation of this system are now discussed.

Research goal 3: Identify learning mechanisms that support transformation for greater social-ecological resilience for well-being of the Boksburg Lake social-ecological system.

The data indicated that social learning processes involving schools and churches supported transformation for greater resilience of the Boksburg Lake social-ecological system and that there was value in bringing in both the educational focus (primarily through schools) and moral focus (primarily through churches).

The data indicates that churches can play a meaningful role in transforming Boksburg Lake, by providing a moral impetus. The involvement of churches was key to the establishment of the Boksburg Lake Forum and church representatives played important roles on the forum, including serving in the position of deputy chair and then acting chair. Commitment to such a forum is a sacrifice of one's resources, such as time. The moral impetus provides a good reason for making this commitment, as expressed by some of the forum attendees. Many church attendees are retired and therefore have time to commit to environmental action, while church leaders can be highly influential in shaping identities and opportunities for environmental involvement.

As highlighted, religious communities are morally motivated and they have influential symbolic systems built on metaphor and values that guide what is right and wrong. For churches to play a meaningful transformative role, the high value of the ecological world must therefore find a meaningful home in their symbolic system. There is a wealth of symbolic resources available to incorporate ecological care into church knowledge, identity and practice, which will be highlighted in the final section (section 7.4). However, there are also some strong ideologies that are opposed to ecological care that need to be addressed, including anthropocentrism that is inspired by the dominion mandate (White 1967), spiritual/ natural dualism, nature has little moral worth, and an other worldliness, to name a few.

The focus on schools had favourable results and data indicates that teachers and peers can have an important social influence on patterns of identifying, types of knowledge and forms of agency. Youth realised the high value of Boksburg Lake and they quickly adopted a strong identity with it that inspired the desire for action. They also expressed much enthusiasm and vision for being involved in processes for real world change and there was evidence that youth had a positive impact on their schools and to a more limited degree, community environments. A number of learners and schools played particularly active roles in the initiative with Reiger Park High being a prime example.

A number of key learning mechanisms were identified to support transformation of the Boksburg Lake social-ecological system. Firstly, data indicated the value of

learning that happens in a real world context. This encourages the generation of meaningful and embedded knowledge (Hornborg 1996) and links abstract concepts to concrete experience (Rogoff 1990). In the Boksburg Lake case study this was enhanced because the lake was already a meaningful space for local people, where their identity has been moulded by Boksburg Lake and it holds a significant place in collective memory as a place of high social value. Within schools one of the postulated reasons for the initial effectiveness of the initiative was that Boksburg Lake still resonated with local people and was therefore relevant. Learning has therefore occurred around a meaningful local symbol that is tightly linked to Boksburg's socio-cultural identity. This has facilitated processes of mediation, knowledge internalisation and how meaning is made (Vygotsky 1978). Secondly, the power of the historical educational activity to provide a reference point for what is possible for the Boksburg Lake system was key in shaping identities built on being change agents. This indicates the role of learning mechanisms that provide reference points to change the status quo of what is normal, from degraded to healthy social-ecological systems. Thirdly, the Boksburg Lake case study indicates the value of learning mechanisms that develop systems thinking. Fourthly, the fact that learning happened in a space of action around a meaningful local symbol played a valuable role in shaping transformative patterns of identifying, knowledge acquisition and agential development in the Boksburg Lake case. Learning mechanisms that link knowledge, identity and action are therefore advised. Fifthly, this case study indicates the value of providing the youth a space to get involved in real world action and be part of a community of practice. Not only do the youth respond enthusiastically to such opportunities, they can also be important agents of change (Hart 1997; Schuslera *et al.* 2009) and benefit from the social learning processes of which they become part (Rogoff 1990).

This section ties together the summaries of research goals 1-3 to answer the primary research question: **What generative mechanisms constrain and enable the development of social-ecological resilience for well-being in the modern social-ecological system of Boksburg Lake?** An important qualifier is that not all generative mechanisms will have been identified but I hope to have highlighted the key ones.

Generative mechanisms that constrain social ecological resilience for well-being

A summary has been provided above of the generative mechanisms causing the degradation of Boksburg Lake. These occurred on different levels of the laminated system, namely the physical-chemical-biological, socio-economic, psycho-social, political-institutional and normative. Four generative mechanisms are recognised as

most influential. Two of these lie on the normative level, have manifest empirical consequences on the physical-chemical-biological, socio-economic and psycho-social levels and have been named hegemonic symbolic systems. The primary symbolic system consists of the four identified normalising ideologies that promote human progress at the expense of ecological health. The secondary, more explicit symbolic system, built on this, consists of the following normative concepts: economic growth is imperative, unrestrained development is promoted, competition is the necessary means and consumerism is the good life. These two symbolic systems have had causal influence on the systematic erosion of ecological processes and biological diversity that has occurred in Boksburg, with the consequent undermining of social-ecological resilience for well-being. The third mechanism that constrains resilience is the power$_2$ relations that have shaped Boksburg's economic history and social-ecological system. This has resulted in a society built on inequality and injustice with all its associated social and environmental ills, expressed as externalities. According to Anderson (2010) social and environmental injustice has primary causal influence on the environmental problems currently faced. The fourth mechanism reducing the resilience of the Boksburg Lake social-ecological system resides in Boksburg's political and municipal dynamics. These structures are not designed to tackle complex social-ecological problems and they hold considerable agential power, yet seem dysfunctional at present. Municipal politics and dynamics were not a focus of this study. However, retrospectively it would have been useful to engage in deeper research to identify the generative mechanisms that limit EMM from being effective in tackling the social-ecological problems at Boksburg Lake.

Generative mechanisms that enable social-ecological resilience for well-being

In chapter seven the role of learning to bring about a sustainable future was highlighted. The focus of this thesis has consequently been on learning mechanisms that bring about social-ecological resilience for well-being as summarised above (research goal 3). A few important points from the summary will be highlighted. Firstly, it is important to employ learning mechanisms that encourage patterns of identifying with Boksburg Lake and the earth and give it personal meaning and moral value. Secondly, findings indicate the value of learning mechanisms that increase systems knowledge and generate local meaning. Thirdly, learning mechanisms that provide a space for the youth to undertake action to address a real world problem as part of a community of practice, where they can learn from peers and adults, can have fruitful consequences. Fourthly, findings indicate that schools and churches are important institutions that can positively influence patterns of identifying, knowledge about and agency for Boksburg Lake and can thus play a role in transforming hegemonic symbolic systems and social imaginaries.

8.2 Insights into modern social-ecological processes and transformative possibilities

By encouraging researchers to identify and understand the underlying generative mechanisms operating in a particular context, Critical Realism provides the tools to make generalisations broader in scope than the particular case study examined (Danermark *et al.* 2002; Mingers 2011). It therefore becomes possible to examine the Boksburg Lake social-ecological system case study as a means to explore broader modern social-ecological generative mechanisms in operation.

The increasing biophysical degradation and growing social inequality that characterises Boksburg's history provides a microcosm of more general global processes where apparent human progress is at the expense of ecological health and social equality. This is leading to a dramatic loss of social-ecological resilience for well-being, with severe consequences predicted for the dynamics of the earth's climate, the health of terrestrial ecosystems and the oceans, the availability of natural resources and social security (Swilling 2012). As is evident in Boksburg, the influential and dominant normative concepts that economic growth is imperative, industrial, urban development is valued, consumerism is encouraged and competitive values support progress, is driving this trajectory. As discussed in summary 1 and 2, these are underpinned by a deeper symbolic system consisting of the four normalising ideologies of human-ecological dualism, anthropocentrism, nature is mechanised and nature is to be controlled. These concepts have a significant influence on how we relate to the world and inform how reality is represented, what is valued and ignored, what is identified with or not and consequently what actions are taken (Dalton 2010). In addition, it can be generalised that the power$_2$ relations driving Boksburg's economy are also in operation in global economic patterns. This has created spaces for powerful individuals and multinational companies, for example, to externalise the costs of production to maximise profits (Leonard 2007). This leads to economic actions highly exploitative of the natural world and vulnerable peoples.

Learning on a societal level has been highlighted as a key means to bring about greater social-ecological resilience for well-being (Bawden *et al.* 2007). The remainder of this section discusses how the findings on learning mechanisms within the Boksburg Lake case can provide insight into mechanisms for more global transformation.

Firstly, it is evident that learning processes need to create opportunities for new concepts to emerge that give us different meaning in relation to the ecological world. A starting point is to critically and creatively reflect on people's patterns of identifying within social-ecological systems, the types of knowledge they develop and the forms of agency they are engaging in.

Patterns of identifying that increase connection rather than alienation with the ecological world and vulnerable peoples would have transformative effect. This is discussed in more detail in the last section that discusses my vision of a transformed reality and the normalising ideologies underpinning patterns of identifying that support this.

There are a number of key characteristics, listed below, of the types of knowledge about social-ecological systems that increase reality cognisance and a personal engagement with the ecological world that potentially has transformative effect.

- Systemic knowledge that grasps the complexity, interconnectedness and relational aspects of social-ecological systems at different scales (Meadows 2008; Wiek *et al.* 2011).
- Knowledge of underlying structures and generative mechanisms and how this translates into empirical manifestations (Bhaskar 1975).
- A critical reflection of the underlying normalising ideologies, values and assumptions and social imaginaries that characterise particular societies and how this translates into different degrees of social-ecological resilience for well-being.
- Knowledge about absences, their causal effect on social-ecological realities and how normalising ideologies perpetuate particular absences. This will provide a deeper understanding of the status quo, help identify what is preventing change and therefore what absences need to absented for transformative change to take place (Bhaskar 1993; Norrie 2010).
- Creative knowledge that envisions different possibilities for a transformed future (Jensen & Schnack 2006; Wiek *et al.* 2011).
- Knowledge of the social and ecological consequences of particular actions that occur beyond immediate time and spatial boundaries (Bauman 1994).

For a transformed future, individual and collective agency needs to be developed that 1) challenges underlying structures and generative mechanisms supporting unwanted absences; 2) improves the functioning of ecological processes; 3) addresses social inequality; 4) works in solidarity, across different institutions and groups of people,

towards a collective vision; and 5) thereby increases social-ecological resilience for well-being.

Based on insights from the Boksburg Lake case study, the learning mechanisms that support societal development of the above patterns of identifying, knowledge and agency include the following:

- Learning reflexively together within communities of practice that provide opportunities for active rather than passive learning;
- Learning through information acquisition, investigation, action and deliberation;
- Learning about abstract concepts and theoretical knowledge but embedding this in local realities;
- Learning that provides reference markers for how things can be different; and
- Involving the youth as they are a group of people with notable enthusiasm, vision, energy and motivation.

Particular institutions play key roles in bringing about increased social-ecological resilience for well-being. Schools and higher education institutions have an important role to play in the development of knowledge that can lead to transformation of the status quo while religious institutions shape morals and values and can influence patterns of identifying and social imaginaries (Dalton 2010). Political institutions play an important agential role by developing policies that constrain or enable particular actions of individuals, communities and other institutions (e.g. economic institutions). The media is also critical as they have a strong influence on passive learning processes and can perpetuate hegemonic patterns of identifying, forms of knowledge and types of agency.

8.3 A critical reflection of my process as a reflexive practitioner

The above summary of insights into modern social-ecological processes and opportunities for transformation reveals gaps in my process as a reflexive practitioner in the degraded Boksburg Lake social-ecological system. Firstly, I lacked enough knowledge on EMM, including its structure, the relevant departments to include and areas where it was dysfunctional, which was a constraining factor on effective political and municipal involvement in the SSE initiative. This lack of knowledge also limited the impact that the Boksburg Lake Forum had on effective municipal engagement. Secondly, I did not create effective learning spaces in school contexts for critical reflection of underlying normalising ideologies and power$_2$ relations, as I was introduced to these helpful theoretical concepts after being a practitioner. Thirdly,

the development of systemic knowledge of the Boksburg Lake system could have been better directed through maximising the value of the resource pack. Most of the impact of the initiative came through the Boksburg Lake Day. This supported the development of a community of practice and community learning, increased meaning associated with Boksburg Lake and inspired action. However, the systemic information on the Boksburg Lake system was mostly contained in the resource pack. On reflection, it would have been beneficial to provide teachers with more encouragement and guidance on how to use the resource pack in ways that would improve systems knowledge. Fourthly, the SSE initiative needed to be part of a bigger process of transformative action, especially when dealing with such an integrated, complex system with multiple variables and feedback loops driving the degrading trajectory of Boksburg Lake. This was highlighted by the resilience of the Boksburg Lake system to real change.

In addition, many intentions and plans went unrealised (see section 3.6.4). If they had been followed through, the transformative effects of the SSE initiative may have been more considerable. Consequently, in some areas the developing momentum was not carried through. For example, a number of the unrealised plans linked to the local media developing an environmental citizenry. The media could have been utilised better to positively influence patterns of identifying, knowledge and agency. The unrealised plan of holding quarterly community forums would have supported the development of a wider community of practice and broader processes of social learning. Producing the intended Handprint booklets on three or four of the most effective school action projects would have shared learning and practice and therefore strengthened social learning processes between schools. Other unrealised actions would have strengthened and increased the sustainability of participating schools involvement in locally relevant environmental issues. This includes providing more effective support for participating schools to develop environmental clubs, become Eco-Schools and link up to EMM's EYE (Ekurhuleni Youth for Environment) programme. These additional programmes and activities would have brought in extra resources and provided additional learning opportunities.

A critical reflection of my research process focuses on my decision to use a grounded approach. This was both a time consuming and challenging process that resulted in broad emergent meanings from the data that could not be confined to neat theoretical spaces. On reflection this hampered the development of a clear theoretical framework and I suspect that there are some important theoretical gaps in my thesis. A related point was the disjunction in time between my role as a practitioner (when most of the data was collected) and my full-time role as a scholar when I deeply engaged with

theory and philosophy. This distance in time between data collection and theoretical engagement was in part what necessitated my initial adoption of the grounded approach. It also meant that my data was not always directly congruent with the theoretical concepts that were emerging. The grounded approach did, however, support the authentic voice and experience of local people to emerge and provided an interesting nexus between local evidence and global thinking.

The chapter now moves onto the final section that discusses my vision of a transformed reality.

8.4. My vision of a transformed reality

I believe that there are two basic trajectories of reality: one that increases alienation, and is similar to Bhaskar's concept of a sub totality (Bhaskar 1993), and one that increases unity. In addition, there are two contrasting states of being that have an important influence on the strength of each trajectory, namely love and fear, identified by poets (e.g. Leunig 2006), authors (e.g. Johnson 2014) and philosophers (e.g. Gibran 1923) as two elementary and opposing forces in human reality. Human values, normalising ideologies and metaphors, reflecting symbolic representations of the world and ourselves, are based in fear and strengthen alienation, or are rooted in love and strengthen unity.

This thesis has discussed a number of normalising ideologies that can be regarded as being rooted in fear and which lead to alienation between ourselves and the rest of the ecological world. These are human-ecological dualisms, anthropocentrism, nature is mechanised and nature is to be controlled. The relationship between these concepts and patterns of identifying, knowledge and agency was discussed in section 8.1.

I regard all four interlinked and reinforcing normalising ideologies as deriving from a general fear of the natural world; nature's wildness, complexity, uncontrollability and 'malevolence' need to be controlled to ensure humans' sense of security and well-being (Abram 2010). It is not difficult to see how all four of these normalising ideologies have increased human alienation from the ecological world.

My vision for a transformed reality is one where normalising ideologies are informed by patterns of identifying, types of knowledge and forms of agency rooted in love that consequently strengthen unity. Such concepts are varied and can be drawn from a variety of spaces. Bhaskar (1993), for example, introduced the philosophical concept of totality that builds on a relational ontology and reflects the profound

interconnectedness that exists in the world. The well-being of the whole is important as it in turn affects the well-being of individuals and aspects of the world. Bhaskar also highlighted that it is a partial totality, where change is inherent and new aspects continually come into being. In this notion there is much room for creativity and agency to bring about an envisaged future. The theory of evolution based in scientific discourse indicates the connectedness of humans to the rest of the ecological world. As McCallum (2008: 32) has expressed "it would appear that the poetry of the brotherhood and sisterhood of all living things has become science". Within popular environmentalism there are useful concepts such as Lovelock's (1972) Gaia hypothesis that view human beings as one part of a living, self-regulating super organism. There are also concepts that can be drawn from many indigenous communities around the world. Examples include the idea that we are part of an animated, communicative world (Pierotti & Wildcat 2000); that there is a kinship connection with animals, where the Raramuri tribe of Mexico, for example, regard particular animals as their siblings (Salmon 2000); and that there is no separation between people and the natural world, where the Tukano people, for example, view their environment as an extension of themselves and damage of the environment means damage to themselves (Reichel-Dolmatoff 1996). Finally, there is a wealth of metaphor and concepts that can be drawn from the major religions (Buddhism, Christianity, Hinduism, Islam and Judaism). Examples include: the metaphor that all life is related (Buddhism) (Palmer, Nash & Hattingh 1987); that the world is animated (Buddhism) (Palmer, Nash & Hattingh 1987), the unity and oneness of all things (Hinduism) (Palmer, Nash & Hattingh 1987); the metaphor that humans are made in the image of God and therefore have the responsibility of expressing God's sacrificial, suffering love to all life (Christianity) (Goddard 2008); the concept of the immanence of God where the earth is animated with God's presence and is therefore highly valued (Christianity, Hinduism, Judaism) (Peacocke 1983; Polkinghorn 1986; Southgate 2008; Wallace 2009; Palmer, Nash & Hattingh 1987); the idea of humans being stewards of the earth who have the responsibility of maintaining ecological health (Islam, Christianity, Judaism) (Palmer, Nash & Hattingh 1987); and a theocentric perspective where God, rather than humans, is at the centre and in control (Christianity, Islam, Hinduism, Judaism) (Palmer, Nash & Hattingh 1987), freeing humans to let go of fear and needing to be gods themselves.

These examples indicate that there is a wealth of symbolic representation we can draw on to envisage and guide us towards a future of greater unity within humanity and between humans and the rest of the ecological world, that is rooted in love.

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Appendices

Appendix B: List of Knowledge Resources in the Resource Pack on Urban Water Catchments

1. River Catchments
2. Healthy and degraded water catchments
3. The River
4. Factors affecting the character of Boksburg Lake
5. Pollution
6. East Rand Pans
7. Historical Postcards
8. Boksburg - Once upon a time
9. “My Lake” By Montague White
10. Group presentation on Boksburg Lake
11. Ecologocal footprint
12. Testing for Water Quality
13. Investigating the health of our rivers
14. Water Creatures and their scores
15. Water Creatures identification sheet
16. Mini SASS score sheet
17. River Health Survey

Appendix D: Semi-structured interview schedules (2009-2010)

2009 Interview Schedule

Questions about the Boksburg Lake Day

1. What was your experience of this day?
2. How do you think the learners experienced it?
3. What do you think worked?
4. Didn't work?
5. Which activities do you think worked the best?
6. Activities that didn't provide much?
7. Responses from the children?
8. What do you think the impact of such a day has been?
9. Has there been evidence of them

- Learning things
- Change in attitude
- Change in behaviour

10. What can be done to increase

- the learning?
- community mobilisation
- facilitate meaningful sustainable actions

11. Do you have plans on how to take this forward?
12. What would you like to see happen now?
13. What kind of support would you like to receive?
14. Suggestions for the next lake day

Questions about the Boksburg Lake Resource Pack

1. Please provide a brief description of how you used the resource pack.
2. Please explain whether you collaborated with other teachers in the implementation of the resource pack and why/ why not?
3. Was the resource pack easy or difficult to use and why?
4. What learning area/s did you focus on when using the resource pack?
5. How many lessons did you do, based on the resource pack?
6. What grade did you focus on when doing this resource book?
7. Is English their first, second or third language?
8. Was the level of English appropriate for them?
9. Do you have any recommendations to make it easier for them to understand? (Please think about both the language and design of the resource packs).
10. Which grades do you think this resource pack is most suitable for and why?
11. Please make comments (positive/negative) on the:

- Story and comprehension exercise
- Knowledge resources
- The Boksburg Catchment activity (map, coke bottle catchment and cards)

12. Which activities were the most effective and why?
13. What do you think your learners have learnt through going through this resource pack?
14. What do you think was missing from their learning about Boksburg Lake and her water catchment? Are there things that you would like to see added to the pack that would support better learning about Boksburg's urban water catchment?
15. We are looking to improve the environmental education strategy for Boksburg Lake for 2010. What general suggestions would you make
16. Action project: are you thinking of doing one?
17. If yes, what do you plan to do
18. If no, why not?
19. Importance of action projects: what do you think can be done to help/ support/ facilitate schools engaging in action projects.
20. Handprint idea and video

General Questions

1. What motivated you to be apart of this initiative?
2. Why still involved – a few schools indicated an interest but didn't jump onto the wagon.
3. Benefits to being involved
4. Costs to being involved?

2010 Interview Schedule

1. What did you think of this year's Boksburg Lake day?
2. How did it compare to last years day?
3. Best aspects of day?
4. Things that can be improved?
5. Impact it has had on you?
6. Impact it had on learners?
7. What role do you want to play in this initiative?
8. What actions do you want to do?
9. What have you learnt through this experience?
10. Have you used the resource book?
11. Usefulness?

Appendix E: Semi-structured interview schedule for focus groups conducted with learners (2009 to 2011)

Semi-structured focus group interview schedule for 2009

1. When you think of the Boksburg Lake day what first comes to mind?
2. What was your experience of the day?
3. What did you enjoy about the day?
4. Anything you didn't enjoy about the day?
5. If you were in charge of organising the next event what would you do? What would the day look like?
6. Now for the important question: what do you think you learnt from this whole experience?
7. Go through the activities with photos

- Waste: What did you learn?
- The History activity, what did you learn from that one.
- Urban jungle
- Snake
- Water quality

8. Vision: what did you want to put down for your vision
9. Making banners: what message did you want to give on your banners.
10. March: what did you think of the march?
11. Which activity was your favourite!
12. Before the day your teacher went through a few activities with you. What did you learn?
13. Is there anything you are going to do differently after going through the resource pack and experiencing this day?
14. What do you think the Boksburg community should do to improve the lake?
15. If you could choose a project for your school or class to do what would you like to do?

Semi-structured focus group interview schedule for 2010

1. What did you think of the Boksburg Lake Day?
2. What were you expecting?
3. How did it compare to last years event?
4. Best aspects of the day?
5. Things you didn't like?
6. What impact did it have on you?
7. Why do you think Boksburg Lake is polluted? Who do you think is responsible?

8. Wrote the banner. What message did you want the community to get from what you wrote on your banner? What was the main thing that you wanted to tell them?
9. What have you done differently since going to the day?
10. What do you think needs to happen for people to start caring and do you think you can be involved in that?
11. Do you want to do anything to improve the lake?
12. What has your school done/ any school action projects?
13. What do you want your school to do?
14. What was the most important thing you learnt going to the lake?
15. What else did you learn?

Semi-structured focus group interview schedule for 2011

Show them slide show
Then show one slide with 6 photos (March, picking up litter, having fun with friends, Miss Earth, practical learning, children doing plays)

1. Pick the photo you like best and tell me why you chose it.
2. Which of these activities did you learn the most from?
3. What did you say on your Banner?
4. Please describe the message that you wanted to put across in your play?
5. Did you write a statement to the municipality? What did it say?
6. As individuals write down 5 things that you learnt.
7. How does this project differ from you normal school experience?
8. What did you learn that was different from normal school?
9. What did you learn that helped you understand other things that you're learning in school?
10. Do you do anything differently after the Boksburg Lake day?
11. Do you think you can make a difference for Boksburg Lake?
12. How would you like to make a difference?
13. Do you think your school can make a difference to Boksburg Lake? If yes how, if no, why not.
14. What kind of person would you describe Boksburg Lake as?
15. How do you want to relate to that person?

Appendix F: Full list of themes that emerged from data representations in chapter 6 and from which the analytical statements

1. Mining viability and racial exploitation go hand in hand.
2. A dominant ideology of European settlers was to maintain white supremacy and purity.
3. In these early years of Boksburg's history white racism, the need for cultural preservation and maintaining power was explicit. A fair assumption is that these themes run throughout much of human history and profoundly affect the nature of social-ecological systems.
4. Ideologies over racial purity and supremacy and economic goals were closely interlinked and for a while pitted against each other. Apartheid helped ensure that both won.
5. The ERPM mine is synonymous with Boksburg's identity: The mine has been a celebrated and highly valued feature of Boksburg, often linked to its identity. This is largely because of the economic benefits it has brought.
6. Boksburg's identity was driven by a desire to be an industrial giant and centre of economic growth.
7. Very high value is placed on economic growth.
8. Local industries had very high value to Boksburg and were regularly celebrated in the Advertiser.
9. Unrestrained development was promoted from the 1960s till late 1990s.
10. The ERPM has brought both significant economic 'growth' and environmental and social ills.
11. Throughout Boksburg's history, values of economic growth, progress, expansion and competition were at the heart and fundamental to Boksburg's identity and aspirations.
12. Throughout the years Boksburg carried the stigma of being a sleepy dorp town and its explicit aim has been to throw this off by becoming one of the economic giants in the country.
13. There is a strong competitive spirit where locals wanted to be the biggest and best.
14. There is a lack of regard for nearby cities' economic welfare.
15. In 1990s there is a growing emphasis on consumer values, promoted through the East Rand Mall.
16. The East Rand Mall was a driver for economic growth as well as social and environmental decline.
17. Very rarely, if never, is the environment brought into discussion in articles on the celebrated, needed economic growth. The word vacant for areas earmarked for industrial sites is telling.

18. From the mid 1990s a shift was happening where the impact of unrestrained development was beginning to be felt.
19. It is almost as if economic growth gives people a high, an adrenalin rush. It can be compared to a drug where people can never get enough. There is no thought of the consequences.
20. 1997 was the last year where the development and growth of Boksburg dominated the local newspaper's headlines.
21. By the late 1990s the social (such as increasing crime, many vagrants) and environmental ills of development was becoming apparent. Boksburg was even facing a financial crises.
22. With the ending of Apartheid black people were allowed into the cities. This created issues of vagrants, informal settlements etc. which justified development on open land. The powerful were wanting to maintain power and keep spaces in their control.
23. Environmental decline predominated the news in the 1990s and 2000s.
24. From the 1990s there were serious issues over water quality from industry and mining, including acidic water.
25. There are problems of solid waste dumping throughout the 1990s and 2000s especially in Reiger Park.
26. Deterioration of parks and public spaces in the 1990s; dangerous, littering, home of 'vagrants'.
27. The homeless and poor were given derogatory names and seen as a nuisance.
28. From the late 1990s there is a growing deterioration of aesthetics and increasing filth and rubbish in Boksburg.
29. A growing civil response ran parallel to the increasing environmental deterioration.
30. The civil response was from a wide range of role players: young and old, rich and poor, different races, different occupations and involved both groups and individuals.
31. Many different clean ups by different groups were organised for Reiger Park over the years.
32. A number of businesses addressed the issue of litter/ rubbish in different ways.
33. Action groups were mobilized to address the deterioration of water bodies.
34. One victory for the environment and civil group over a big company was a big inspiration and encouragement to many. Momentum builds when a change agent wins a victory; it gives a sense of empowerment and belief that more change can happen.
35. Civil groups express the feeling of being an under dog.
36. A lot of passion and commitment to the environment expressed.
37. The issue of vagrants and squatters is often used as a justification for development. E.g. the vlei used as a toilet, which causes it to stink. This

reduces the value of these natural areas, which then justifies their 'development'.

38. People campaigning for environmental protection against development draw on the following reasons: the negative impact on bird life, the negative impact on ecological functioning, the economic value of water filtering and social benefits of natural areas.
39. Campaigners were against values of greed, corruption and power.
40. Campaigners promote values of environmental preservation, place high value on nature, the future generations and biodiversity, do not believe in the exclusive ownership of nature and state that the 1st/ 2nd and 3rd world must work together.
41. Developers/ people on developers' side draw on values of and connections to the economy (can buy the vlei at a market related price), being civilized and being part of the first world.
42. From the early 1900s Boksburg Lake quickly developed a reputation for being a highly valued/ sought after recreational area and would draw not only local people but crowds from other towns and cities on the Rand.
43. Aspects of the lake that were valued/ appreciated included the natural beauty and the bird life (mostly from an aesthetic rather than ecological functioning perspective.)
44. The identity of Boksburg is closely linked to the lake.
45. From being one of Boksburg's biggest assets the lake turned into a high risk/ hazardous site, both socially and environmentally.
46. In 1980 council said it didn't have money to put up lights at the lake, in-spite of having significant economic growth behind it (economic growth seems to often happen at the expense of social benefit/ things that hold a community together).
47. By 1980 the social centre of Boksburg was beginning to move away from the lake and be focused on commercial centres/ places that promote consumerism.
48. Boksburg Lake's water quality was threatened by mines and industry.
49. The dust clouds from the ERPM probably contributed significantly to the sludge build up in Boksburg Lake.
50. Boksburg Lake experienced deterioration in the 1990s, both in terms of water quality and aesthetics/ facilities etc.
51. Rapid deterioration of Boksburg Lake began in the late 1990s into the 2000s.
52. Boksburg Lake had recreational value up until early 2000s.
53. Throughout 1990s there were numerous attempts to revamp the lake, which were never realized.
54. Boksburg Lake has been a heavily contested racial space.
55. In the early 1990s there was a struggle between the value placed on Boksburg Lake as a prioritized recreational centre and the growing water pollution, deterioration of infrastructure and racial issues that constrained this.

56. Vandalism and security issues resulted in the lake being less user friendly.
57. Social decline and decline of the value and usability of open public green spaces is closely linked and negatively perpetuate each other which leads to further environmental decline.
58. From 2004 the municipality put a project in place to revamp the lake, which was highlighted and emphasized in 2007. Many promises and plans and financial input were made. By 2013 the lake's grounds had deteriorated considerably.
59. In-spite of efforts by the municipality, civil groups and schools Boksburg Lake has continued to deteriorate.
60. Boksburg Lake's deterioration dominated the headlines between 2007 and 2009. After that there were very few articles on the lake's condition.
61. The ERPM caused pollution to the lake, as early as the 1920s.
62. From 2002 Boksburg Lake was under the spotlight for severe water pollution.
63. By 2007 the lake had flipped into an undesirable/ unusable condition both ecologically and socially.
64. A low view of the poor has been consistently expressed in the newspaper.
65. There were many plans, promises and investment from 2007 to dredge the lake but it has still not happened.
66. ERPM became the backbone of Boksburg's economy.
67. There was a fear of non-whites becoming skilled and posing a threat to white dominance.
68. In the 1960s industry replaced mining as the main economic driver.
69. During the 1970s rapid expansion continued and was celebrated.
70. Emphasis and value placed on growth continued into the 1980s.
71. The aim of the city was to become one of the country's economic giants.
72. There is rapid growth throughout the 1990s.
73. Many social activities were organized for the East Rand Mall. Social centres move to the commercial centres and economic and social structures become more tightly coupled.
74. The East Rand Mall is attributed very positive adjectives and high social value.
75. Pride of place and consumer benefits is closely linked.
76. The East Rand Mall had negative economic effects on nearby cities.
77. Value is expressed towards dominating other reef towns.
78. From the 1990s high value is placed on consumers being able to consume cheap goods.
79. Many developments/building plans were approved throughout the 1990s.
80. The ERPM has been a celebrated, personified and highly valued feature of Boksburg.
81. In 1996 there was a shift in developmental attitudes where both the poor and rich were considered in how development should proceed.

82. Unrestrained development was in the name of "*vested financial interest (and) massive profits*", which as had negative social and ecological impacts.
83. The desire for economic growth and development is never satisfied. No matter how much economic growth had been preceeded, still more was demanded.
84. Growth of the East Rand is seen as essential to the country's well being.
85. It is assumed that economic health will take care of social health/ will be of most benefit to society.
86. In 1999 the city was facing financial problems.
87. The ERPM mine attracted native labour to the Vaal. When it closed in 2000, it resulted in a huge surplus of unemployment.
88. There are growing crime problems in Boksburg. Serious crime throughout the 1990s which resulted in businesses leaving the area.
89. Growth is needed to sustain itself. Without growth an economic decline rapidly happens.
90. In 1970 large amounts of industrial effluent are in municipal drainage system.
91. From 1996 there is deterioration of parks and public spaces.
92. In the late 1990s and 2000s there is a growing deterioration of aesthetics and increasing problem of litter.
93. There is increasing developmental pressure on water bodies, such as pans, wetlands, rivers and dams. Degradation and destruction of wetlands occurred in the 2000s.
94. Illegal dumping, litter and a lack of refuse service delivery were growing problems and dominated the environmental headlines in 2001, 2002 and 2007 and 2009.

Appendix G: List of 59 concepts that emerged from the first round of data analysis

A. Emotional response to Boksburg Lake (positive)
B. Emotional to Boksburg Lake response (negative)
C. Human responsibility for environmental problems
D. Littering
E. History
F. Negative description of Boksburg Lake
G. Positive description of Boksburg Lake
H. Human responsibility to solve environmental problems
I. Importance of community/ working together
J. Empathy with animals
K. Youth empowerment
L. Desire for personal action
M. Identity
N. Role
O. Current actions
P. Learning
Q. Reasons for learning and agency
R. General impact of the day
S. Action/ agency
T. Environmental strategy happening
U. Environmental strategy didn't happen
V. Tensions/ limitations/ constraints
W. Opportunities
X. Memories of Boksburg Lake
Y. Resource Pack
Z. School/ church/ Christian link
AA. Environmental citizenry (youth)
BB. Strategies to improve Boksburg Lake
CC. Identity with Boksburg Lake
DD. Increased happiness, commitment, drive
HH. Knowledge on the Boksburg Lake social-ecological problems
II. How knowledge arose (T-shirts, banners as mediators)
JJ. Knowledge on solutions for the Boksburg Lake social-ecological system
KK. Slogans
LL. Lake's role/ vision for the lake
MM. Water focus
NN. Lake deterioration causes/ time frame/ history etc.
OO. Learning mediation: banners, T-shirts etc.

PP. Contextual learning
QQ. Lake day experience
RR. Ideas/ desire for action
SS. Care for lake
TT. Feelings
UU. Hope/ belief it can change
VV. Lake improvement
WW. Actions required
XX. Glad to be part of the solution
YY. Lake observation/ connection
ZZ. Church strategy
AAA. Desire for change/ improvement
BBB. Church actions
CCC. Church theology
DDD. Resources required
EEE. Differs from normal school
FFF. School/ project link
GGG. Church opportunities
HHH. Current church actions (Boksburg)
III. Current church actions (More generalized)
JJJ. Church ideas for action for Boksburg Lake

Appendix H: List of 33 new concepts to emerge in relation to identity, knowledge and agency

Identity

1. Aware that humans cause degradation
2. Empathy towards/ identification/ connection with the lake and her creatures summary
3. General connection
4. Desire to help/ care etc.
5. How Boksburg Lake is perceived
6. People's responses to the lake's degradation
7. Sense of personal responsibility towards Boksburg Lake
8. Vision for Boksburg lake
9. Values attached to Boksburg Lake
10. Identity in relation to the world/ general identity
11. How they see themselves relating to/ want to relate to the lake
12. A strong sense of collective agency/ working together to bring about change
13. Generative mechanisms

Knowledge

14. Knowledge of the risk/ problem
15. Knowledge of causes of the problems
16. Knowledge linked to action
17. General learning
18. History
19. Knowledge from experience of the lake
20. Knowledge that people can make a difference
21. Value of nature
22. Water quality
23. Lake improvement
24. Extent of learning
25. How to improve learning
26. General improvements

Agency

27. Knowing/ belief that Boksburg Lake can change
28. Belief that one can be part of the solution
29. Desire to be involved in the change/ be part of the solution
30. Intended/ desired actions
31. Power of collective agency
32. Actual action – linked to knowledge
33. Generative mechanisms

Appendix I: Article submitted to the *Boksburg Advertiser* about the clean-up day held on 14 May 2012

Boksburg Lake Clean-up Day a Success

The clear sunny weather on the morning of 14 May boded well for the success of the clean-up which had earlier been postponed due to rainy weather. About 100 Boksburg residents participated, the majority being learners from Witfield and St Michael's Primary schools. A big thank you is extended to these schools for their enthusiastic support. The event was also supported by the Boksburg historical association, local churches and of course committed members of the general public.

Before lunchtime a municipal skip was almost filled with litter collected from the area around the amphitheatre and the north eastern shore of the lake. The skip as well as the refuse bags were supplied by the Ekurhuleni Metro. Unilever kindly donated refreshments whilst Kimberly Clarke provided gloves to ensure that the litter could be collected safely.

Not only was the event successful in terms of the litter collected, but equally as important in the public visibly showing commitment to maintaining the environment around the Lake, in sending the message that the litter should really not be there in the first place and in reclaiming the lake area for the general public. Apart from all of the above there was a general consensus that the morning was a lot of fun.

One of the next Major events planned is the Boksburg Lake day in September. In line with the objectives of the clean–up day it is hoped to make the event more inclusive this year by inviting the participation of a wide range of organizations, whilst still retaining the focus on learners from local schools. Part of this will be be to include floats in the march around the Lake with prizes for the most attractive or impactful. Commerce and industry, the Ekurhuleni Metro, schools, religious communities and schools are encouraged to participate in entering floats. This will not only be in support of a worthy environmental cause, but could also be an excellent marketing opportunity.

Appendix L: Full list of themes from which the analytical statements were derived in chapter 7

1. Learners had a very enjoyable experience on the day.
2. Learning about the history of the lake has been a powerful activity eliciting a desire for a transformation of the system.
3. Learning about the history has provided a reference point, where the learners realize what the lake can be like and their culpability in it's present condition.
4. Learners have expressed considerable leadership, passion, enthusiasm and action in relation to being involved in transforming Boksburg Lake.
5. The youth want to be involved in change.
6. The youth respond enthusiastically to opportunities to being involved in change.
7. The youth can be powerful agents of change.
8. Learners have adopted an identity of being change agents for Boksburg Lake.
9. Litter is highlighted as the main problem for many learners.
10. The initiative has inspired many learners to stop littering.
11. Teachers' motivation affects learners.
12. People in power, such as teachers, can create structures in which learners can act for change.
13. A community of practice has developed around transforming Boksburg Lake.
14. People's enthusiasm is contagious.
15. An external catalyst can be a powerful agent of change.
16. Particular individuals play significant roles in whether change happens or not.
17. Individuals/ agents can considerably change momentum and the initiative's trajectory through their participation or withdrawal.
18. Members of faith communities played key roles in the initiative.
19. Structures constrain or enable particular possibilities.
20. Individuals play a key role in an initiative's success.
21. Learning can be powerful when it is relevant and related to one's local context.
22. Learning happens through participation in real world events.
23. Different ways of learning reinforce each other.
24. The youth teaching the youth can be a powerful means of learning.
25. Learners expressed compassion/ identification/ empathy for Boksburg Lake.
26. Learners respond emotively to knowing that animals are being negatively affected and this can change their practices.
27. Learners have become very aware that the lake has changed from a previously valued placed to its degraded state.
28. The initiative shows the importance of creating spaces for people to act, especially learners. When learners were given an opportunity to take initiative, show leadership etc. some really flourished.

29. A strong sense of a collective identity in transforming the lake emerged.
30. The youth believe that change can happen.
31. Learners show a desire to change their actions when they realize their culpability.
32. There are strong collective memories of Boksburg Lake's past social value.
33. Learners realize their dependency on nature and this affects their identity in relation to it.
34. Boksburg Lake is connected to the identity of local people.
35. Role players have expressed much vision and commitment in seeing the lake restored.
36. There is an impoverishment of green spaces in Boksburg and some youth crave such spaces.
37. There is power for change in collective identity and action.
38. The lake is perceived as both a degraded and smelly place that expresses death as well as a green space that brings all the associated benefits of fresh air, peace, quietness and biodiversity.
39. The lake acts as a mirror for learners of more global environmental risk.
40. Learners realize their culpability in the lake's deterioration.
41. Learners' knowledge was mostly focused on the empirical, rather than the real (critical realism).
42. There are strong emotional responses to the lake's degradation, the predominant one being sadness/ heartbreak.
43. A primary way learners expressed connection to Bokburg Lake was through the animals that live there and are affected by its condition.
44. Knowledge related to animals was a key means to realize the effect of litter and prompt a desire for change.
45. Learning about the history of the lake, how healthy and valued it was, as well as the current negative impact on animals provide two powerful moments of identifying. Identifying with the way the lake used to be; their culpability in the present condition; and the consequent harm done to animals, fuels a desire to see positive transformation.
46. Learners want to relate to the lake through attitudes of care and compassion.
47. Some learners related to the lake in an attitude of oneness and belonging.
48. Learners from Reiger Park High collectively expressed the strongest identity with Boksburg Lake and engaged in the most meaningful actions, being true agents of change.
49. There has been some significant change in some individual's behaviour and school practices/ structures.
50. An historical vantage has been especially powerful as it provides a reference point to compare the present social-ecological system with that of the past and carries a lot of emotive value.
51. There has been a strong emotional response to this change.

52. There is knowledge that the lake has serious social and ecological problems.
53. The lake of the past is closely linked to the identity of the Boksburg community and is remembered as having high recreational and social value.
54. Littering is the most commonly cited cause of problems at the lake.
55. The link is made between littering and the impact on animals – this is the main reason it is seen as a problem.
56. Learners expressed a strong emotional response to the lake's degradation.
57. Learners recognize that the attitudes and values (people don't care) of people cause problems at the lake.
58. Learners recognize that polluting water through a variety of sources causes problems at Boksburg Lake.
59. Addressing the litter problem was cited the most frequently as the way to address the lake's problem.
60. There is recognition of the power of a historical reference point.
61. There are strong collective memories of Boksburg Lake.
62. The dominant values was dependency on the earth.
63. The lake is valued as a place worthy to receive affective emotion/ worthy to be loved, respected and treated the way humans should be treated.
64. Nature is valued because of its emotional benefit.
65. Nature is seen to hold much more than utilitarian values.
66. Spiritual values are given to nature.
67. Historically the lake is seen in a very positive light.
68. The lake is valued for its recreational potential.
69. Learners are aware that the lake's poor condition is caused by human beings.
70. Human's implication in the lake's degradation points to their responsibility for global environmental degradation.
71. Ideas for the vision of the future is drawn upon by ideas of the past.
72. There is a strong desire to see the lake changed.
73. There is a clear belief that the situation at Boksburg Lake can change for the better.
74. There is a belief that human beings can find the solution.
75. Learners believe that they can be part of the change.
76. A strong sense that we need to take action now and that the change lies with 'us'.
77. There is a strong realization of the culpability of human beings in Environmental degradation.
78. Littering, realising its wrong and that individual practices need to change, was one of the most dominant themes to come out of data.
79. One of the main things that children do differently is not to litter.
80. Although litter is a big learning area and a point of change, it is also a very entrenched habit and hard to break.
81. There are strong emotional responses to the lake's degradation.