STAKEHOLDER MEANINGS AND ROBUSTNESS IN SOCIAL-ECOLOGICAL SYSTEMS: IMPLICATIONS FOR MANAGING CHANGE

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Abstract

Alignment of stakeholder behaviour with policies and rules is a key concern where natural resources are managed in the public interest. This thesis is based on the premise that behaviours are founded upon meanings as meanings direct stakeholder preferences for resource benefits. I developed a framework representing a social-ecological system and drew on the theories of symbolic interactionism and ecosystem services to illustrate the dynamic relationship between meaning, context, behaviour, perception of benefits and public infrastructure (policies). I propose that by incorporating meanings into the design of institutions, public infrastructure will continually reflect adjustments in meaning reordering in relation to the meanings of the collective to promote supportive stakeholder behaviour and enhancing system robustness during times of slow as well as rapid, disruptive change. The validity of the framework was tested using a case study from Tokai, South Africa. An interpretive and post-normal paradigm provided the foundation for the detection of stakeholder meanings brought to the fore by semi-structured narrative interviews. Computer aided software and a combination of inductive and deductive analysis were used to generate themes and expressions to illustrate the construction and evolution of meanings during two distinctive phases in the social-ecological history of Tokai.

Using the framework to interpret results I was able to illustrate how meanings and meaning prioritisation influence the perception of benefits and how these aspects direct behaviours. The findings indicated the importance of procedural and distributive justice in the negotiated design of public infrastructure and I was able to illustrate the implications for sustaining system robustness. The framework was helpful as a model to interpret the dynamic relationship between meanings, behaviours and institutional design but additional frameworks were needed to facilitate the construction of scenarios that incorporate vulnerability of robustness as reflected by varying levels of relational connectedness and relational capital during cycles of change. I suggest incorporating relational connectedness together with attention to meanings as an approach to fostering relational capital that is likely to direct behaviours to align more constructively with the meanings of the collective, and the associated public infrastructure.

My research exposes opportunities for further inquiry: (1) Deeper insights into the relationship between meanings, collective identity and behaviours; (2) Understanding the influence of organisational culture on the adaptive management of collective identity and (3) Greater understanding of how these theoretical aspects should be applied in the practice of adaptive management and governance.

Declaration of Originality

The work described in this thesis was carried out in the School of Agricultural, Earth and Environmental Sciences, University of KwaZulu-Natal (UKZN), Pietermaritzburg, from January 2007 to December 2014, under the supervision of Professor Charles Breen, and under the co-supervision of Professor Wayne Freimund, Department of Society and Conservation, The University of Montana.

These studies represent original work by the author and have not otherwise been submitted in any form for any degree or diploma to any tertiary institution. Where use has been made of the work of others it is duly acknowledged in the text.

I, Ernita van Wyk, declare that

1.   The research reported in this thesis, except where otherwise indicated, is my original research.

2.   This thesis has not been submitted for any degree or examination at any other university.

3.   This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.

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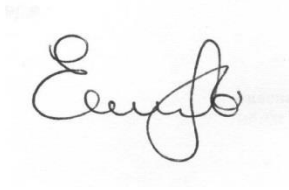Signed on this day the 16th of March 2015:

Ernita van Wyk

Declaration – Publications and manuscripts

1. **van Wyk E, Breen C and Freimund W (2014)** Meanings and robustness: propositions for enhancing benefit sharing in social-ecological systems. *International Journal of the Commons* 8(2):576-594.

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Abbreviations

MEA   Millennium Ecosystem Assessment

SANBI   South African National Biodiversity Institute

SANParks   South African National Parks

SES   Social-ecological system

TMNP   Table Mountain National Park

CHAPTER 1

INTRODUCTION

"I frequently tramped eight or ten miles through the deepest snow to keep an appointment with a beech-tree, or a yellow birch, or an old acquaintance among the pines." (Thoreau 1854)

Henry David Thoreau, 1817 – 1862 (American poet, philosopher and naturalist)

Thoreau's quote reflects a personal, deep and endearing attachment to a selection of trees of his choice. In this thesis I show that such attachments affect not only the way in which people understand their world but also profoundly influence how people choose to respond to change.

Human well-being depends on the ability to anticipate, adapt to and benefit from change (Walker *et al*. 2004). Imagining the future and leveraging change within the human sphere of influence is an important endeavour for those concerned with promoting sustainable benefits from natural resources. How society engages change and the interventions devised to enhance well-being is determined by our view of change: our view of how ecosystems change and our appreciation of the human interaction with that change.

For much of the 20th century, scholars, practitioners and policy makers based their management approaches on the notion that ecosystems are well understood, that they can be controlled within the bounds of a defined state and that the system can be maximised to deliver predicable harvestable stocks, mostly of single species (Hughes *et al*. 2005; Anderies *et al*. 2006; Folke 2006). This view of ecosystem dynamics and benefit accrual from natural resources is founded upon 'optimal control' techniques which originated from optimisation mathematics. This approach found its way into economics in the early 1900s and into natural resource management by the mid-1900s. It matched a mechanistic view of the world suited to the industrial era of the 19th century and gave rise to a style of management that emphasises technical solutions to issues of natural resource management (Wondolleck & Yaffee 2000; Mangel & Levin 2005). Despite acknowledgement of severe limitations of this model when applied to ecosystems (Begon *et al*. 1990), this theory and its use still maintain traction. This is so, not because it has wide applicability in terms of real-world problems of natural resource management but because of a lack of alternative models, and because it is based on simple mathematical models that are "elegant representations of generalised problems in natural resource management" (Anderies *et al*. 2006; p. 6).

From about the 1960s the long accepted view of ecosystems as being stable and behaving in a deterministic fashion was fundamentally challenged (Wondolleck & Yaffee 2000; Folke 2006). The change in thinking was driven by a number of factors. Firstly, a growing appreciation of ecosystems as being dynamic, characterised by complex interactions and thresholds with multiple possible future outcomes and inherent uncertainties, emerged (Holling 2001; Hughes *et al*. 2005; Mangel & Levin 2005). This view was founded upon population-level experiments that exposed multiple 'stable' states and the conditions under which a system moves from one state to another. This work demonstrated the transient behaviour of ecosystems that are not near equilibrium, challenging the assumption that ecosystems always attain, and then maintain, a

stable equilibrium state and that resource harvest can be maximized and sustained at that state (Folke 2006). According to the new paradigm, ecosystems are understood to be non-linear in behaviour, complex, linked multi-scaled systems that exist in alternative stable states in perpetual adaptive cycles of growth, accumulation, restructuring and renewal (Holling 2001; Gunderson & Holling 2002). Changes to or in these systems may come in the form of incremental change or rapid, shock-like disturbances.

Secondly, over the last few decades it has become increasingly apparent that humans are dominant agents in ecosystem change and that escalating human demands on ecosystem services lead to challenges in equitable and sustainable resource allocation and benefit sharing (Folke 2006; Nkhata *et al.* 2012). In the new paradigm (also known as 'resilience thinking') ecosystems and human behaviour are understood to be coupled, with the economic, ecological and social systems each responding to the other over time with interactions, feedbacks and multi-scale effects (Holling 2001; Gunderson & Holling 2002). The new framework for interpreting change encouraged scholars to start integrating social theory into studies of social-ecological systems and to interrogate the usefulness of applying resilience heuristics to social systems (Patterson & Williams 1998; Redman *et al.* 2004; Folke 2006; Davidson 2010; Cote & Nightingale 2012).

The need for a new way of thinking about the dynamics of ecosystems and resource use was also driven by insights from resource management. Practitioners found that they were frustrated in attempts to address issues that are difficult or impossible to resolve using conventional technical approaches. They were challenged by so-called 'wicked problems', characterised by recurrence, complexity, uncertainty and a host of seemingly contradictory views, each of which has legitimacy from a particular perspective (Ludwig 2001; Lach *et al.* 2005; Walker & Salt 2006; Jentoft & Chuenpagdee 2009; McCool 2009). Central to these acknowledgements is the realisation that natural resource issues cannot be separated from issues of human meanings and values, equity and social justice (Funtovicz & Ravetz 1993; Ludwig 2001).

The popular idea of the 'balance of nature' is thus revised by one that acknowledges variability, surprises and societal values in coupled systems of nature and society. For some, these insights have led to a shift from a policy of control of ecosystems to a policy of coping and adaptation within the context of dynamic social-ecological systems (Rogers *et al.* 2000; Folke 2006). The emergent frame for understanding change has also led to the development of a variety of novel types of institutions, such as co-operative governance, co-management and benefit-sharing arrangements, intended to organise society in ways to better cope with change in social-ecological systems (Folke *et al.* 2005; Plummer 2009; Lockwood *et al.* 2010; Nkhata *et al.* 2012).

Because of a new focus on multi-level and decentralised control in the management of social-ecological systems, recognition of the potential for communities to self-organise and to influence change at the level of use has been much emphasised in research (Dietz *et al.* 2003; Pretty 2003; Ostrom 2007; Berkes 2010). Change implies that the ecosystem state does not stay the same, but varies over space and time; if the state changes so do the resource-related costs and benefits each individual experiences according to personal circumstances and preferences. Therefore, implicit in the concept of change is each person's ability to anticipate and manage the consequences of change. It is this ongoing, dynamic balancing of costs and benefits across a

diverse set of user preferences that motivates us to seek to influence the direction and trajectory of change. While sustaining a direction and trajectory of change commonly involves technical intervention, setting the direction and trajectory and gaining support for change, is a social process involving intentional choices based on the expected outcomes of trade-offs among those affected. And, because of the complex nature of social-ecological systems that are under the influence of forces of change of which we may have little knowledge or control, we are challenged by uncertainty. Even when we do set the direction and trajectory there must be continual adjustments to accommodate change.

This understanding informs us that when we deliberately set a direction for change we will alter the distribution of costs and benefits among stakeholders. In so doing we may arouse the ire of some and receive enthusiastic support from others. What is it that underlies such responses? How should we prepare when consideration is being given to set a new direction? How can we "design change when trouble and contradictions become evident in cultural settings?" (Roth & Lee 2007; p. 188). In addition stakeholders are often-times required to respond to an intervention as a collective, even though we acknowledge that personal preferences for the direction of change may vary as users imagine future costs and benefits accruing to them. This points to the need to emphasise not only how each stakeholder interprets how the change might affect them, but also how each person imagines the change to affect the cost and benefit re-distribution for others. Appreciating not only one's own possible future trajectory but also those of others implies particular skills, for example the ability to 'disconnect' and 'suspend' one's own attachments, to engage without personal preferences prohibiting one from listening to, and taking account of, the preferences and interpretations of others (Senge *et al*. 2005).

The development of this thesis was inspired by the need to understand fundamental motivations for stakeholder behaviours that vary from support to resistance or withdrawal when faced with the prospect of change in the distribution of resource costs and benefits (Spaeder 2005). This theme is of particular interest given that it is typically assumed that stakeholders will align behaviours with new policies, rules and technical interventions that drive change towards a new ecosystem state and we are surprised when they do not. Abel *et al*. (1998; p. 86) state that: "fundamental transitions in understanding are psychologically painful, often jerky, reluctant and perhaps never made." Why is this? Traditional responses to promoting supportive stakeholder behaviours have been primarily technical and expert-driven (Cowling *et al*. 2008; Stirling *et al*. 2007), and focused on educating users (Miller & Hobbs 2002; Bremner & Park 2007; Holmes *et al*. 2012) and much less on understanding why people take or maintain the positions they do. In this study the purpose of the inquiry was to investigate fundamental motivations underpinning human behaviour, supportive or otherwise, in the context of change interventions which alter the resource cost- and benefit distribution among stakeholders. The intention was to generate a greater understanding of these factors and to provide insights to management agencies, in particular, given the need for agencies to retain consistency, reliability and social acceptability ('robustness') during times of rapid or transformational change.

In the following chapter (Chapter 2) I present research propositions and develop a theoretical and conceptual foundation for interpreting behaviours in terms of user meanings, perceived benefits and context, and the institutional arrangements whereby these aspects can be reflected upon and ordered. Following the development of a conceptual foundation, research objectives are defined. In Chapter 3 I present a case example from South Africa (Tokai, Cape Town) and

describe the historical and contemporary setting for field research and data collection. In Chapter 4 the methods and underlying methodological philosophies are outlined, while in Chapter 5 I present the results of the study in a temporal-longitudinal fashion. In Chapter 6 I discuss the results of the study by drawing on models of adaptive change and collective identity. I then draw conclusions and discuss opportunities for future research.

CHAPTER 2

MEANINGS AND ROBUSTNESS: PROPOSITIONS FOR ENHANCING BENEFIT SHARING IN SOCIAL-ECOLOGICAL SYSTEMS

2.1   Introduction

It is widely acknowledged that equity and sustainability are important goals in natural resource management (Smith & McDonough 2001; Brock & Carpenter 2007). Behaviours are indicative of how users perceive equity and sustainability as they realise what and how much they stand to benefit, or not, from the allocation and distribution of benefits. As demands for benefits grow, benefit sharing is increasingly characterized by complex trade-offs among beneficiaries (Rodríguez *et al.* 2006; Janssen & Anderies 2007; Nkhata *et al.* 2012). As pressures grow and competition between potential beneficiaries intensifies, it is common for users to challenge the rules and decisions that underpin benefit-sharing schemes. An important issue in the management of these situations is that contestation and even supportive behaviours appear at times to be difficult to anticipate, recognise and understand. An appreciation of factors that underpin behaviours is therefore important for the management of benefit-sharing schemes, particularly during times of transformational change. The better we are able to understand the determinants of behaviour, the greater the prospect for designing benefit-sharing schemes that encourage support rather than contestation. I acknowledge that the motivations for contestation of the rules that direct benefit allocation may originate from a variety of sources. In this chapter I emphasise two issues and offer propositions to enhance our ability to appreciate and direct behaviours in a social-ecological system in which users and decision makers are concerned with sustaining equity and supportive behaviours when change introduces new rules and a redistribution of benefits (Annexure 1).

The first and most fundamental proposition is concerned with how users value the resource. I argue that perceptions of the value of benefits are an important factor underlying persistent contestation of, or support for the rules that direct the redistribution of costs and benefits. The valuing of natural resources has traditionally been considered from an economic perspective (De Groot *et al.* 2012). A problem with economic analysis (i.e. the allocation of scarce resources amongst competing ends) in a benefit-sharing context is that it assumes collective agreement on benefits or 'desirable ends'. This is because economic approaches are primarily concerned with quantifying the conversion of ecosystems to economic products and less concerned with the manner in which users perceive benefits and agree upon baskets of benefits (Farley 2012). A related issue is that non-material benefits, which are not easily measurable in economic terms, tend to be under-valued in attempts to illustrate the economic value of ecosystem services to human wellbeing (Daniel *et al.* 2012; Tengberg *et al.* 2012). In this chapter I argue that value allocation is fundamentally shaped by meaning and context, and that when users assign positive meaning to an ecosystem service, that service is perceived to be a human benefit. I also suggest that attention to meanings offers insights into why individuals take the positions they do when supporting or resisting the rules that govern benefit-sharing schemes.

The second proposition is that social-ecological systems (SESs) with benefit-sharing schemes in which the rules and outcomes are continually contested, are less able to maintain social acceptability, and so become less reliable in the face of change. I propose that robustness (the maintenance of desirable elements) in SESs can be advanced through the collective design of rules that promote and reflect an understanding of meanings and their ordering within defined contexts; and that this may lead to resource users making behavioural adjustments that are in greater accordance with the rules. I argue that the regulatory instruments (policies) should be an outcome of how resource users collectively reflect on the meanings associated with ecosystem services, the supply and demand for and ultimately the distribution of those services.

In this chapter, I use an SES framework proposed by Anderies *et al.* (2004), expanding it to advance an understanding of the role of benefits, meanings and behaviours as elements that qualify the relationship between the resource, resource users and regulatory instruments. I use insights around meanings as a way of valuing natural resources, as a basis for a novel proposition in relation to collective institutional design in SESs. I discuss the implications for robustness and benefit sharing in SESs and comment on the conceptual advantages and anticipated limitations of the framework. Finally I consider potential challenges for testing the framework.

2.2 Perceptions of resource value: meanings, benefits and behaviour

The Millennium Ecosystem Assessment (MEA) (2003) and related scholarly works on ecosystem services have made significant conceptual advances in describing and quantifying benefit streams that explicitly link ecosystems and human wellbeing. Although a diversity of approaches is emerging, there is agreement that the manner in which users allocate value to resources and benefits is an important consideration when striving for equity, sustainability and efficiency in sharing benefits (Lockwood 1999; De Groot *et al.* 2002; Boyd & Banzaf 2007; Wallace 2007; Fisher & Turner 2008). But these scholarly works have focused predominantly on the expert classification of ecosystem services for the purpose of economic comparison. They have not addressed the manner in which users assign value to natural resources, how users perceive the benefits that flow from them or how these aspects are incorporated into decision-making.

Some scholars have proposed meaning as an element that fundamentally determines behavioural response (Stedman 2003; Davenport & Anderson 2005) and more generally as a way whereby people make sense of their world. This school of thought is based on the premise that human society is characterised by the use of meanings, or symbolic abstractions that denote significance to those who hold the meaning (Colton 1987). Scholars from the field of symbolic interactionism (rooted in sociology and social psychology), such as Mead (1934), Blumer (1969) and Greider & Garkovich (1994), provide foundational principles for the relationship between meanings and behaviour. Human beings act towards things on the basis of the positive or negative meanings assigned to those things. 'Things' can include physical objects, landscapes, other human beings, categories of human beings (e.g. community activists, eco-fascists), institutions, and ideals (e.g. integrity or independence) as well as processes, activities and situations. For example, actors can assign meaning to any ecosystem element or service, whether it is classified as an abiotic input, an intermediate (process-oriented) or final service, or some combination of these (Boyd & Banzaf 2007; Fisher & Turner 2008). The point I wish to

convey is that, from a behavioural perspective, the allocation of meaning to any process (such as participation or decision-making) or ecosystem aspect will lead to a perception of that 'thing' as a benefit (positive meaning), or a perception that benefits are reduced (negative meaning), and that this will influence behaviour.

Meanings are held personally but are socially constructed, arising out of social interactions. Behaviour is not seen to be imposed by, and is not the product or outflow of social structures. Although meanings are understood to emanate from structures, i.e. the values, norms and cultures by which people define themselves (Saegert & Winkel 1990), behaviour is rather seen as conduct which is formed as actors handle and modify meanings as they encounter different situations or contexts (Blumer 1969; Smagorinsky 2001). This perspective places deliberate emphasis on human volition and negotiation in the construction of meanings (Benzies & Allen 2001).

Because meanings are assigned, people and landscapes ('things') do not have inherent meaning. Rather, biophysical settings together with personal-social aspects specific to a situation give rise to context and provide the foundations upon which meanings are formed (Mishler 1979; Terkenli 2001; Gobster *et al*. 2007). This interpretation is similar to that of geographers who define 'place' to mean 'biophysical space imbued with meaning' (Tuan 1993; Vanclay 2008). Thus the construction and priority ordering of meanings is context-dependent, influenced by situational aspects which are themselves in part socially constructed. Through this process, landscapes and landscape attributes become the material manifestation of a system of meanings (Greider & Garkovich 1994). Robinson & Smith-Lovin (1992) state that "once an object becomes a symbolic representation of meaning for a person, it becomes important to maintain that meaning in order to sustain a coherent, cohesive view of the world" (p. 14). But meanings are also dynamic, expressive of the interaction between natural and cultural forces and therefore change over time (Zube, 1987; Antrop 2005). Being rooted in values and beliefs, meanings have a persistence that gives them long-term continuity (Greider & Garkovich 1994). Scholarly works on 'place attachment' illustrate how meanings and context become tightly bound such that place attachment tends to be persistent over time (Williams *et al*. 1992; Kaltenborn 1997; Davenport & Anderson 2005; Manzo & Perkins 2006; Walker & Ryan 2008).

Shore (1991) and Greider & Garkovich (1994) suggest that categories of shared meaning may emerge. One landscape or landscape aspect may embody multiple meanings that can be grouped together due to being shared by others in the same setting (Kyle *et al*. 2005; Bjerkli 2010). Meanings convey significance in two ways. One component conveys distinctiveness, where one meaning is said to contrast with another, held either by the same person or held by others. The second component is concerned with the strength of the meaning held. When meanings are held strongly, they will prompt behaviours that give expression to that meaning and will serve to reinforce that meaning to be significant. When a group of people share the same meaning strongly, they may engage in collective action as a way of reinforcing the significance of their shared meaning, especially when that meaning, or set of shared meanings, is threatened by other meanings. If a proposed change conflicts with meaning, an actor may adjust, or reorder meanings in response to learning about the new context, or about meanings held by others, and may then support the change. Alternatively, actors may insist on the priority position of their meaning and contest the change. Because different actors may hold different sets of meanings in relation to the same thing, a proposed change may evoke support from some and resistance from

others. "Communities of shared meaning compete for what meanings will be assigned to a specific place or resource." (Williams & Patterson 1996; p. 512). Resource users therefore compete for which meanings will be assigned and given priority because those prioritisations will subsequently be reflected in the regulatory instruments (policies) and therefore also in the allocation of benefits.

From this perspective, the way in which a benefit is perceived can only be fully appreciated by recognising the manner in which meaning is constructed. For example, a forester earns an income (a benefit) from timber harvesting. For that person, the meaning of the plantation may be commodity, dependence and/or purposeful engagement associated with silvicultural practices, timber harvesting and sales. For a recreationist (e.g. hiker with dogs), the same plantation provides gains such as health through exercise and fresh air and the opportunity to express aesthetic and recreational values. For this person, sense of place (intimacy with the landscape) and scenic beauty, and perhaps to a lesser degree, purposeful engagement, may be more prominent meanings. So as users encounter different situations (contexts) they interrogate a range of meanings to associate with that context and then rank them according to the benefits they can derive. If we take this view, then we can appreciate that within a defined landscape benefits are perceived and ordered according to meanings, and that when landscape attributes change, people respond not only to the change in benefits but also, and more fundamentally, to the meanings they may associate with the benefit (Hunziker *et al.* 2008). Another confounding factor in attempts to manage the sharing of benefits is that, in general, benefits are more substitutable than meanings because meanings are rooted in values whereas benefits are not directly associated with values. Also, some meanings may be more easily substitutable by changing landscape attributes than others. The comfort provided by a shade tree when removed can be replaced over time by a fast-growing tree species. But for those who attach heritage meaning to a tree, a replacement tree cannot invoke heritage meaning. Meanings are the fundamental drivers of the demand for benefits. As a consequence, actors will strive to sustain landscape attributes that provide the benefits that hold significant meaning to them.

I do not wish to suggest that the notion of meanings is the only concept that can explain behaviour in a shared resource scenario. For example, some scholars have emphasized the values-attitudes framework for explaining planned action (Ajzen & Fishbein 1980; Manfredo *et al.* 2003), while others have focused on mental models in shaping human understanding and behaviour (Abel *et al.* 1998; Zaksek & Arvai 2004). These models of behaviour tend to be deterministic in relation to behaviours and do not explicitly address non-material values. In contrast, a meaning-oriented approach deals with material and non-material values and exposes the complexity inherent in how people perceive and allocate value in association with benefits, showing that meanings are personal, sometimes overlapping, context dependent and therefore variable across space and time (Smagorinsky 2001). Attention to meaning helps to explain why decisions that result in change invite both resistance and support. It also suggests that the popular concept of a benefit, or gain, is more fundamentally underpinned by the notion of meaning. If users perceive benefits through the allocation of meaning, then greater appreciation of meaning is necessary in order to understand the behaviours that underpin benefit sharing. Lastly, this approach provides a basis for value allocation which incorporates material as well as non-material value in relation to natural resources. I further wish to explore the incorporation of

the concepts of meaning, benefit and behaviour into ideas on institutional design to expose opportunities for enhancing stakeholder support for benefit sharing schemes.

2.3 Robustness in social-ecological systems

For this thesis I wish to emphasise the dynamic relationship in SESs between the resource, meanings, behaviours and institutional design. I draw on a definition by Janssen *et al*. (2007), who define an SES as composed of interacting biophysical and social components where (1) individuals have purposefully invested time and effort in developing and maintaining infrastructure that affects decision-making and patterns of resource use and distribution among stakeholders as they cope with diverse disturbances, and where (2) these biophysical and social components are embedded in a network of relationships among smaller and larger components. This interpretation emphasises the point that humans design some parts of the SES, for example, the social processes and rules that guide and constrain human action, whilst other parts of the system are self-organising, such as social networks and behaviours.

The SES framework proposed by Anderies *et al*. (2004) is a useful starting point to develop propositions about the relationships among resource users, and between resource users and the resource, and how these relationships relate to the regulatory infrastructure set up to direct user behaviour. Their framework is a 'minimal representation' of variables and linkages to broadly describe a social-ecological system. In that framework the resource is linked with resource users, public infrastructure providers (rule makers) and public infrastructure (regulatory instruments or institutions e.g. rules, trust, and physical infrastructure). The minimal representation provides opportunities for scholars to expand on elements and relationships of the framework across different natural resource contexts, and to provide more detailed interpretations of subsets of relationships. Various authors have used this framework as a foundation to devise propositions and theories, mainly to develop ideas around vulnerabilities associated with the persistence of certain types of robustness (Anderies *et al*. 2007; Janssen & Anderies 2007; Janssen *et al*. 2007). I use an adaptation of the Anderies *et al*. (2004) SES framework (Fig. 2.1) to emphasise and expand on the relationship between the resource (Fig. 2.1A), resource users (Fig. 2.1B) and the regulatory instruments (Fig. 2.1C) designed to direct behaviours. I then use this interpretation to discuss implications for robustness in social-ecological systems that are also common-pool resources.
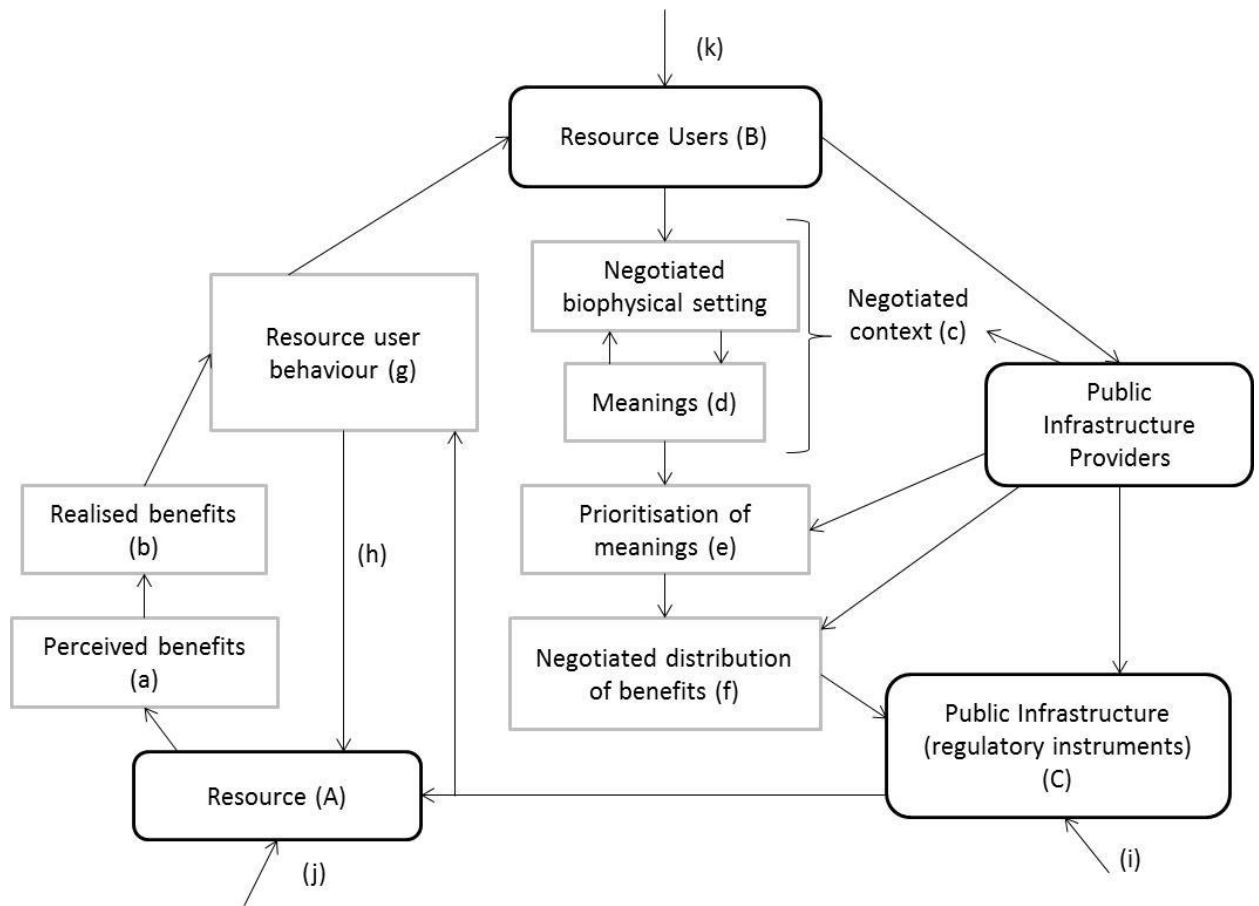
Figure 2.1. A conceptual framework, adapted from Anderies *et al*. (2004), showing resource user behaviour driven by the experience of benefits as well as the regulatory instruments that are designed to reflect a prioritisation of meanings and the negotiated distribution of benefits.

Robustness is widely appreciated as a key concept when thinking about how SESs respond to change (Folke 2006) and the concept is especially useful when wishing to address specific issues of design and decisions in a well-defined system (Anderies *et al*. 2013). Anderies *et al*. (2004) have defined robustness as "the maintenance of some desired system characteristics despite fluctuations in the behaviour of its component parts or its environment." (p. 7). Robustness in an SES therefore refers to the state of a system resulting from the purposeful design of an aspect of the system such that it is consistent and reliable when subjected to change. The manner in which resource users relate to each other and behave in relation to the resource strongly influences the robustness of a social-ecological system (Van der Leeuw & Aschan-Leygonie 2000). This is because coping with the uncertainties inherent in complex systems and making trade-offs among users requires on-going design of the formal and informal institutions that regulate behaviour, and individual and collective commitment to these institutions. I argue that benefits are perceived as a consequence of the context and meanings users allocate to the resource. Furthermore, I suggest that user behaviour is driven by the expectation of (Fig. 2.1a), and by the actual experience of, benefits (Fig. 2.1b) as they relate to the constructed contexts (Fig. 2.1c) and meanings (Fig. 2.1d) associated with the resource (Fig 2.1A). In addition, behaviour is influenced by the perception of fairness of the process (Fig.

2.1f) or 'procedural justice', leading up to the formation of public infrastructure (Fig 2.1C) that determine rights of use and the distribution of benefits ('distributive justice').

The intention of the collective procedure to design the regulatory instruments is to facilitate shared understandings among users who have assigned different contexts and meanings to the benefits that emanate from the resource. This shared understanding is necessary to promote the negotiation and priority ordering of meanings (Fig. 2.1e) to achieve collective action, because commonly not all meanings can be accommodated nor can the necessary contexts for those meanings be created or sustained. Implied in this is that ordering meanings also serves to define the preferred contexts. During this process, stakeholders may be encouraged to accept that their meanings have been assigned a lower priority in the collective reordering of meanings, but would still behave in ways that are supportive of the rules that govern resource use. Once meanings are articulated and ordered fairly (Fig. 2.1e), and the distribution of benefits (who gets what) affirmed (Fig. 2.1f), it is possible to design the formal and informal institutions (Fig. 2.1C) that will regulate behaviours to align with prioritised contexts and meanings (Fig. 2.1e). Legitimate resource use (Fig. 2.1g) and the accrual of benefits flow from this process, which in turn affects the state of the resource (Fig. 2.1h).

In common-pool resources, ecosystem services and meanings can be diverse and therefore an array of user behaviours can result, which may or may not be compatible (Smith *et al*. 2011). Also, user demands on the resource can change and diversify rapidly. Disturbances may also originate from outside of the system, such as policy changes (Fig. 2.1i), ecosystem fluctuations such as floods or droughts (Fig. 2.1j), or changes in the user group and user demands (Fig. 2.1k) that may initially develop outside of the system (Dietz *et al*. 2003; York & Schoon 2011). The system is therefore dynamic and actors must continually cope with change in order to sustain system robustness. I propose that the fair and collective ordering of meanings and associated rules helps to direct and regulate behaviours, and that in doing so these aspects contribute to robustness. I acknowledge that SESs may be characterised by different types of robustness. In particular, robustness to one type of variability can lead to an SES developing vulnerability to new kinds of disturbances (Janssen *et al*. 2007). However for this thesis my aim is to contribute to an understanding of how meaning prioritisation in a fair and collective process can promote SES robustness as characterised by decisions that receive public support in the face of change.

2.4   Discussion

I argue in this chapter that a major issue for collective design, and one which has not been given attention in scholarly works, is the conceptualisation of the relationship between resource users and the use and benefits perceived in association with the resource. Some scholars emphasise that these factors significantly influence people's willingness to engage in, and their acceptance of and support for land stewardship and conservation initiatives (Le Maitre *et al*. 1997; Manzo & Perkins 2006; Walker & Ryan 2008; Lokocz *et al*. 2011). However these issues have not been well understood as being embedded in a complex system of benefits, meanings assigned by resource users and the instruments designed to direct behaviours. Despite the contribution economic approaches have made to understanding the role of biodiversity in human wellbeing they have yet to find wide public acceptance, particularly because it has proved difficult to acknowledge meanings and incorporate socio-cultural benefits (Appleyard 1979; Williams & Patterson 1996; Oreszczyn & Lane 2000; Philip & MacMillan 2005; Farley 2012).

I propose that the adaptation of the Anderies *et al*. (2004) framework offers several conceptual advances. Firstly, explicit attention to meanings creates opportunities in the institutional design process for resource users to appreciate the fundamental motivations underpinning the different positions adopted by a diverse range of users. This prompts resource users to learn about and appreciate others' meanings alongside their own. It is therefore reasonable to propose that benefit sharing has as much to do with equity in the distribution of costs and benefits as it has to do with recognising a diverse basket of meanings, across contexts and scales, that determine how people perceive benefits. I contend that in situations where meanings are contested, conventional expert-analytical approaches to decision-making such as risk and cost-benefit analyses would, on their own, most likely not garner public support. This is because they are not set up to expose and take account of meanings and the complex relationship between meanings and the perception of benefits. Rather, they are designed to simplify and aggregate elements of interest as defined by experts (Stirling *et al*. 2007).

Secondly, the ordering of meanings is necessary in the design process for the sanctioning of meaning prioritisations among stakeholders. An appreciation of a diverse basket of meanings among resource users encourages the ordering of values and meanings among them such that individual resource users may accept or tolerate a decision to favour a certain set of meanings even though it may not have been their preferred meaning or set of meanings within the particular context (Smith & McDonough 2001). The sanctioning of meaning prioritisation among stakeholders promotes a perception of fairness associated with the procedure (procedural justice) designed to arrive at the new rules. In other words, stakeholders assign meaning not only to the resource but also to the collective meaning-ordering process and this influences the level of acceptability users will assign to a benefit-sharing arrangement. Conversely, when meaning re-ordering is not sanctioned, resistance to the regulatory instruments may persist, eroding robustness of the SES.

Thirdly, the framework represents a dynamic social-ecological system. In common-pool resources in particular, the resource typically delivers benefits to a diverse user group. And, new contexts and new meanings may emerge as situations change. I argue that, given the dynamic aspects of the system, it is likely to be more robust if the design process continually and reliably reflects an appreciation, ordering and re-ordering of a range of values and meanings. I acknowledge the risks of proposing single 'solutions' (for example robustness) to issues relating to natural resource governance systems (Ostrom *et al*. 2007). However, given the personal nature and the diversity of meanings and perceived benefits, it may be feasible to place emphasis on users, the meanings they hold, the contexts they prioritise (Wilson *et al*. 2007; Cote & Nightingale 2012), and their influence on the design of the regulatory instruments and sanctioning of behaviours.

In this chapter I suggest that meanings are exposed when actors participating in the process of negotiating desired contexts are asked to describe motivations associated with certain benefits. Those meanings may have more influence and explanatory power related to user behaviour than the resource benefits, or policies, or management actions that are being discussed. I further assert that indicators of meaning such as symbols and emotions can be expressed verbally (Kaltenborn 1997). It has been suggested that some sets of meanings are more common and have more expressive power such that some classes of meanings may be easier to study than others (Lockwood 1999; McCool 2001). While 'meaning' may be difficult to measure since

meanings are held individually and personally, I propose that interview questions or prompts that elicit responses from resource users that are expressive of meanings or sets of meanings, can be developed.

2.5   Research propositions and objectives

The overall research objective was to illustrate the role of meaning in the management of change that results in the re-distribution of resource costs and benefits among stakeholders. Despite the prominence of ecosystem services and benefits in emerging dialogue around natural resources and human wellbeing (Vaccaro & Norman 2008; Dickie *et al*. 2014), few scholars have interrogated the relationship between meanings and benefits as expressed by users. I argue that meanings are fundamental to how stakeholders (including and in particular, users) perceive benefits and behave as a result.

2.5.1   Research objective 1

Do users distinguish between meanings and benefits when responding to change in the landscape? Can users express a range of meanings with sufficient clarity for meanings to be a useful concept in research as well as in dialogue towards managing change? The first aim of this study was to elicit stakeholder meanings, benefits and related behaviours in relation to past as well as new resource attributes and distribution of benefits. The objective was to develop insights around the relationships between variables suggested in Fig 2.1 and to explore potential challenges associated with stakeholder ability to express meanings.

2.5.2   Research objective 2

The framework (Fig. 2.1) suggests the importance of the process of collective ordering of meanings and values and that this process influences the level of stakeholder support for decisions and policies. Does the perception of this process influence stakeholder behaviour? The second research objective was to gather and describe a range of stakeholder behaviours associated with public engagement and with the change process more generally. Finally I intended to draw conclusions about how agency-led dialogue with stakeholders could be improved with knowledge of meaning ordering and procedural justice when a change in the distribution of benefits, is proposed.

2.6   Summary

In this chapter, I developed a conceptual framework for behaviours in relation to shared natural resources. The framework is based on the notion that meanings, perception of benefits and context fundamentally shape behaviours. I furthermore proposed that changes in policy (public infrastructure), with associated implications for benefit accrual, would tend to encourage stakeholders to reflect upon and re-order their meanings, or to maintain their meaning prioritisation and resist the change. I developed research propositions structured around the intention to test the role of meanings and benefits in shaping behaviours and to explore the role of institutional arrangements in the ordering and re-ordering of stakeholder meanings.

CHAPTER 3

CASE STUDY - TOKAI

3.1   Introduction

The purpose of Chapter 3 is to describe a suitable empirical scenario with which to test the research propositions outlined in Chapter 2. Eliciting expressions of meanings, benefits and behaviours and associated contexts implies the need for interviews (generating qualitative data) within the context of a case study selected for this purpose. The rationale for qualitative research and the use of a single case approach are discussed in detail in Chapter 4.

The choice of case study had to satisfy certain criteria based on the research objectives. The case study had to:

- Present an example of change in resource benefit distribution, which could be traced from before the change, during and possibly after the change, to illustrate how stakeholders motivate support for or resistance to a change intervention. In addition, the change had to draw a mix of responses (preferably a wide range, including supportive and resistance responses) from stakeholders.
- Offer opportunities to elicit stakeholder expressions of meanings, benefits and behaviours in relation to the relevant resource (past, present and future) as well as elicit responses in relation to the change process, from a sufficient sample of willing stakeholders.
- Reflect an historical time frame that is possible to research and which enables the gathering of information on meanings constructed over a period of time before the change intervention. This information would be necessary to gain insight into the development and persistent nature of meanings that tend to underpin resistance to change and allow for critique of the concept of robustness in the context of meanings, benefits and behaviours.
- Facilitate the generation of insights that can be applied to other situations.

Landscape change in Tokai, Cape Town, prompted me to explore this as a potentially suitable case study to test the conceptual framework presented in Chapter 2. The permanent removal of 600 ha of pine plantations since 2005 has drawn support from some and resistance from others as exemplified by the following communications in a local newspaper:

"Urban people require woody shade and barrier plants to soften their homes and neighbourhoods. Today the mix of non-indigenous and other South African trees and shrubs make Cape Town the desirable city it has become. Without its non-indigenous woody plants Cape Town would be a hot dusty and wind-swept hell – with the south-easter in summer and the north-wester in winter making life most unpleasant. Unfortunately we have lost almost all our sand plain lowland Fynbos areas. By removing the plantations some people argue that they can return these areas to a low, scratchy, grey-green shrubland full of interesting and intriguing plants that, to thrive, will need to be burnt from time to time by hot fires, ideally in extreme

weather conditions. So we are felling the pines to create, in my opinion, a wasteland." (Cape Times, February 2011).

"Although only a few areas have been burnt to date some 328 indigenous plants species of Cape Flats Sand Fynbos and 131 Peninsula Granite Fynbos species have been recorded. By any standards this is a spectacular tally made even more impressive by the 26 threatened IUCN Red List species found in the Cape Flats Sand Fynbos section. [This area] is the last opportunity to conserve Cape Flats Sand Fynbos as a viable ecosystem." And "A perfectly acceptable compromise would be to plant shade trees within 5 minutes' drive of the [restoration] area. This will provide shaded landscapes without compromising threatened Fynbos. Those who want shade can have shade. And South Africa can fulfil its legal obligation as a signatory to the Convention on Biological Diversity to protect 17 per cent of terrestrial areas and to restore at least 15 per cent of degraded areas." (Cape Times, March 2011).

3.2 Introduction to the Tokai area

Tokai is an area of land situated in the Constantia Valley on the eastern slopes of Constantiaberg (meaning Constantia Mountain) on the Cape Peninsula in the Western Cape Province of South Africa (Plate 3.1). Tokai includes a portion of mountain extending into the lowlands, or valley floor, and falls within the bounds of the Table Mountain National Park as well as the City of Cape Town. The Cape Town City municipal boundary encompasses an area of 2 460 km^2. The city's population is estimated at 3.7 million and growing at a rate of 55 000 people per year (Holmes *et al*. 2012).

Plate 3.1. A view (December 2003) from a fire lookout point onto Tokai plantation forest (dark green trees) which extended from the mountain and into the lowlands Photo: with kind permission from Chris Botes, Tokai plantation manager 1993 to 2012.

The Table Mountain National Park (TMNP) was established in 1998, amalgamating 25 000 ha of land on the Cape Peninsula previously under separate management by a number of different agencies and with insufficient coordination between them (www.sanparks.co.za). The TMNP falls entirely within the municipal bounds of the City of Cape Town (Fig. 3.1). TMNP is an open-access park, except for three points of entry where access and entry fees are managed. Access to Tokai Forest and Park is free to hikers but activities such as dog walking, mountain biking and horse riding require an 'activity card' for which membership carries an annual fee. Table Mountain National Park is the most visited of all of South Africa's national parks (about 4.2 million visits annually). The Cape Peninsula (and TMNP) is situated within the Cape Floristic Region, which reflects high levels of botanical richness and endemism (Rebelo *et al.* 2011).
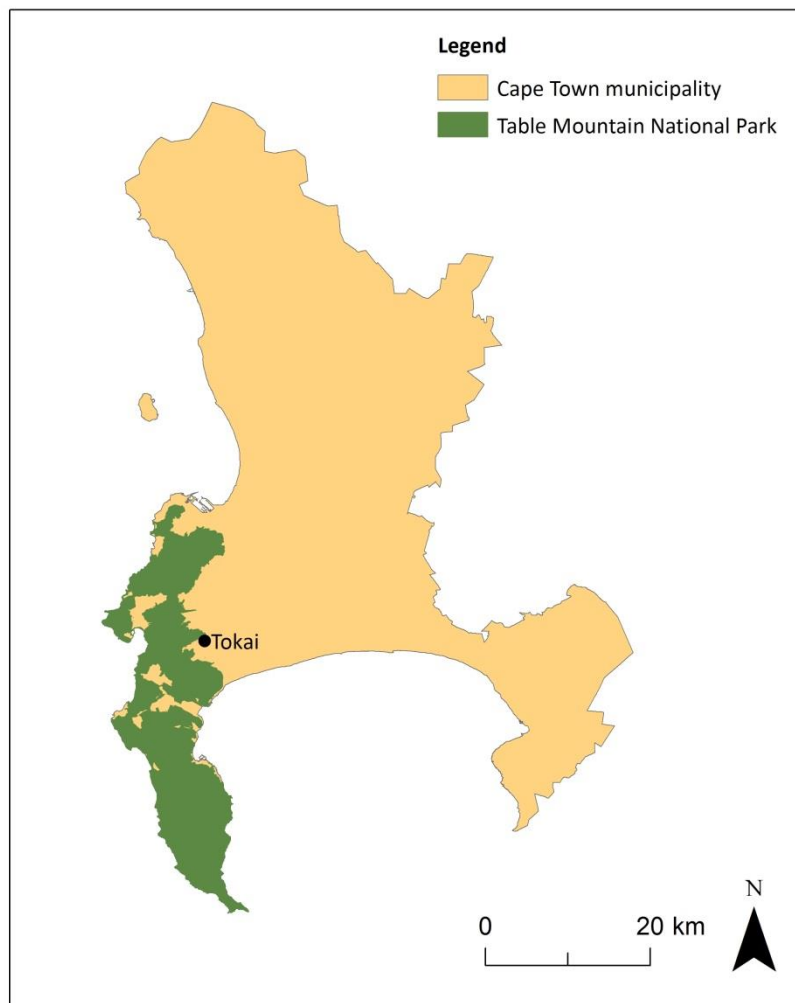
Fig 3.1. Map showing the locality of Tokai relative to the Table Mountain National Park within the municipal bounds of the City of Cape Town. (Map credit: Ms Haylee Kaplan, SANBI.)

The relatively recent decision to permanently remove the pine plantations from Tokai prompted exchanges in the popular press in relation to the change. This observation encouraged me to explore the situation in Tokai as a potential case study. Plantation forests (mainly *Pinus* species)

were established in the late 1800s at Tokai. The extensive planting of conifers for timber production created a large area of shaded landscape. Whilst these forests primarily supported a timber-producing concern, the plantation landscape was also available for recreation, especially during the latter part of the 1900s. The shaded areas included slopes and level areas in the valley which drew different types of recreationists. Tokai also became popular because, for urban residents, it allowed access to an extensive recreation area without having to travel too far. Policy changes described later in this chapter, resulted in the recently initiated (2005) and currently ongoing permanent conversion from plantation forest to open (without shade) native heathland.

Plate 3.2. A Google Earth image of the Tokai plantation in April 2014 (Sourced: 2 August 2014). The dark patches are remaining plantations. Pale-coloured blocks indicate where plantations have been permanently removed.

The decision underpinning this transformation has some support but is strongly resisted by others. For this study, I purposefully situate the current issue (simultaneous support and resistance to landscape change) in an historical context. The aim was to explore how the evolution of user experiences over time, contributed to how meanings were constructed, developed and reinforced. The following sections provide an account of the historical Tokai landscape and events leading up to the present.

3.3   The Tokai landscape prior to afforestation

Giliomee & Mbenga (2007) and Anderson & O'Farrell (2012) can be referred to for a complete discussion of the pre-colonial people of the Cape and the use of natural resources in the area prior to European settlement. However, because of the current policies and actions towards restoring pine plantation areas to native Fynbos (heathland) vegetation, it is pertinent to this study to describe the native vegetation that would have been present in the area before new land

uses were brought to the Tokai area during colonial times. Current understanding of what vegetation would probably have occurred there comes from various sources. William Purcell compiled a comprehensive plant species list from the farm neighbouring Tokai, 'Bergvliet', from 1915 to 1919 and this is used to inform current vegetation restoration efforts (Hitchcock *et al*. 2012). Attempts are currently being made to document a more comprehensive collection of historical information on the cultural and ecosystem characteristics of the Tokai area. Historical evidence suggests that pockets of afromontane forests would have been present but confined to the valleys by fires (Anderson & O'Farrell 2012), and that the rest would have been Fynbos (heathland) with substantial populations of 'kreupelhout' pincushions, i.e., *Leucospermum conocarpodendrum* (Plates 3.3 and 3.4).

Plate 3.3 (left) and 3.4 (right): The green subspecies of *Leucospermum conocarpodendrum*, or tree pincushion, a tree-like shrub 3-5 m tall is said to have been a dominant species in the Tokai area. (Photo: Alice Notten, SANBI, Kirstenbosch National Botanical Gardens)

Silver trees (*Leucadendron argenteum*) also occurred in the area, and the remains of silver tree forests were still visible and their presence recorded in 1883 (Plates 3.5 and 3.6). Under the instruction of the Superintendent of Forestry and Woods, Count de Vasselot De Regne, the silver tree forests were earmarked for future protection but these trees were destroyed by the time the Tokai Forest Station was established (Berta van Rooyen, historian; pers. comm.). These observations are confirmed in a letter written in 1913 to Parliament by Hendrik Cloete, who farmed in the area (Alphen Farm): "Before the afforestation took place on the slopes of Table Mountain there were silver trees, proteas and much indigenous undergrowth…" (Cloete 1913).

Plate 3.5 (left) and 3.6 (right). Indigenous silver trees (*Leucadendron argenteum*) in Table Mountain National Park. (Photos: Ernita van Wyk)

3.4 The pre-forestry colonial Tokai landscape

The Dutch East Indian Company (VOC) was the world's most prominent trading enterprise by the 1650s. Their trade was predominantly in black pepper but also included cloves, nutmeg, cinnamon and mace. To procure these products, the Dutch had to travel the seas to the Far East. Although Portuguese sailors were among the earliest to navigate successfully around the southern tip of Africa in 1486 (Bartholomew Diaz) and again in 1497 (Vasco da Gama), the Dutch followed between 1595 and 1597 and saw an opportunity to establish a halfway station between Europe and the Far East so that sailors could get fresh water, fruits and vegetables at the Cape. In 1652 ninety Dutch settlers arrived by ship and built a fort called Good Hope and established vegetable gardens near the settlement. As the settlement at the Cape expanded, the Company (VOC) established farms and orchards further south of the original settlement (in what is today the Rondebosch area; about 7 km, about 5 miles, from the original settlement) and allocated farm land to selected company employees in the same area (Giliomee & Mbenga 2007).

The Tokai area, located further south, about 23 km (about 15 miles) from the original Cape settlement, was initially (around 1792) allocated as grazing lands to prominent officials of the Cape under Dutch rule. As this land became subdivided and sold off to various new land owners, the farms of the Tokai area became a varied matrix of diverse agricultural land uses, alongside the simultaneous development of forestry in the area in the latter half of the 1800s and into the 1900s. Dairy, poultry and pig farming, vegetables and vineyards were substantial ventures at the time and from around the 1880s farmers developed extensive avocado and almond orchards. Tokai also had a reformatory for young boys (Porter School), who from their land also contributed to the agricultural produce of the area. An aspect that is prominent, both

implied and explicit, in the historical material is that Tokai represented a peaceful rural lifestyle, an 'escape', in contrast to life in the centre of the City of Cape Town (Kavanagh 1963; Mauve undated). As plantation forestry in the area was expanded into the 1900s this land use became increasingly prominent in Tokai.

3.5   The history of plantation forestry in Tokai

3.5.1   European settlement: 1652 to the early 1900s

Since Dutch settlers landed in the Cape in 1652, they drew their timber supplies from the pockets of local indigenous forests. The use of this resource was not strictly regulated and by the time the Cape was ceded to Britain in 1806, the indigenous forests were largely denuded (King 1938). As a consequence, over the next fifty years the Governor at the Cape shut down all forest cutting in the Western and Southern Cape and appointed various officials in charge of forest conservation and specifically to devise strategies for more responsible harvesting of the indigenous forest resource. As part of these efforts Joseph Storr Lister, drawn from the British Forest Service in India, was appointed in 1875 in the post of Chief Conservator of Forests for the Cape Colony. He recognised a need to supplement indigenous wood supplies with faster-growing exotic plantations and in 1883 established the Tokai plantation (planting mainly *Pinus radiata*) which was managed on a 40-year rotation (King 1938). The introduction of pine trees to South Africa reflected a global trend of the time whereby a large variety of tree species were imported, for ornament and for commercial purposes, to parts of the world newly colonised by European settlers (Dickie *et al*. 2014).

Plate 3.7. A 1935 map of the Tokai plantation. The early 1900s was an era of plantation forest expansion in Tokai as well as elsewhere in South Africa. With kind permission from Chris Botes, plantation manager, Tokai, from 1993 to 2012.

Plate 3.8. Manager of Tokai plantation 1932-1958, H.G. (Geoffrey) Good, next to a *Pinus radiata* tree in compartment B24. With kind permission from Peter Good.

Plate 3.9. Tree-cutting in Tokai, 1948. With kind permission from Peter Good.

At the time of its most extensive distribution, the Tokai plantation covered 610 hectares. During the early days, much work in the plantation forests was done using horses and mules. Mules were used extensively during this time to extract timber to the roadside, to cart wagons and, to a lesser extent, to open fire breaks. Forestry staff used horses to visit various working teams in the plantation and to patrol the plantation to monitor illegal harvesting of forest products or wild flowers. Later on, horses were also used for recreation in the plantation forest. During the winter months the Cape Hunt Club hosted drag hunts in the plantation. *"These hunts were popular and many people used to turn up to watch them. There were quite a number of riders and also lots of hounds to smell-out and chase the drag. And the Department would erect jumps for the horses at several points, always in the fire belts."* (Peter Good pers. comm.).

Plate 3.10. Timber extraction with mules, Tokai 1948. With kind permission from Peter Good.

Plate 3.11. The Cape Hunt and Polo Club Opening Meet in Tokai Forest, May 1954. With kind permission from Peter Good.

Tokai plantation yielded the first large sale (64 905 British pounds) of South African grown pine timber after the First World War. This substantial commercial gain sparked much interest in plantation forestry and the government at the time decided to expand forest plantations around the country. Since then, the Tokai plantations have continued to produce several thousand cubic meters of good quality timber annually (Chris Botes pers. comm.).

Plate 3.12 (left) and 3.13 (right). Timber products (left: *Eucalyptus* logs and right: pine logs) from Tokai during the 1960s. With kind permission from Piet van Zyl, Tokai plantation manager 1982-1994.

The Tokai forest includes an arboretum, an area for the cultivation of trees and shrubs, both local and exotic in origin. The arboretum was established by Lister in 1885 and was declared a National Monument, a century later, in August 1985 (Mauve undated). Lister also established the first Forest School in the country in Tokai in 1906 for "the training of men for the higher grades of the forest service" such that there would be a cohort of foresters and managers to manage forests into the future (King 1938; p. 10).

Plate 3.14. South African School of Forestry, Tokai, 1910. Photo: with kind permission from Chris Botes.

3.5.2   Evolution of public use of plantation forests

From the beginning of plantation forestry in South Africa (during the late 1800s and early 1900s) some public access to State forests was allowed (Bigalke 1983; Olivier 2009). Even during these early days, the meanings allocated to the introduced trees were not entirely (though primarily) commercial production, but also included meanings around ornament, shade and education, and to add variation to what were considered at times to be monotonous treeless landscapes (King 1938). The Tokai arboretum, for example, was established as a collection of living woody plants initially for educational and scientific purposes for students of forestry. In later years the arboretum also became a popular educational destination for school groups and, in addition, became valued for its shade and tranquillity and as a result, became a popular picnic spot.

Historical publications indicate that recreation had always been allowed in State forests although in various forms and intensities. Prior to 1960, private individuals were allowed to enter State forests for recreational purposes with a permit from any forest office, with the exception of members of the Mountain Club of South Africa who were allowed to enter State forests without a permit, as long as they were able to show their Mountain Club membership

card. During this time few people entered plantation forests for purely recreational purposes. Most visitors, mainly researchers, entered for special purposes such as butterfly collection. At a few plantations (including Tokai, Bain's Kloof and Cederberg in the Western Cape) public picnic spots and camp-sites were established and maintained (Olivier 2009). This policy remained unchanged until the 1970s, when Danie Ackerman, Chief Director of Silvicultural Services at the time, issued instructions that the public should be encouraged to visit the large tracts of State land (both afforested as well as unplanted areas) under the jurisdiction of the Department of Forestry. He felt that it was their right as tax-paying citizens, but also because he anticipated that nature lovers would assist the Department with wildlife observations. With this in mind, he established the Division of Conservation and Outdoor Recreation and instated legislative amendments that made provision for a network of hiking trails. Picnic and visitor facilities were upgraded and new hiking trails were established on Forestry Department land around the country (Olivier 2009). Since then, recreational use of plantation landscapes has grown with increased economic growth and urbanisation (Bigalke 1983). The Tokai plantation was well visited from the time of Ackerman (Olivier 2009) and by the 1980s the main recreation activities were picnicking, mushroom foraging (during the winter months), walking and horse-riding, including drag hunts (Piet van Zyl pers. comm.). Later on dog-walking, mountain biking and trail running became prominent activities in the forest. Initially mountain bikers were allowed to ride only on the service roads but later on they were allowed to ride amongst the plantation trees. Tokai forest was also a popular venue for hosting outdoor art classes and on occasion television advertisements have been filmed here (Piet van Zyl pers. comm).

Plate 3.15 *Boletus edulis*, or porcini mushrooms (left). Plate 3.16 (right) *Lactarius deliciosus,* pine rings (right). Photos with kind permission from Nicky Allsopp, Annalie Melin and Jonathan Colville (SANBI).

Plate 3.17 (left) Cars being parked by runners arriving for the annual 15 km Forest Run in the Tokai Forest (2012). Plate 3.18 (right). Horse-riders on the pathway between the plantation and the Fynbos (heathland) being restored, 2012. (Photos: Ernita van Wyk.)

3.5.3   Plantation forestry under pressure

Plantation forestry has come under pressure more recently despite an acknowledgement of forestry's positive contributions to the economic and other sectors (Richardson 1998; De Wit *et al*. 2001; Van Wilgen & Richardson 2012). This pressure is due to the impacts of invasion by woody alien plant species, such as disproportionate water use and displacing indigenous vegetation. Of special concern are pine species that self-seed prolifically beyond managed plantations. *Pinus radiata* can invade native Fynbos, forest gaps and grasslands (Henderson 2001). For these reasons, *Pinus radiata,* native to south-western North America, is listed in South African legislation governing the assessment, control and monitoring of invasive species (National Environmental Management of Biodiversity Act 2004). According to this legislation, the species is permitted as managed plantations and wind-rows. National heritage or monument trees of this species are not listed and, particularly relevant to this study, specimens with a diameter greater than 400 mm at a height of 1000 mm, are permitted in the urban areas of Cape Town. In all other areas of the Western Cape and anywhere in a riparian area, the trees must be removed. The issue for conservation is that, despite this legislation and efforts to manage pines outside of plantations, all indications are that they spread faster than the current efforts to control them (Richardson 1998; Van Wilgen & Richardson 2012). Biological control has been tested as a possible solution for slowing the spread of these trees outside of plantations, but the forestry industry has cautiously decided to not implement this option because of the possible opportunity created by the biological control for encouraging pine pitch canker, a problematic pathogen in pine forests (Hoffmann *et al*. 2011). Another policy decision that is important for this study is forestry's initiative to phase plantation forestry out of areas where economic returns are marginal. This and other policy changes are discussed in more detail in the next section.

3.6   Recent changes: policy and land management of Tokai

Following a century of expansion, the Ministry of Agriculture, Forestry and Fisheries made a decision in 1999 to phase out commercial plantations on the Cape Peninsula. This forms part of a national Forestry 'exit' programme whereby plantations that are commercially non-viable are being withdrawn from all forested areas of the Western and Southern Cape. In most cases the intention is for land to be transferred to appropriate conservation authorities with the aim of

rehabilitating the vegetation to a 'natural' state. In line with this strategy, South African National Parks (SANParks) was assigned the management (and phasing out) of Tokai plantation as part of the Table Mountain National Park during April of 2005. TMNP is responsible for managing the 'exit lease' or contract whereby a forestry company [MTO Forestry (Pty) Ltd.] has been given the right to harvest 600 ha of plantations over a 20-year period (SANParks 2009). Because the Tokai forest has now been brought under conservation management, the rehabilitation of endangered Fynbos (in particular sand plain Fynbos in the lower-lying areas) and the phasing out of non-indigenous plantation trees will form a major part of the landscape transformation. In line with these landscape changes, what used to be 'Tokai Forest' (currently a mix of growing Fynbos and shrinking pine plantation) has been renamed 'Tokai Park'. These changes would bring to an end Tokai's 122-year association with plantation forestry.

In a working plantation some blocks of trees are always being felled while others are being planted. In the case of Tokai, following on from the policy decision of 1999 to withdraw forestry, normal rotational felling continued but no more pine tree seedlings were planted from 2004. The confirmation of forestry's withdrawal from Tokai was affirmed by the 'exit lease' agreement between SANParks and MTO Forestry which came into effect on 1 April 2005 (Chris Botes pers. comm.).

Once selected blocks of pine trees were felled, these areas were burnt to stimulate Fynbos regeneration from seed banks that had remained dormant in the soil. While this process was being initiated, vegetation specialists outside of SANParks who were aware of the uniqueness of and pressure on lowland Fynbos types recognised the opportunity for a more comprehensive lowland Fynbos restoration project in Tokai. These specialists had produced scientific publications to substantiate their claims that whilst mountain Fynbos areas are well protected, the lowland Fynbos areas, with distinctive flora, are particularly under threat due to transformation by agriculture and urban sprawl (Rebelo *et al.* 2011; Holmes *et al.* 2012). They collaborated with staff of the South African National Biodiversity Institute's Threatened Plant Programme and proposed, to SANParks, a plant restoration project for Tokai that would involve active planting (i.e. the re-introduction of rare and threatened plant species into their areas of origin and that were hitherto conserved in nurseries, botanical gardens and as seed banks). In addition, the vegetation recovery and lessons learnt would be carefully documented. There had been attempts to implement such projects in other lowland Fynbos remnants within the City of Cape Town but those had had varying degrees of success (Anthony Hitchcock, SANBI pers comm.). The Tokai area presented an additional opportunity since the area is large compared to other fragments of lowland Fynbos within the City bounds. Tokai also had the advantage of being situated on land that had been brought under formal conservation (i.e. SANParks) management and was therefore thought to be under less threat of transformation by urban development (Anthony Hitchcock, SANBI pers comm.). The participating organisations welcomed the proposal, because if implemented, it would serve national and City of Cape Town targets to conserve and restore rare vegetation types, notably the target of 13% for lowlands conservation (Rouget *et al.* 2004; Holmes *et al.* 2012). The proposed restoration plan, if implemented, would also give effect to a requirement set by Target 8 of the Global Strategy for Plant Conservation (2012) that 20% of threatened plant species be available for recovery and restoration programmes (Global Strategy for Plant Conservation 2010; Anthony Hitchcock pers. comm).
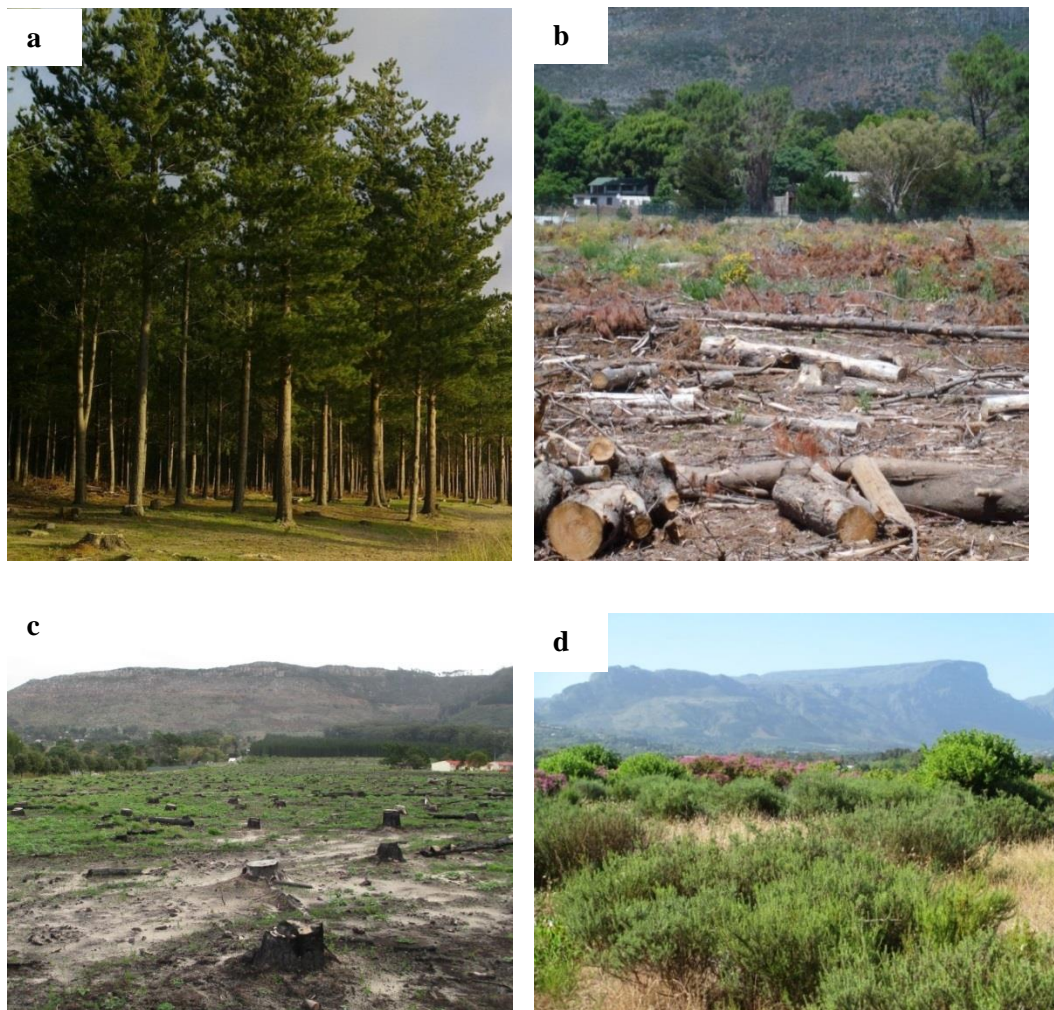
Plate 3.19 (a-d): illustrates the Tokai landscape change from pine plantation (a) to slash after felling (b), burnt slash (c) and emerging native vegetation (d). Some heathland species grow from a seed bank in the soil whilst others are replanted from seeds and cuttings after the burn and before the winter rain (Hitchcock *et al*. 2012). Photos: Claudia and Ernita van Wyk.

3.7 Resistance to landscape change in Tokai

A media release dated March 2003 presents a contrast to the plans and events as described above. In this media statement (Kasrils 2003), the Minister of Water Affairs and Forestry at the time, Ronnie Kasrils, stated a vision of outcomes that does not accord with the plans released in 2009 (SANParks 2009). The media statement indicates that all parties had committed to a plan to retain the plantation forests in Tokai and to strike a balance between "conservation, timber production, outdoor recreation and cultural landscape values". According to this Ministerial statement the intention at the time was not to completely remove the plantation forests.

SANParks conducted a public participation process during 2006 to prepare a vision for the Tokai area previously under plantation forest, recognising that the goals of biodiversity conservation, heritage resources, recreation and ecotourism development options must be accommodated within a new management framework for Tokai (SANParks 2009). One objective of the new management framework is to accommodate recreation activities in a

shaded (i.e. wooded) environment, although greatly reduced, as well as open (i.e. Fynbos) environment. The area available for recreation will remain the same as is currently, but the visitor experience will change as plantation forests are removed and alternative shaded areas, and open (un-shaded) areas, are created. It was felt that the current state of the landscape, with the pine trees included, does not allow SANParks to achieve biodiversity conservation targets. From a biodiversity perspective "Tokai represents one of the last opportunities to effectively link ecological processes from the mountain to the lowlands but also is one of the few remaining opportunities to rehabilitate a sustainable area of critically endangered Cape Flats Sand Fynbos." (SANParks 2009; p. 3). At the same time, it was felt that, given the goals of biodiversity restoration, not enough emphasis was placed on providing adequately for heritage aspects and the need for maintaining or enhancing shaded recreation opportunities. SANParks is striving for a compromise between these goals and the intention of the management framework is to reflect this compromise. In the management framework, high-level goals for the four themes (biodiversity, heritage, recreation and eco-tourism) are articulated. With regard to the most cited objection from users about wanting shaded recreation to continue, a major commitment by SANParks is "the continuation and enhancement of current recreational activities without compromising the sustainable rehabilitation of threatened vegetation types" (p. 12). Three strategies have been proposed for accommodating shaded recreation. Firstly, small pockets of native Afromontane forests will be restored. Secondly, new shade routes will be established that link already shaded areas along existing tree avenues, as continuous shade routes or 'broken' or intermittent shade routes along rivers. Thirdly, 'transition areas' will be established in lower Tokai along the urban edge where replanting pines, Fynbos restoration and burning will be implemented in turn to create temporary shade whilst conserving and promoting the development of the Fynbos soil seed bank. The nature of recreation in the 'transition areas is also likely to change. "As plantation compartments are harvested and rehabilitated [back to Fynbos], footpaths and routes will need to be formalized to minimise impacts on restoring Fynbos" (p. 15).

Despite the public participation process facilitated by SANParks and the decision to promote the protection and restoration of indigenous vegetation types and to provide some shaded walkways, resistance to the decision has persisted. In an August 2010 Parliamentary Meeting of the National Assembly, a number of questions were posed to the Minister of Agriculture, Forestry and Fisheries about the landscape change in Tokai. Questions were centred around the processes followed to secure public support for the decision and specifically why stakeholder concerns had not been adequately addressed before as well as after the commencement of permanent tree felling. Formal responses to the questions posed to the Minister were prepared by vegetation specialists involved in the Tokai lowlands Fynbos restoration project and (SANParks pers. comm. 2014) such that any arguments for future landscape options other than removing the plantations permanently were not presented. When asked about the possible reversal of the decision, the response was that legally binding contractual agreements are in place to remove the pine plantations and that it would not be desirable to revisit the decision (South African National Department of Agriculture, Forestry and Fisheries 2010). These sentiments were affirmed by Table Mountain National Park (TMNP) management in a letter to the press in April 2011 (SANParks 2011).

Objections to the plan to permanently remove the pine trees came from a number of stakeholders of Tokai forest. Apart from a desire to protect Tokai as a heritage landscape as one of the oldest plantations in the country, the plantations had been enjoyed by recreationists for a hundred years. One of the most often mentioned objections from stakeholders, as judged from press articles on the issue, is that the replacement of plantation trees with Fynbos vegetation would remove shade, thereby limiting shaded recreation in this landscape.

Plate 3.20. An insert into the Cape Times Newspaper of March 2011 indicating resistance to the permanent felling of plantation trees.

Plate 3.21. Remaining pine plantations (on the right) contrasts with the Fynbos heathland (on the left) as different contexts for recreation. (Photo: Ernita van Wyk).

In a formal response to the proposed SANParks framework, a lobby group 'Shout for Shade' indicated two major concerns. The first is that they felt that the proposed area under permanent shade is not sufficient to sustain a quality shaded recreation/relaxation experience for visitors. In their report (Hewitson *et al*. 2012) they make specific recommendations with maps and figures and propose a more extensive parkscape area for permanent shaded recreation in Tokai, but also propose to retain areas for Fynbos restoration. The second concern is around the use of fire in relation to the desirable success of the Fynbos restoration project. Fynbos needs to burn at certain frequencies and intensities in order to regenerate and remain or, in this case, to become viable. Due to risk of damage to people and property, implementing prescribed burns that are ecologically optimal, is not always feasible in an urban setting (Forsyth & Van Wilgen 2008; Van Wilgen *et al*. 2012). As a result, some have questioned the feasibility of the Fynbos restoration project in Tokai.

The main events leading up to the recent policy change and associated stakeholder response, are summarised in Table 3.1. The Table Mountain National Park management plan revision is currently under way (2014) and this means that the Tokai Management Framework, which is a lower level, subsidiary 'site plan' to the overall TMNP park-level management plan, may be revised, with public input, during 2015 (SANParks staff pers. comm.).

Table 3.1. The main historical events leading up to the transformation of the Tokai landscape from plantation forests to open heathland (Fynbos).

Date	Event
1652	Dutch settlers arrived and established at the Cape
1792	Dutch agriculture and settlements expanded and reached Tokai
1883	Pine plantations (*Pinus* species) established at Tokai
1906	First South African Forestry School established at Tokai
1970s	Department of Forestry policy adjusted to promote recreation in State forests
1998	Table Mountain National Park established
1999	Government decision to phase out commercial forestry on the Cape Peninsula
2003	Government (Kasrils) media statement affirming that the Tokai plantation forest will remain.
2005	Management of Tokai transferred from the Department of Forestry to SANParks
2006	SANParks conducted a public participation process for Tokai
2009	SANParks releases Tokai Management Framework

3.8   Suitability of Tokai as a case study

The Tokai case study satisfied the criteria as set out at the beginning of this Chapter. Because of the wide range of recreational and other activities in Tokai the situation offered a diversity of meanings, contexts and benefits to interrogate. The Tokai case also offered a change intervention, i.e., policy that promoted a conversion of shaded plantation forests to open heathland, which garnered both support and resistance. A large collection of expressions in the popular press about the change indicated that both those supporting and resisting strongly held onto their motivations for support or resistance. This information also showed that, despite efforts facilitated by the management agency to create awareness and gain public support, the change has not enjoyed wide stakeholder support. Many users with a long association with Tokai (for some, 40 years) still live in the area and were willing and accessible for interviews to

discuss what the Tokai landscape had meant to them over the years. Many stakeholders indicated that they were eager to participate in the research process, to present their views of the change and of the process that was conducted to incorporate public views and why they held these views.

The plantation forest history at Tokai and, in particular, the forest policy with regard to public use of plantations over time, are recorded in a number of published books and papers and I was thus able to draw on this material in addition to interviews. Both historical factual information and stakeholder narratives were important sources of information necessary in order to portray the co-evolution and role of meanings in promoting robustness in SESs. Official documents of Government and of the land management agencies involved were also available and easy to access. More generally, the Tokai case in addition reflects tensions inherent in attempts to reconcile urban recreation needs with native biodiversity appreciation in an urban setting (Miller & Hobbs 2002; Miller 2005; Dickie *et al*. 2014). The case was also considered potentially illustrative of the conceptual relationships between meanings, benefits and behaviours that could be applied in contexts other than just urban situations. The Tokai case study was also convenient in that the issue of stakeholder resistance to change was current at the time the study interviews were conducted.

3.9   Summary

In this chapter I described the attributes of the Tokai case study, with emphasis on the long history of plantation forestry in the area, the recent land use change brought about by policy and the simultaneous support and resistance prompted by the change. I also reflected on and discussed the suitability of the chosen case study in the context of the research objectives defined in Chapter 2. In the next chapter I present the methodology and approach to analysis.

CHAPTER 4

METHODOLOGY AND APPROACH TO ANALYSIS

4.1   Theoretical framework

4.1.1   The research paradigm

Numerous scholars highlight the lack of connection between recognising social-ecological problems and the actions that are taken to address them (Walker & Salt 2006; Pahl-Wostl *et al.* 2008). Such scholars assert that this disconnect is not due to an insufficient understanding of the challenge. They claim that the disconnect exists rather because the types of knowledge that science typically generates to solve these problems (i.e. reductionist science in a closed knowledge system) are not designed for promoting fundamental shifts in understanding among the user-scientist-policy-maker group of actors (Hummel 1991; Berkes *et al.* 2000; Folke 2006). Some argue that this dilemma is at least in part embedded in the origins of resource management sciences, which were based on a paradigm of maximising the utility benefits from natural resources. As a consequence, conventional, reduction-based knowledge types, whilst they are valuable in defined and bounded knowledge contexts, are generally not able to support transformative action in relation to problems of social-ecological systems. The development of post-normal scientific methodologies and paradigms is a response to such problems of knowledge generation. Post-normal science acknowledges that issues inherent in the social-ecological environment are characterised by high levels of uncertainty, where it becomes important to incorporate values, to make values explicit within the extended peer community who stands to gain or lose from the dialogue (Funtowicz & Ravetz 1993; Francis & Goodman 2010), and to allow actors to learn within their social-ecological contexts (Tàbara & Chabay 2013).

This study is situated in a setting in which resource user meanings and patterns of use that have been reinforced over years, are challenged by administrative change. It is a setting in which there can be multiple legitimate perspectives, each of which is associated with its own ordering of meanings and allocation of benefits and, consequently, of responses to proposed change. Given that the chosen case study illustrates that a range of perspectives is legitimate, the situation called for an approach to information generation that is systemic, synthetic and humanistic, (Funtovicz & Ravetz 1993). I used a qualitative research approach to gather and analyse data and draw insights using an interpretive frame. A particular motivation for using a qualitative approach is that the purpose of enquiry was to obtain detailed information about phenomena, such as thoughts, feelings and emotions, that are difficult to derive from other research methods (Strauss & Corbin 1998). An interpretive approach assumes that reality is socially constructed and rich in context. The overall goal is to improve understanding, rather than to explain (Hudson & Ozanne 1988). More specifically, an idiographic case study approach (understanding one case study well) was used to uncover the meanings and motivations for behaviours in situations where users expressed support for or opposition to a proposed change in a landscape. The method used is similar to the 'extended case method' (Babbie 2004, p. 293), where the researcher lays out beforehand, as coherently as possible, a theoretical framework, as described in Chapter 2, that guides expectations and the design of empirical data collection. The aim was to seek evidence for the relationships proposed in

Chapter 2, but also to uncover unanticipated findings (Davenport & Anderson 2005). This contrasts with a 'grounded theory' approach, which tries consciously to not rely on the conclusions of previous scholars. I used semi-structured interviews to elicit narrative responses that describe the meanings people hold, the benefits they experience in relation to specific landscape contexts and how they behave as a result.

4.1.2   The narrative approach in qualitative research

The 'narrative' approach to questioning respondents was an attractive consideration for this study because of the explicit attention of this approach to meanings and context expressed in historical sequence. Definitions of narrative as a phenomenon vary with different scientific disciplines, but there is general agreement that, narrative entails imposing a meaningful pattern on what would otherwise be random and disconnected (Riessman 2008). According to Riessman (2008), narrative must accord with the following attributes:

- A narrative must be a personal account;
- Narratives must contain contingent sequences; that is, each event or idea is dependent on foregone events and ideas; therefore narrative demands the consequential linking of events or ideas that have implications for later actions;
- A narrative is always situated within context and involves, for example, specific characters and the particulars of a setting;
- Narrative allows a person to construct meanings, impose temporal and logical order on events and ideas, thereby enabling connection with others;
- Narratives are strategic and purposeful. Individuals, for example, use the narrative form to remember, argue, justify, persuade, engage, entertain, and even mislead an audience. Groups use narrative to mobilize others and to foster a sense of belonging. The descriptive details of the story-teller are selected, deliberately or unconsciously (Strauss & Corbin 1998).

In qualitative inquiry there are various forms of interacting with subjects, such as in-depth interviews, narratives, participant observation and focus groups (DiCicco & Crabtree 2006). According to Mishler (1986), personal narratives are the most internally consistent interpretation of the presently understood past, the experienced present and the anticipated future. Narrative is a mode through which individuals express their understanding of events and experiences. A great variety of materials are appropriate for generating data for narrative analysis, for example, memoir, biography, interviews, conversations, autobiography, diaries, archival documents, folk ballads, photographs and other forms of art. Narrative forms of data are increasingly being used as a tool to analyse complex problems (Browning & Boudès 2005) and to reveal patterns of culture and behaviour that are typically overlooked when using conventional questionnaires (Snowden 2003).

For this study it was important to distinguish between event- and experience-centred narrative research. Both of these approaches assume an individual, internal representation of phenomena to which narrative gives expression. Experience-centred, or 'thematic' narrative research, in contrast to event-based, language-centred research, is based on the assumption that "experience can, through stories, become part of consciousness" (Andrews *et al*. 2008; p. 41). Thus it is defined by theme rather than the structure of the language. Experience-centred narrative research emphasizes that representations of phenomena (solicited

in this study according to appreciation of context, meaning and behaviour) do not remain constant, but will vary over time and across circumstances experienced (Riessman 2008). Andrews *et al.* (2008) define experienced-based narrative by the following attributes:

- Meaning: A participant's representation can be non-story material, such as ideas, theories and descriptions and it can still be considered meaningful. Various materials are appropriate, interviews as well as written works.
- Sense-making: Story telling is about making meaning and therefore all stories contain an aspect of morality and are therefore fundamentally sociological as people use stories to make sense of phenomena within the context of social life. Temporal sequence is less important than emotional sequence as aspects of a narrative.
- Reconstruction: Narrative involves some reconstruction of a story across space and time. Narratives convey experience through reconstructing it; the possibility of multiple and changeable story lines are acknowledged and acceptable. Context is considered important.
- Change: Experience-centred research addresses themes of change.

The oral interview is the most common form of obtaining material for experience-centred narrative analysis. Most experience-centred narrative interviewing is semi-structured (Andrews *et al.* 2008). Although narrative analysis is case-centred its purpose is to generate general concepts, as other case-based methods do. Generalising in narrative analysis takes the form of theoretical and conceptual propositions (Riessman 2008). This approach to generating knowledge accords with the notion of 'idiographic' explanation of a phenomenon in the social sciences, where the intention is to explore causal factors in one case fully (Babbie 2004). Therefore, theoretically, the approach is inductive, where insights from a particular case are used to construct or inform a theory about a general pattern in a social-ecological system.

In this study, for example, there is evidence for the relationship between landscape context, meanings and behaviour. With this I was able to set up a construct that is theoretically defensible. However, the relationships between the concepts are not well understood in a situation that is focused on landscape change. More specifically we do not know how or why the concepts are dynamically connected in situations where actors respond to change. In this study, broad propositions were made based on the theoretical framework (i.e. deduction) and specific questions and observations were designed to generate insights about these propositions. The empirical data gathered through narrative interviews were expected to provide new insights that will inform the initial theoretical framework.

Narrative research provides a data-gathering approach that is highly suited to this study. Its explicit attention to meaning and context (Mishler 1979) are aligned to the major conceptual themes of this study. Although this study does not focus specifically on the sequential aspects of meanings in the analysis, the concepts are inherently sequential, with meaning emerging from experience in a landscape context and actions taking place as a result of meanings held. In addition, respondents were asked to talk about past, current and anticipated (future) contexts and meanings, and in this way connect with the consequential properties of the narrative approach. The narrative technique was used to elicit narrative responses that contain indicators of meanings, benefits, context and behaviours.

4.1.3   Response expectations

Users may prioritise benefits differently based on how they define diverse contexts at the scales of the user experience. So there may be multiple contexts perceived for any landscape or even a patch of forest. The different contexts experienced by the user, in different combinations (mixes) of biophysical patches and services and uses, in turn create conditions for the new services (benefits). Users attach specific meanings to specific biophysical settings, contexts and the associated benefits and this shapes their behaviours.

Context reflects both the biophysical setting and the way people engage the services. Therefore context and users are neither stable nor homogeneous (Pickering 1994; Pfund *et al*. 2011). If the biophysical setting changes, whether through natural forces or through deliberate or non-deliberate intervention, the mix of services (benefits) is altered. Users then engage the services differently and so new contexts emerge. New contexts may also emerge when, for example, preferences change, sometimes as a consequence of access to new technologies such as mountain biking and paragliding. So, when the biophysical setting changes, opportunities to create new contexts and meanings emerge but, importantly, it may not be possible to sustain the contexts and meanings associated with the previous biophysical setting, at all or to the same extent. As a consequence, in the changed landscape, previous meanings and context may receive less priority. The users who preferred to prioritise meanings associated with the previous biophysical setting, services and contexts, may contest the change, or seek alternative biophysical settings or learn to appreciate and adopt (or reprioritize) the new meanings that enjoy higher priority in the altered biophysical setting. Table 4.1 shows in a hypothetical example how, in the same context, meaning prioritisations may differ for different users, potentially leading to tension.

Table 4.1. Users perceive benefits differently and allocate different meanings to the benefits and the context.

Theme	Forester	Hiker	Invasive species manager
Activity/use	Silviculture and timber harvesting	Walking in the forest	Motion to remove plants
Benefit/service	Timber	Recreation	Reduced water resources and displacement of indigenous vegetation
Determinant of well-being or ill-being	To earn income and gain a livelihood.	Health through exercise and fresh air; Opportunity to express aesthetic and recreational values associated with ecosystems.	Threat to ecosystem resilience; increased ecosystem shocks and stresses.
Meaning	Commodity; Dependence; Purposeful engagement	Dependence; Purposeful engagement;	Alien invasive species. Threat to native ecosystems; associated with ecological and economic risk.
Resultant behaviour	Continued activity and applications for plantation expansion.	Continued activity	Application to legally restrict planting and management of spread.

4.1.4 Recognising meanings

One of the challenges of this study, as mentioned briefly in Chapter 2, is creating a system for eliciting meanings and being confident that meanings are being recognised and interpreted correctly. How can the researcher be confident that a piece of text refers to a meaning or set of meanings? Meaning per se is difficult to measure since meanings are held individually and personally. According to Blumer (1969), the social world is essentially made up of acting units, or, the individual. It is the individual who designates and appraises objects or 'things', designates meanings and makes decisions. However, meanings are exposed when actors' intentional states are realized through their participation in the system of meaning negotiation that is inherent in culture. Indicators of meaning such as symbols and emotions can be expressed verbally (Kaltenborn 1997; see Table 4.2) and, according to Strauss & Corbin (1998), respondents are typically reliable in providing good descriptions of their observations and experiences. Meaning thereby achieves a form that is socially situated, i.e., public and communal, rather than private (Bruner 1990). With certain interview techniques it is possible to expose what people think and feel about events and experiences through their representations in verbal and written accounts, as well as other forms of expression.

Table 4.2. A schematic of four dimensions of human systems. Meanings can be elicited through appropriate interpretation when actors participate in the exterior dimensions. Adapted from Maiteny (2000).

	Interior ('in-the-mind')	Exterior ('in-the-context')
Individual	Intention; volition motivation; choice; subjective; invisible; psychological; emotional; experiential.	Individual behaviour and expression; objective; visible; biological; material.
Collective	Shared frameworks of interpretation and meaning; (inter)subjective; invisible; cultural/symbolic; e.g. religious and political ideologies, values, beliefs.	Group expression; effects on context (e.g. of behaviour); (inter)objective; visible; social; ecological; economic; institutional structures; political expression, debate.

A range of literature dealing with meanings was consulted to derive classes of meanings and their descriptions (Table 4.3).

Table 4.3. Fourteen categories of meanings relevant to ecosystem services (nature-based benefits) based on a literature review.

Meaning category/dimension	Interpretation/attributes	References
Identity	Sense of pride, uniqueness, definition, detail and distinctiveness of the landscape: to distinguish self from others. Those dimensions of the self that define the individual's personal identity in relation to the physical environment. The landscape is a means of creating and maintaining one's self and self-esteem. The landscape is also important for creating shared meaning or group identity.	Williams *et al*. (1992) Twigger-Ross & Uzzell (1996) Oreszczyn & Lane (2000) Gustafson (2001)
Dependence	Recreation satisfaction. The potential of a landscape to satisfy the needs and goals of an individual and the assessment of how this landscape compares with other available settings that may satisfy the same set of needs. Self-efficacy: landscape supports lifestyle and effectiveness in goal achievement	Williams *et al*. (1992) Twigger-Ross & Uzzell (1996)
Sustenance	Sustenance – providing a flow of tangible goods and services	Davenport & Anderson (2005)
Sense of community	Community involvement; shared space; friendships, social connections and interactions (formal and informal). Attitudes towards the natural landscape are linked to attachment to community.	Hannam (1997) Gustafson (2001) Beckley (2003) Clarke & Stein (2003) Manzo & Perkins (2006) Walker & Ryan (2008) Lawrence *et al*. (2010)
Links with the past	Link with history, giving a sense of history and humanity being part of the landscape. Links with previous and future generations / family members Having lived in or visited the landscape for a long time, and sometimes across generations. Memories, including childhood memories Nostalgia	Twigger-Ross & Uzzell (1996) Hannam (1997) Kaltenborn (1997) Le Maitre *et al*. (1997) Oreszczyn & Lane (2000) Gustafson (2001) Davenport & Anderson (2005) Manzo (2005)
Contribution to	Diversity, perspective and pattern, visual presence, boundaries creating the unexpected	Dwyer *et al*. (1991)

landscape pattern across time and space	(and the notion of mystery). Changing colours, sounds and scents across seasons.	Oreszczyn & Lane (2000) Gustafson (2001)
Landscape intimacy	Sense of the character of the landscape; Intimacy with landscape features. Depth of direct experience with settings, personal connection. ('sense of place')	Oreszczyn & Lane (2000) Manzo (2003) Brown & Raymond (2007) Lawrence *et al*. (2010)
Therapy	Therapeutic, boosting, pure enjoyment, tonic, healing, restorative, health-giving, beneficial.	Davenport & Anderson (2005). Bratman *et al*. (2012)
Planning, care and management	Association with perceived approach to landscape planning and management	Oreszczyn & Lane (2000) Ryan (2005) Manzo & Perkins (2006) Walker & Ryan (2008)
Wildlife sanctuary	Visual and personal pleasure of seeing wildlife and plants. Returning to nature.	Oreszczyn & Lane (2000) Gustafson (2001) Davenport & Anderson (2005) Ryan (2005) Lawrence *et al*. (2010)
Scenic beauty	Appreciation based on a preference for idealised naturalistic scenery; traditional emphasis on the visual, the dramatic, the picturesque and formal composition of the attributes of nature. Deriving pleasure from the landscape irrespective of its ecological integrity.	Wood (1988) in Gobster (1999) Gobster (1999)
Ecological value	Ecologically significant landscapes (which may be aesthetically ordinary), or perceived beauty in the landscape associated with ecological health, diversity and/or sustainability. The 'ecological aesthetic'.	Le Maitre *et al*. (1997) Gobster (2008)
Commodity	An appreciation of a landscape as a managed production system - for how it may be changed to serve human needs via the production of goods and services.	Le Maitre *et al*. (1997) Gobster (1999) Gobster *et al*. (2007)
Sense of purpose	Engagement in purposeful occupation/activity that provides social, health and spiritual benefit; restores value and purpose to life. Can exercise choice (i.e. have control over ones activities and aspirations). Occupation encompasses doing, being, belonging and becoming.	Hammell (2004)

4.1.5 Recognising benefits

The Millenium Ecosystem Assessment (MEA) framework defines ecosystem services as "the benefits people obtain from ecosystems" (MEA 2003; p. 78). Ecosystems deliver services (i.e. benefits). In an attempt to integrate the notion of 'ecosystem services' into landscape planning and sustainable development, landscape planning scholars use the term 'landscape services' or 'environmental services' (Termorshuizen & Opdam 2009; De Groot *et al*. 2010) and the terms are used synonymously (Hermann *et al*. 2011). The meaning an individual attaches to these services within a defined context determines to a large extent how they select for benefits. But to benefit the individual has to engage, or experience the service, in other words, the user has to engage in one or more activities. So, resource-user behaviours are shaped by the perception an individual has of the available services and the expected associated benefits. As users engage in activities and realise the benefits derived from the services, they interpret how a proposed landscape change would alter ecosystem services and, in particular, how the change would affect the meanings they have prioritised. According to this assessment, the individual may choose to modify the landscape so as to optimise the preferred benefits, those benefits that hold greatest meaning for the individual or group of individuals.

The MEA framework enables us to conceptually link benefits (ecosystem services) to less tangible meanings within a defined landscape context. Ecosystem services have been categorized in a number of ways by various scholars (Millennium Ecosystem Assessment 2003; Hermann *et al*. 2011). For the purposes of this study I draw on the MEA framework to describe services (benefits) (Table 4.4) because it recognizes natural as well as human-modified ecosystems as sources of benefits and because this framework is explicit about tangible and intangible benefits. These elements are in line with this study's aim to describe a range of benefits and to illustrate how changes in vegetation influence the supply of benefits and therefore the associated meanings and behaviour.

Table 4.4. Ecosystem Services (Benefits) Framework (Millennium Ecosystem Assessment 2003).

Provisioning Services *Products obtained from ecosystems*	**Regulating Services** *Benefits obtained from regulation of ecosystem processes*	**Cultural Services** *Nonmaterial benefits obtained from ecosystems*
• Food • Fresh water • Fuelwood • Fiber • Biochemicals • Genetic resources	• Climate regulation • Disease regulation • Water regulation • Water purification • Pollination	• Spiritual and religious • Recreation and ecotourism • Aesthetic • Inspirational • Educational • Sense of place • Cultural heritage
Supporting Services *Services necessary for the production of all other ecosystem services* • Soil formation • Nutrient cycling • Primary production		

One of the challenges when considering the MEA framework was that 'sense of place' had been classified by the MEA as a 'service', but also appears in the literature as a 'meaning'. As a concept, there is little agreement on the interpretation of the term, and where it is clearly defined (Stedman 2003; Lewicka 2011) it is too broad (denoting meanings plus attachment) to describe any one particular meaning or set of meanings. So, depth of direct experience or 'intimacy with the landscape' was chosen from the literature to describe a meaning that is relevant to this study. 'Sense of place' was retained as a type of benefit (Table 4.4). Although the MEA is not expansive in its description of this benefit category, I interpret it to mean a positive meaning and affinity to a certain landscape context as a result of a sense of intimacy and familiarity with the landscape context and features. In Table below I have used the MEA (2003) interpretation with additions from the description of the term 'sense of place' by Stedman (2003). It was useful to refer to Table 4.5 with the more detailed descriptions of services when anticipating the need to interpret text from interview respondents.

Table 4.5. Categories of Ecosystem Services (benefits) and their interpretations, based on the MEA (2003).

Provisioning Services	
Food and fibre	The range of food products derived from plants, animals and microbes, as well as materials such as wood, hemp, silk, cotton.
Fuel	Wood, dung and other biological materials that serve as sources of energy.
Genetic resources	The genes and genetic information used for animal and plant breeding and biotechnology.
Biochemicals, natural medicines and pharmaceuticals	Medicines, biocides, food additives such as alginates and biological materials derived from ecosystems.
Ornamental resources	Animal products such as skins and shells, and flowers are used as ornaments.
Fresh water	Water
Regulating Services	
Air quality maintenance	Ecosystems both contribute chemicals to and extract chemicals from the atmosphere, influencing air quality.
Climate regulation	Ecosystems influence climate locally and globally; at the local scale, for example, changes in land cover can affect temperature and precipitation.
Water regulation	The timing and magnitude of runoff, flooding and aquifer recharge can be strongly influenced by changes in land cover.
Erosion control	Vegetative cover plays an important role in soil retention and the prevention of landslides.
Water purification and waste treatment	Ecosystems can be a source of impurities in freshwater but can also help to filter out and decompose organic wastes introduced into inland water and coastal and marine ecosystems
Regulation of human diseases	Changes in ecosystems can directly change the abundance of human pathogens, such as cholera, and can alter the abundance of disease vectors, such as mosquitoes.
Biological control	Ecosystem changes affect the prevalence of crop and livestock pests and diseases.
Pollination	Ecosystem changes affect the distribution, abundance and effectiveness of pollinators.
Storm protection	The presence of coastal ecosystems such as mangroves and

	coral reefs can dramatically reduce the damage caused by hurricanes or large waves.
Cultural Services	
Cultural diversity	The diversity of ecosystems influences the diversity of cultures.
Spiritual and religious values	Many religions attach spiritual and religious values to ecosystems or their components.
Knowledge systems	Ecosystems influence the types of knowledge systems developed by different cultures.
Educational values	Ecosystems and their components and processes provide the basis for both formal and informal education in many societies.
Inspiration	Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture and advertising.
Aesthetic values	Many people find beauty or aesthetic value in various aspects of ecosystems; for example, a 'scenic drive'.
Social relations	Ecosystems influence the types of social relations that are established in particular cultures; fishing societies, for example, differ in their social relations from nomadic herding or agricultural societies.
Sense of Place	The affinity to a defined ecosystem as a result of a sense of intimacy, recognition and familiarity with the ecosystem and related features.
Cultural heritage	Many societies place high value on the maintenance of historically-important landscapes or culturally-significant species.
Recreation and ecotourism	People often choose where to spend their leisure time based in part on the characteristics of the natural or cultural landscapes in a particular area.

4.2   Data collection

4.2.1   Selecting a sample of interviewees

The aim of the interviews was to gather respondent stories about recent landscape changes in Tokai that indicate a range of meanings, contexts, benefits experienced and behaviours displayed by users of Tokai. The aim was not to capture all possible examples of these themes, but to gather a sufficient range in order to (1) gain greater insight into the dimensions of the themes and (2) better understand the relationship between the concepts and between the concepts and the notion of robustness. To achieve this, my aim was to interview users across a range of activity types, on the assumption that a range of activity types would reflect a range of behaviours, preferred contexts and meanings. For example, I planned to approach respondents participating in a range of common or well-known activities such as dog walking, hiking, mushroom-picking and horse-riding and also planned to find out about lesser-known activities and to interview people who engage in them. Having interviewees express a range of themes was therefore more important than trying to be representative (Buchecker *et al*. 2003). Therefore, not interviewing some people and perhaps missing out on a number of activity types, meanings and behaviours, would likely not have an appreciable effect on the findings.

Before I started the interviews I was already familiar with a number of people connected to the Tokai story, and I started by interviewing them, using snowball sampling, also known as 'referral' (Babbie

2004) to find more people to interview. These respondents tended to be key informants and users. To connect with more users of Tokai forest, I relied on 'on-site recruiting' (Clifford *et al*. 2010) at the site of recreation to interview some of the recreation groups that I was not able to access through snowball sampling. For this, I used the entrance to the Tokai arboretum and the associated parking lot because many recreationists use that as the starting point of their walks and mountain-bike rides. Mountain biking and horse riding are, for example, regulated at this entrance, where activity cards are checked by a management agency staff member. I also interviewed a number of South African National Parks (SANParks) and Forestry officials who have been close to the planning process, the tree-felling process and the process of addressing user and public concerns. According to Bjerkli (2010), it is important to interview the management agency since the agency has a large influence on the meanings assigned to a landscape and is responsible for influencing and managing sets of meanings in relation to landscapes. Due to the publicity of the issue in the popular press, I also became aware of the existence of certain groups such as 'Shout for Shade', a group formed to resist the landscape change in Tokai. I also committed to ensuring that I would interview people who felt that the landscape change was favourable as well as those who felt that the change was not welcome.

When approaching someone to invite them to an interview, I introduced myself, the University of KwaZulu-Natal as my affiliated university, and my study supervisors, and I indicated that the study was being conducted under the auspices of a research permit issued to me by SANParks. I then explained the aims of the study. This established legitimacy for the student and the study. All respondents were assured of their anonymity if they agreed to be interviewed. The probable length of interview was given as thirty to forty minutes, but it was stated that if respondents wished to spend more time on the interview, that would be allowed. I carefully explained that regardless of whether an interviewee felt positive or negative sentiment towards the changes being implemented, all responses would provide insights for the study to illustrate how meanings and benefits influence behaviours when landscapes are changed. Standard qualitative interviewing techniques were used (Strauss & Corbin 1998) with emphasis on the narrative style. The approach conformed with the ethical requirements that regulate research at the University of KwaZulu-Natal and at SANParks.

4.2.2 Sampling

Thirty-eight respondents participated in the study and were interviewed between May and September of 2012. I started by interviewing a few individuals I knew who were involved with the issue. I also connected with the Mountain Club (Cape Town branch), asking for volunteers wishing to talk about the issue to be interviewed. I was also assisted by a SANParks ranger who helped me connect on site with mushroom collectors and mountain bikers. From here I used snowball sampling to invite further participants to be interviewed. I made the assumption that conducting interviews across a range of activity types would uncover perspectives on the issue of the permanent removal of the plantation forest. I used the following strategies and techniques to engage people who might hold different perspectives: Once I started interviews I categorised respondents into different groups such as activity types, key informants, managers, users or affected parties, members of pressure groups, and people with historical connections. The respondent categorisation facilitated the use of snowball and other sampling techniques and it helped me to select contrasting views, interests and responsibilities. For example, care was taken in the sampling techniques to seek diverse perspectives and to avoid the risk of interviewing only like-minded respondents. Snowball sampling (referral) sometimes tended to produce new interviewees with similar perspectives to the interviewee who referred them. When this happened I changed my technique to connect with new interviewees selected not through referral but by on-site contacts, or through stakeholders from the local Mountain Club who had volunteered to be

interviewed. Diverse perspectives were furthermore ensured as I made greater and more focussed attempts to gain access to participants involved in activities that were less well represented, such as mushroom foraging. To connect with more mushroom foragers for example, I gave the SANParks ranger a short, written project description and asked him to use that to connect with mushroom collectors and to source the contact numbers of early morning foragers who were willing to be interviewed, as SANParks rangers were on duty at dawn.

I was particularly interested in interviewing users who had been so for a long time, to illustrate the notion of meanings becoming entrenched over time. Some respondents were 'key informants', people who may or may not be users but have a special interest in the topic and who would have been actively involved in aspects of the issue in some way.

4.2.3   Response format

Everyone who responded to an initial invitation (via e-mail or phone) to an interview, agreed to the interview. I allowed each respondent to choose the venue for the interview. Preferred venues were the respondent's home, place of work (office) or a quiet coffee shop. For some interviews, the interview duration was 30 to 40 minutes but the majority of interviews lasted for an hour or slightly longer. All in-person interviews were recorded using a Philips Dictaphone and respondents were asked for their permission to record the interview. Each respondent agreed to the recording and the majority of respondents emphasised at this point that they felt comfortable sharing their perspective on the topic.

Two interviewees preferred to respond by e-mail to questions about the Tokai landscape. Of these, the first respondent preferred the e-mail format and the second respondent had retired and moved to another town and therefore preferred to e-mail responses to the interview questions. E-mail responses were thoughtful but were far less rich in content and explanation than in-person interviews. I sourced one discussion on a SANParks (Table Mountain National Park) Forum blog, and asked for, and was given, the writer's permission to make use of his perspective. All interviews were transcribed into Microsoft Word documents *ad verbatim*. Three interviews were conducted in Afrikaans and I translated these into English during the transcription of the interviews.

4.2.4   Narrative interviewing technique

Narrative interviewing practices must be conducted so as to stimulate a narrative response. The goal in narrative interviewing is to generate relatively detailed accounts rather than brief answers or general statements. Thus, narrative interviewing has more in common with ethnographic practice than with mainstream social science interviewing. Because narrative analysis relies on details, longer opportunities to talk are required than, for example, the customary length of research interviews. In particular, the narrative technique is designed to gather information about context as part of how stakeholders understand their world. Few studies concerned with human adaptation to change have given due consideration to context and other aspects that influence the development of behavioural responses at the level of the resource user (Cote & Nightingale 2012). However, narratives can take different forms, ranging from tightly-bounded stories, for example, in response to a specific question or set of questions to long narratives (i.e. extended accounts), that build over the course of several interviews with the same person (Mishler 1986; Andrews *et al*. 2008).

In an interview response, one story may lead to another, revealing associations and meanings that might connect the stories. Details include specific incidents and turning points, not just general evaluations. Interview efficiency may have to be compromised for gathering detail. Respondent

'digressions' must be allowed. The speaker should be allowed to hold the floor beyond the limits of a usual turn, because respondents' story-telling tendencies are suppressed by interruptions (Mishler 1986). Ask questions that invite an extended account, e.g., "tell me what happened" as opposed to "when did x happen?" The narrative approach is often used to elicit details about life stories. For this study, however, accounts are not required to cover such a long period of time. Instead respondents were asked mainly about Tokai and related experiences, events and meanings of the last 10 years, but extending further back if the respondent had a longer association with the Tokai area and forest. In narrative interviewing listening by the interviewer must be emotionally attentive and engaged. The interviewer should also actively participate by encouraging the expansion of certain story-lines. The interviewer may participate actively by mediating which themes are developed more than others. The narrative method accepts that the interviewer and the prior theoretical understanding play a major role in co-constructing the narrative data. The interviewer therefore directs the stories participants tell (Andrews *et al.* 2008).

4.2.5   Interview questions

The following is the question list I had in front of me in each interview. Some of the questions had related questions to help me frame the question differently if necessary. In reality, I asked respondents only about five of the questions shown below, as interviewees generally covered all of the other issues as part of responding to those five questions. The 'notes' in brackets indicate links to the conceptual framework in Fig 2.1.

Q1: Why do you visit or have an interest in Tokai forest? [Note: This question should elicit responses about the landscape context (e.g. activities, social settings, biophysical landscape attributes) and meanings associated with Tokai forest; the question also aims to connect with the respondent's current experiences in and of Tokai so as to start the interview off with a question that the respondent can relate to immediately (the 'now'); note the question is not yet specific about pine trees in the Tokai landscape].

Q2: How often do you visit Tokai? [Note: Frequent visits may signify supportive behaviour; or simply that the respondent lives close by. The meanings may therefore be different and the questioning should prompt responses that expose the motivation for visiting Tokai].

Q3: For how long have you been a user/have had an interest in Tokai forest and the Tokai landscape? What was the nature of your connection with Tokai forest then? Did it have special meaning to you then? Do you have favourite memories? [Note: This question asks the respondent to talk about meanings held in the past, to find out what those meanings were and whether those meanings have changed over time and if so, how].

Q4: What do you think about the pine trees in the Tokai forest landscape? Do you think your experience in Tokai forest would be the same, or different, if the forest consisted of a different tree species, e.g. eucalypts or oaks? And if the experience would be different, how would it be different do you think? [Note: What aspects of the landscape context are the meanings directed at and what meanings do they evoke? i.e. does the species matter for the meaning, or is the meaning more closely related to, for example, the vegetation structure providing a specific benefit, i.e. shade?].

Q5: Are there other places where you could have a very similar experience within reasonable travel distance? Do you go there? [Note: This question asks the respondent to indicate whether they feel that Tokai forest can be substituted in relation to the meanings that they hold. Current understanding

indicates that some types of meanings can be substituted whilst others cannot. In situations where substitution is possible, the meanings held in relation to Tokai forest may not be felt deeply].

Q6: How have you responded to and what do you think about the recent proposed change in the Tokai forest landscape? And why? [Note: The response to this question will indicate behaviours in relation to meanings and landscape context, and may even highlight certain meanings].

Q7: How do you think the proposed change will affect the Tokai forest landscape? What do you think it would be like, 10 years from now? How do you think it would affect the landscape characteristics in Tokai forest and your experience in it? Would you still visit Tokai then? [Note: Here the respondent is asked to describe their imagined future Tokai landscape context, and the meanings that may be associated with the imagined future Tokai landscape context and the behaviours that result].

Q8: Has the recent proposal for change persuaded you to think about Tokai differently than before? In what way? [Note: The aim is to determine whether the proposed change has encouraged people to become aware of other meanings and perhaps how other meanings affect the meanings they hold in relation to Tokai forest].

Q9: How do you think your current response/behaviour (i.e. motion for support or resistance) will influence the proposed change? What effect, do you think, will your actions have on the management of the future Tokai forest? [Note: This question asks the respondent to talk about how their behaviours may be expected to direct the state of the future landscape context via management interventions].

4.3   Data analysis

4.3.1   Conceptual frame for data analysis

In Chapter 2, I developed the proposition that meanings, perceived benefits and context together determine behaviours. The purpose of data analysis was to show:

1. How users articulate or express meanings;
2. How multiple meanings and contexts emerge in relation to the same physical landscape;
3. How clusters of meanings develop and how these influence behaviour;
4. How meanings, benefit perception and context, together, shape behaviours;
5. How actors learn about meanings and adapt meaning priority over time; and
6. Unanticipated findings and their implications.

Chapter 2 provides a broad framework for linking key concepts in the proposition about the drivers of behaviours in response to landscape change. For data analysis, a refined interpretation is required whereby concepts are defined and linked together to present a dynamic social-ecological system (Fig. 4.1). An interpretation or frame for analysis must link to the conceptual framework in Chapter 2, but must be grounded in the specifics of landscape use and change.

As users encounter a biophysical setting, commonly with a diverse array of habitats, they derive benefits (ecosystem services), and in doing so they contribute to the formation of specific situations (contexts) so as to reinforce preferred meanings. So, as implied, users create a context when they engage the services emanating from the biophysical setting. The context is further shaped by the interactions among users and their patterns of use of the available services. For example, users influence the context by selecting for a solitary experience, or by being with others (social context), or

by bringing their dogs, or by the type of activity they engage in, for example, cycling, walking or horse riding.
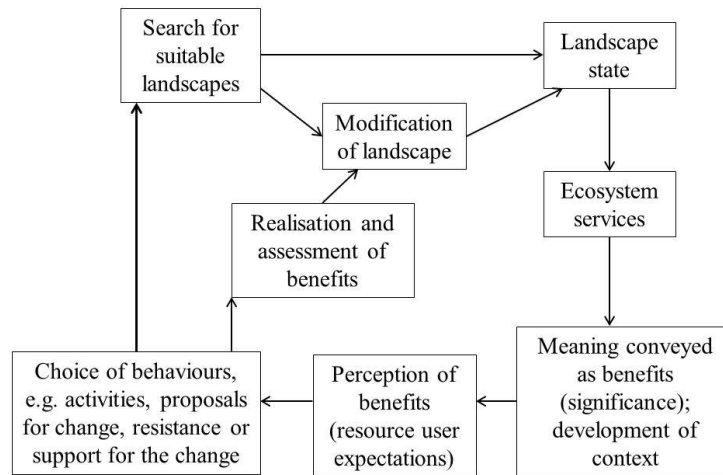
Fig. 4.1. A conceptual framework linking benefits, behaviours, meanings and context to describe and interrogate user responses to landscape change.

4.3.2   Narrative analysis

Traditionally, narrative text analysis is based on close reading with attention to language (e.g. the use of figures of speech), choice of language, social context, audience, narrative style and particular sequences of action. Attention is on the details, how and why a particular event is constructed into narrative. Because narrative analysis uses extended accounts and focuses on details, many prefer to not fragment data into thematic categories by, for example, thematic coding. However, increasingly, scholars in the narrative method approach the data looking for generalities (e.g. themes) as well as particulars. As Riessman (2008) argues: close, detailed reading can be combined with other case-centred and text-based approaches that are more category- and theme-oriented in their analysis.

Texts transcribed from narrative interviews can be used in various ways, depending on the objective of the research. Segments of each story can be analysed and compared to other similar segments from similar interviews; or, segments can be combined to form a set of themes of interest or a single life story can be the object of analysis. Thematic (i.e. experience-based) narrative analysis focuses on content, i.e., what was said or written and not 'how' (i.e. structures of speech), 'to whom' or 'for what purpose'. What one can expect is that different respondents in a sample of interviews may (and probably will) provide different interpretations of the same phenomenon. However a common theme may be discerned. In some cases scholars use the entire narrative as support for the theme, in other words, the narrative/story does not have to be broken up to discern a theme or themes (Riessman 2008). Therefore the boundaries of the narrative are set by the researcher/interviewer according to the theoretical aims of the research.

In thematic analysis of narrative, not much attention is given to the role of the interviewer. In addition, with thematic narrative, because the interest is more with the 'what', it is not necessary to learn much about the lives of the narrators other than what the theme requires. The primary interest is in creating thematic categories across individuals (Riessman 2008). Themes are those relevant to the theoretical framework and research questions, but the interviewer must also look out for emerging

themes not anticipated. The researcher identifies and codes the relevant text segments to relevant themes.

Interview text is ordered thematically, and from this, the researcher develops and tests theories that give a predictive explanation of the stories, moving back and forth between the interviews and generalizations about them (Riessman 2008). The unit of analysis for this study was therefore the themes that reflect aspects of the theoretical framework, as well as emerging themes relevant to the broad research question.

4.3.3   Alternative approaches to analysis

Various approaches can be used to analyse interview text, for example, grounded theory and discourse analysis. I chose narrative research as the preferred approach to data interpretation and analysis because of the explicit sensitivity of this approach to meaning and context.

In narrative method, prior theory always guides inquiry, while at the same time the researcher looks for novel theoretical insights. This is epistemologically different to grounded theory which deliberately does not rely on prior theoretical frameworks. I have chosen to study one case in depth. This approach is in accordance with the narrative method which is truly case-centred (idiographic), in that it tries to draw out themes across respondents within a case, but does not (as in grounded theory), try to generate theory by generalizing conceptual findings from across cases (Andrews *et al*. 2008).

Discourse analysis focuses on the study of socio-political inequality, power, abuse of power, dominance and, in particular, the role of discourse in the production, reproduction, and the process of challenging, dominance (Van Dijk 1993). From the perspective of this study, meanings are considered to be centrally important. How actors exercise power and the related discourse are seen as emergent properties of a social-ecological system underpinned by meanings. A framework explicit about meanings is therefore more appropriate to a study which is trying to illustrate how a fundamental issue like divergent meanings may lead to tensions.

4.3.4   Data coding structure in NVivo

Prior to coding in NVivo, I did detailed repeated readings of the raw data. I wanted to identify and test themes as defined by meanings and benefits (Tables 4.3 and 4.5) that were consistent with prior assumptions and hypotheses as per Fig. 2.1. In other words, I wanted to test whether key concepts I was interested in, were evident in the text and relevant to the research objectives. This manner of handling the data was in line with a 'general inductive approach' (Thomas 2006). The identification of themes was facilitated by the development of Tables 4.3 and 4.5 during which I ensured no overlap in the interpretations of themes within and between meaning and benefit categories. But, I also wished to be sensitive to emerging themes. I reflected on Fig. 2.1 and the data and used concept diagrams to map themes and connections between themes, making sure to look for and map new themes emanating from the data, in addition to expected themes. As a result of the two approaches used, the organising and interpretation of data were both theory-driven (deductive) and data-driven (inductive) (Fereday & Muir-Cochrane 2006). When constructing the concept maps, I used sensitising questions such as 'what is the data indicating?' and theoretical questions such as 'how does this new theme relate to one or more existing themes?' to develop new conceptualisations that were not reflected in the original conceptual framework (Strauss & Corbin 1996). For example, these techniques exposed themes relating to meanings associated with the participatory process which were not dominant

themes in the original conceptualisation. I used these concept maps to create the coding architecture in NVivo10.

NVivo can be used in a variety of ways to summarise, display and process data. For this study, and in accordance with an interpretive frame for social research, NVivo10 was used primarily to collate the data and to extract and organise different themes as NVivo 'nodes' of interest. The objective of using NVivo was therefore descriptive, for purposes of interpretation rather than for quantitative analysis (O'Neill 2013; NVivo9 2010). Similar ideas and concepts from the interviews were placed ('coded') in a node representing a selected theme. In line with an interpretive research approach, words, themes and categories were not quantified as the aim was rather to present a range of meanings and to illustrate how they relate to context, the perception of benefits and behaviours. Data interpretation and presentation was therefore based on data organisation, coding and categorisation. This approach to data processing closely follows that of Davenport & Anderson (2005).

4.3.5   Coding text using NVivo

Transcribed interviews were imported into NVivo10 (2012). Nodes were set up in NVivo according to the main themes, namely, behaviours, meanings, context and benefits (Fig. 4.2), and sub-nodes according to Tables 4.3 and 4.5. Emergent themes that were not anticipated were placed into new nodes. The aim of coding was to organise the interview text, to place similar ideas together across interviews so that patterns could be exposed and general propositions could be drawn from the findings.
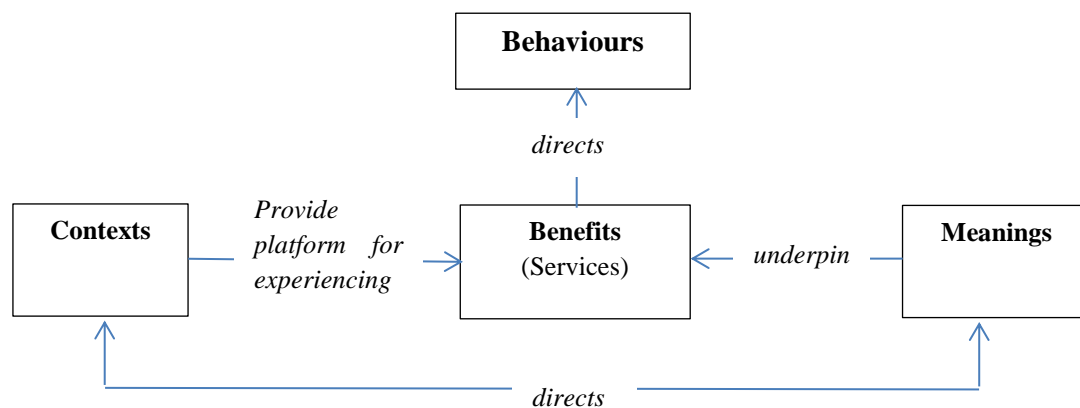
Fig. 4.2. Themes that formed the initial nodes for coding in NVivo10. The diagram was set up to assist with theme (node) creation and node aggregation using NVivo10. No attempt was made to draft an adaptive cycle.

Before coding began, a small number of interviews were read with the aim of identifying further ways to improve the interpretation of text and make confident links between text and theoretical concepts. Particular attention was paid to whether certain grammatical forms or expressions are typically associated with the concepts as defined by the framework. In general, the context in which a word or phrase was used indicates how the respondent's expression should be interpreted (Strauss & Corbin 1998).

Behaviour

The intention of the study was to show how behaviours are influenced, in particular, when defined landscape changes take place. It therefore was important to be able to show how behaviours are influenced by the perception of benefits, which is shaped by context and underpinned by meanings. In each interview, behaviours were identified by defined activities, such as dog walking or mushroom picking, which are activities whereby certain contexts, benefits and meanings are reinforced. Other behaviours may include resistance, support, organizing for engagement, seeking alternatives and expressions about intended future behaviours, given defined landscape changes.

Benefits

Categories of benefits (themes/nodes) were taken from the Millennium Ecosystem Assessment 'Ecosystem Services' framework with refinement of certain categories based on literature. Examples of benefits are: food (provisioning service), climate regulation (regulating services) and recreation and cultural heritage (cultural services). Sometimes benefits are described directly, e.g., by the use of the word 'wood', but sometimes respondents would indicate benefit by phrases such as "I love..." or "I like..." or "It is nice...". Where possible, interviewees were asked to indicate whether they felt that benefits were gained fully, or whether they were diminished/reduced, or whether certain benefits could not be satisfied at all within a given context. These responses were considered important determinants of behaviour.

Meanings

Meanings are symbolic abstractions that denote significance to those who hold the meaning. Human beings act towards things on the basis of the positive or negative meanings assigned to those things. 'Things' can include physical objects, landscapes, other human beings, categories of human being (e.g. environmentalists or community activists), institutions, ideals (e.g. integrity or independence), and activities and situations.

Categories of meanings were extracted from literature to generate a 'meaning typology' (Table 4.3) and unanticipated meanings were noted and coded. In the interview text, meanings were most commonly expressed as adjectives but also appear as similes, and occasionally as verbs, e.g. *unrestricted* recreation (adjective), meaning: can exercise choice; the forest is *like a gift* (simile), meaning: public nature of landscape; we *enjoy seeing baboons* and *hearing owls* (verb and noun combination), meaning: wildlife sanctuary. Other meanings include: links with the past and sense of community. The coding structure was also set up to indicate whether meanings are negative or positive, such that the social-ecological patterns (e.g. decisions, landscape changes) giving rise to negative and positive meaning allocations can be described.

Contexts

Contexts are situations constructed by users by engaging benefits in defined ways (e.g. dog walking or mushroom picking) within certain biophysical and social settings. Examples of contexts include: horse-riding alone in the forest, dog-walking alone in the Fynbos, mushrooming with family members and friends. For this study, it was important to incorporate the state of the vegetation in the context description, i.e., forest intact, less forest and no forest/all Fynbos (heathland).

4.3.6   Establishing reliability and validity

Reliability and validity are important concepts for attaining rigour and quality in qualitative research. Reliability refers to the quality of the measurement method and whether a particular technique, like narrative techniques combined with the same interview questions asked, applied repeatedly to the same object, would yield the same result each time. Validity refers to the extent to which a measure accurately reflects the concept it is intended to measure (Babbie 2004). Some scholars in qualitative research prefer to use the terms 'credibility', 'transferability', 'dependability' and 'conformability' as dimensions of rigour, rather than reliability and validity (Shenton 2004). Shenton (2004) and Morse *et al.* (2002) present strategies and criteria that should be implemented during the research process to enhance the rigour with which a study is conducted. I used the categories proposed by Shenton (2004) to incorporate requirements of rigour into the study.

Credibility in the data was enhanced by a deliberate attempt to randomise sampling (see section 4.2.2) by switching between snowball sampling and non-referred contact with respondents and in this way deliberately seeking participants with diverse and even opposing views; and, participants were encouraged to be frank at the onset of each interview. Initial interview transcriptions were discussed between the researcher and study supervisors to determine the extent to which questions were articulated correctly to elicit the intended responses by participants, and to make amendments where necessary. With more time, the credibility of the data could have been further enhanced by asking participants to read the transcripts of their interview to allow them to comment on whether the wording in the transcript reflected the intended meanings.

Transferability was ensured by providing sufficient information and emphasis on the context of the study site and situation so as to enable readers to make an informed decision about transferability of the findings. In addition care was taken to provide rich descriptions of the phenomena and concepts in the study in order to compare with possible new cases.

Dependability was ensured by making the research design and its implementation explicit and which included a detailed account of how interviews were conducted in the field.

To achieve conformability, the researcher must employ strategies to ensure, as far as possible, that the findings reflect the results of the ideas and meanings of the respondents and not the preferences and characteristics of the researcher (Shenton 2004). To achieve conformability in this study, it was important for the researcher to maintain neutrality in the assessment of the change in question (in fact, to bear and exert no opinion as far as possible) and I specifically encouraged respondents to express their opinion and feelings about the change, and for the researcher to be sympathetic to those, irrespective of whether they were for or against the change. This commitment was built into the study design. In addition, to ensure that the respondent's meanings were clearly understood and correctly interpreted, when an interviewee response was perceived to be vague or unclear, I always asked the respondent to clarify or expand on the particular point. This was a highly effective mechanism to make sure that meanings were clarified by being expressed in an expanded fashion.

I approached 38 prospective participants and all agreed to participate. People were generally very eager to share their views on the study subject and they generously created time for interviews. At about 30 interviews, the same themes emerged and were repeated and very few new themes were mentioned. This is called the point of theoretical saturation (Guest *et al.* 2006). In other words, more interviews would not have produced more new themes to validate the conceptual framework. I would most certainly have gathered new information about meanings and benefits if I had conducted

interviews more exhaustively, but they would not have appreciably altered the interpretation of the conceptual framework. The material gathered from 38 interviews were not only sufficient to validate the conceptual framework, but also provided rich additional themes and insights to enhance the original interpretation of the framework, as well as to raise questions around possible shortcomings of the framework in its original interpretation.

4.4   Summary

An interpretive, qualitative approach was selected for eliciting responses and analysing data in the context of users' perception of change. This choice was deemed appropriate given the aims of understanding and describing how meanings are constructed and reinforced over time and how they direct behaviours and influence public infrastructure, especially when meaning prioritisations are challenged and tensions arise. The MEA ecosystem services framework and a typology of meanings based on the literature, produced categorisations detailed enough to detect and distinguish different benefits and meanings. The narrative interviewing technique was considered particularly suitable for eliciting stakeholder responses that encouraged reflection and facilitated the expression of meaning and context.

CHAPTER 5

THE EVOLUTION OF MEANINGS AND PERCEIVED BENEFITS AS A BASIS FOR UNDERSTANDING RESISTANCE TO AND SUPPORT FOR CHANGE IN THE TOKAI LANDSCAPE

5.1 Introduction

In Chapter 2, I presented a conceptual framework showing that users attach meanings to a natural resource as they anticipate and realise benefits from the use of the resource. The framework proposes that users behave in defined ways as a result of meaning association and meaning prioritisation in accordance with defined contexts. These behaviours can be understood as being supportive, contestational, or characterised by purposeful withdrawal or indifference. Meanings and contexts are dynamic over space and time and require ongoing evaluation in relation to the state of the resource (which is also dynamic) and the benefits users derive from the resource. Change is therefore an inherent property of the system. The framework emphasises the process whereby meanings and contexts are negotiated and re-prioritised to direct and inform the formulation of regulatory instruments ('rules'). The framework therefore implies that institutional design, in particular the extent to which shared understanding in the reordering of meanings is promoted, influences the formation of supportive or resistance behaviours. In Chapter 3 I provide an historical account of the establishment and growth of plantation forests in Tokai and indicate how the policy (public infrastructure) changes of the late 1900s resulted in a landscape transformation from shaded plantation forests to open heathland. This decision has received some support but, importantly, also a great deal of resistance. The Tokai example was deemed suitable to test the ideas encompassed by the framework. In Chapter 4 I discussed the methodological approach and methods used to generate data from the case example.

This chapter is organised according to an historical timeline. I present evidence to illustrate the development and sources of change in public infrastructure in Tokai, firstly over the period when plantation forestry was a growing venture in the Cape and in Tokai. During this period the Cape colonial Government (from the late 1800s), and later the Department of Forestry, were the infrastructure providers (Anderies *et al.* 2004) in relation to the Tokai landscape. Secondly, I present material corresponding to a period of growing concern around threats to and survival of native vegetation in the Cape, and the development of a movement, driven by the biodiversity conservation sector, to alter the public infrastructure in favour of the conservation of meanings associated with native Fynbos (heathland). A consequence was that, from 2005, the land on which the Tokai plantations were situated, was leased to South African National Parks, at which time Table Mountain National Park took over the management responsibility for Tokai. The change in public infrastructure led to an intervention to remove 600 ha of plantation forest and to replace it with indigenous heath vegetation. This landscape change stimulated support as well as resistance among stakeholders.

The objectives of the research (Chapter 2) were to test the conceptual relationships between meanings, benefits, context and behaviour as suggested in the conceptual framework and to gain insights into the importance of collective ordering of meanings on the level of stakeholder support. To illustrate the development and re-prioritisation of meanings, the experience of benefits and the motivations underpinning responses from a user perspective, I present results from interviews with users of the Tokai landscape. Thirty-eight respondents were interviewed during 2012 (Table 5.1).

Table 5.1. A summary of residence time and activities of 38 Tokai stakeholders interviewed during 2012.

Respondent	Nearby resident (y/n)	Number of years as a user	Hiking/ walking	Mountain biking/cycling	Dog walking	Horse riding	Mushroom collecting	Other uses of the landscape
1	No. Key informant	NA	No	No	No	No	No	NA
2	Yes. Key informant	NA	Yes	No	No	No	No	NA
3	Yes	12	No	Yes	No	No	No	NA
4	Yes	20	Yes	Yes	No	Yes	Yes	NA
5	No	recent	Yes	No	No	No	No	Picnics & games for aftercare school children
6	No. Key informant	NA	NA	NA	NA	NA	NA	NA
7	No	20	Yes	Yes	No	No	No	Mountain bike tour operator
8	Yes	18	No	No	Yes	No	No	NA
9	Yes	12	No	No	Yes	No	No	NA
10	Yes	40	No	No	Yes	No	Yes	Flower photography; Children playing in forest
11	Yes	40	Yes	No	No	No	No	Children playing in forest
12	Yes	27	Yes	Yes	Yes	Yes	No	NA
13	Yes	7	No	No	Yes	No	No	NA
14	No	3	No	Yes	No	No	No	NA
15	Yes	18	Yes	No	Yes	No	Yes	Children playing in forest
16	Yes	15	No	Yes	No	No	No	Mountain bike trail maintenance
17	Yes	15	Yes	No	Yes	No	Yes	NA
18	Yes	12	No	No	No	Yes	No	NA
19	No	30	Yes	No	Yes	No	Yes	NA
20	Yes. Key informant	11	Yes	No	No	No	No	NA
21	Yes	12	Yes	Yes	Yes	No	No	Fynbos photography; historical research
22	No. Key informant	38	Yes	Yes	No	No	No	Children cycling
23	Yes	37	Yes	No	No	No	No	Picnics

Respondent	Nearby resident (y/n)	Number of years as a user	Hiking/ walking	Mountain biking/cycling	Dog walking	Horse riding	Mushroom collecting	Other uses of the landscape
24	Yes	30	Yes	Yes	No	No	Yes	Fire wood collection
25	No. Key informant	NA	NA	NA	NA	NA	NA	NA
26	No	16	Yes	Yes	Yes	No	No	Photographing mushrooms
27	No	2	Yes	No	No	No	Yes	Employee at the Tokai Tea Room (restaurant)
28	Yes	34	Yes	Yes	No	Yes	No	Running; Wildlife viewing
29	Yes	32	Yes	No	Yes	No	No	Scouts - orienteering
30	No. City of Cape Town official	NA	NA	NA	NA	NA	NA	City of Cape Town, Biodiversity Management Branch
31	Yes	4	No	No	No	Yes	No	NA
32	No. SANParks official	-	No	No	Yes	No	No	NA
33	No	1.5	Yes	No	Yes	No	Yes	NA
34	No. SANParks official	-	No	No	No	No	No	NA
35	Yes	4.5	Yes	Yes	Yes	Yes	No	Running
36	?	9	Yes	No	No	No	No	Silvicultural forester
37	Yes. Key informant	22	Yes	No	No	No	No	Forest management
38	Yes	30	Yes	No	Yes	No	Yes	Running

5.2   The Tokai system in the plantation forestry era

The Dutch colonised the Cape in the 1650s and the new settlement sparked a demand for timber driven by the construction of forts, ship repairs and the need for fuel (Anderson & O'Farrell 2012). Natural forests of the western and southern Cape were denuded for this purpose and the exploitation of indigenous forests continued until after the Cape became a British colony in 1806 (King 1938; Giliomee & Mbenga 2007). A Colony botanist, Dr Pappe, his successor, Dr J. Croumbie, and the first appointed Conservator of Forests, Captain Baron de Fin, brought the plight of the natural forests to the attention of the Government. The Government of the Cape Colony took control of the forests in 1872 and allocated the responsibility of control to the Commissioner of Crown Lands and Public Works (King 1938). The Forest Service (public infrastructure provider) was created in the latter part of the 1800s to establish rules for the sustainable management of indigenous forests (King 1938).

Up until 1872 the main activity of the Government was to control woodcutting in the indigenous forests. But some realised the "need of plantations to supplement the meagre natural timber resources of the country" (King 1938; p. 6) which resulted in the appointment of Joseph Storr Lister as the first Superintendent of Plantations in 1875 (King 1938). The Forest Service was required to import and cultivate fast-growing conifers (King 1938; Van Wilgen & Richardson 2012). In particular it was required to establish formal plantations, primarily *Pinus* species, on a large scale, to develop the regulatory instruments to guide plantation management and to manage the supply of timber from these plantations. Thus, initially, trees were the resource and timber supply was the benefit that the Government, the Forest Service agency and the public associated with the resource. The context therefore initially developed around timber production, and the primary meanings associated with trees reflected commercial benefits. To support the growing commercial forest industry the agency established the first School of Forestry in 1906 at Tokai to develop production forestry expertise for the future. An arboretum was established to provide a suite of tree species from around the world so that forestry students could be exposed to a range of species to assist in their training. In so doing the agency developed additional meanings around forestry education. As this context developed and the benefits from timber were realised the Government encouraged expansion of plantation forests. Plantations were developed to occupy suitable sites across the country and Tokai plantation was extended to cover an area of 600 ha.

As the trees matured, a new environment was created. For some, the trees and the shaded environment they created were reminiscent of their countries and places of origin in Europe (Brook 2003; Dickie *et al*. 2014).

"I like pine ring mushrooms… they only grow under pine trees. I learnt to do that because it's a Polish tradition to... you know they are very popular in Poland and my mother used to collect them when I was a young lad. So I used to collect mushrooms [in Tokai] and cook them and pickle them." (Interview 17)

These sentiments, together with the open understorey of the plantations and the installed physical infrastructure such as service roads, encouraged people to perceive plantation forests as a multi-faceted resource that offers diverse opportunities for recreation. This stimulated a demand for public access to the plantations for recreational use. (Plate 5.1)

Plate 5.1. A family walking with their dogs in a section of the Tokai plantation forest still remaining in 2013. (Photo: Ernita van Wyk)

"You know I think what it is for many people it's the fact that the trees are tall, it's the fact that there's very little understory, so you've got a free place to walk, it's open and it's shady and it's cool." (Interview 4)

"And because there is little foliage low down we can spread out when we pick mushrooms but still see and call and find each other." (Interview 24)

"One is out in an environment that is very quiet, tranquil, cool… with the shade aspect and uncluttered with the pine trees giving one a sense of openness and free-flowing space under the pines which one doesn't get on the upper slopes where there's Fynbos growing." (Interview 33)

As the plantation became recognised as a context for recreation, there was a subtle shift from timber (the trees) being the resource to one in which the entire plantation became the resource. With this change the agency realised that the rules (public infrastructure) designed to manage timber production were exclusive of the public and too restrictive to accommodate recreation meanings. With growing public use the agency's perception of risk of fire also declined. This further encouraged a willingness to accommodate recreationists in the plantation context.

"Many years ago, the plantations were not accessible to the public. During the summer, no public was allowed in… but over the years they realised that the kinds of people who come, they're not coming to make a fire, they're coming to enjoy the outdoors and so they were welcomed." (Interview 36)

As the agency acknowledged and adopted the recreation meanings that the public associated with the resource, it revised the public infrastructure (rules) for public access to and use of the plantation forests. Users were allowed access for recreation by authorisation but certain activities were prohibited as shown below (Plate 5.2).
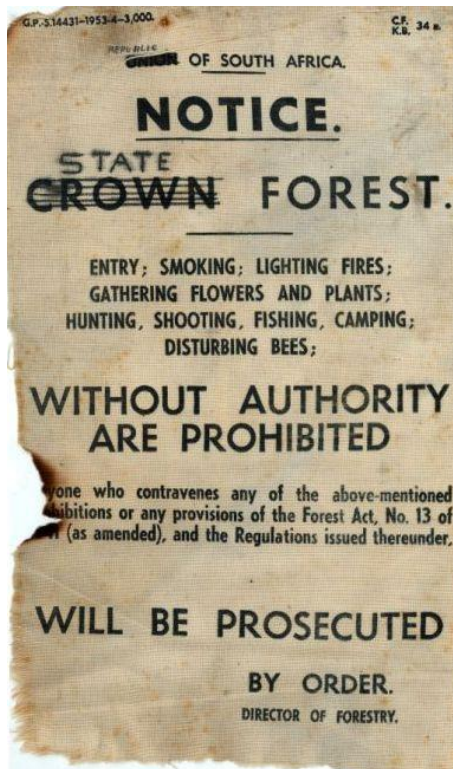
Plate 5.2. A State Forest notice, dated 1953, prohibiting a range of activities (notably making fires and smoking) in state-owned forests. With kind permission from Prof. Brian Bredenkamp, Stellenbosch University.

The regulatory instruments allowing public access and use of the plantation forests reinforced the recreation meanings held by the public. These rules also signified to the public that the agency had adopted and supported user recreation meanings alongside the commodity meaning associated with timber production.

Continued public use and enjoyment of the plantation forests encouraged the agency to reflect on its role as a public entity. The agency sought to be more accountable to the public and during the 1970s the agency adjusted the rules to further promote public recreation benefits alongside the agency's primary benefits derived from timber production. Rules were instated to develop additional physical infrastructure such as overnight huts and new hiking routes, which further reinforced plantations as a recreation context and also served to reinforce the meanings that users were developing within this context. These changes served to enhance the Department of Forestry's image as a public service provider.

"So… at the different plantations they've had picnic sites or walks or huts." (Interview 36)

As the mutual reinforcement between the agency, users and the resource grew, forestry production operations became more sensitive to user meanings. When plantation blocks were due to be harvested, the agency alerted users to pending changes in the plantation landscape brought about by routine timber harvesting operations, allowing users to anticipate the change and to prepare to use other sections of the plantation resource so as to continue to connect with the meanings and benefits that recreational users prioritised.

"And that's one thing that is different in forestry here in the Boland [region]… and especially Tokai…how can I say… it [the public] is more an integral part… you can't just cut down trees… you first have to let the public know." (Interview 36)

Because of the large size of the Tokai plantation, clear-felling in any one block of trees during the plantation forestry era resulted in a localised visual impact, but there were always alternative shaded areas for recreation.

"The State forests were always being felled on a cyclical basis… so… there would always be pockets where the trees are being felled and pockets where the trees were tall so there would always be areas where you could continue to walk." (Interview 4)

This also engendered an appreciation in users of the commodity meaning held by the agency in association with the plantation forests. Users understood that the trees were a 'produce' cultivated to be harvested and that the wood is a commercial product.

"I understand they are grown for commercial use and they must be cut down when the time comes..." (Interview 33)

During this era Tokai plantation, especially because of its accessibility within an urban setting, gained popularity as a shaded recreation resource (Bigalke 1983). As use was being encouraged and facilitated users developed and expanded the range of activities and the meanings they associated with the resource. (Plate 5.3)

Plate 5.3. Walkers starting a hike from the Tokai arboretum, 2012. (Photo: Ernita van Wyk)

In Tokai, a consequence of agency reinforcement of recreation meanings was that users developed a strong affinity for the forests. Together with an emerging sense of public ownership of the plantations and an appreciation of their use and the associated benefits, there was strong support for the rules of use as set out by the agency. User groups tended to police each other's behaviours and the agency had no need to invest additional effort monitoring user compliance (Piet van Zyl pers. comm.)*.

"The public loved the forest and looked after it. I used to brag and say that I don't need rangers to patrol the forest because the public were my rangers." (Piet van Zyl pers. comm.).

The plantation was affirmed as a recreation resource over time. Meanings such as 'dependence' ('recreation satisfaction'), 'links with the past', 'sense of community' and 'sustenance' were emphasised by respondents.

"We have been here 40 years. Initially when there were a lot of trees, we used to walk in it, you know… exercise. Our kids ran around there… played games… we used it for general recreation." (Interview 11)

"With mountain biking, we go through all those single tracks under the trees… Tokai is challenging from a mountain biking and running point of view… and it's more interesting, with more paths… from a [horse] riding point of view. I actively choose to exercise in Tokai because of the cover." (Interview 35) (Plates 5.4 and 5.5)

Plate 5.4 (left). Mountain bikers entering Tokai (Photo: Ernita van Wyk). Plate 5.5 (right). A mountain biker riding in a young Tokai plantation during 2004. With kind permission.

For some, Tokai forest had become a place of tranquil and restorative relaxation ('therapy') and respite from an otherwise busy life in the city.

"Well... it's an escape for people. I think nobody maybe thinks of Tokai as a tranquil place, but it is peaceful, a place where you can get away from everything within the city..." (Interview 16)

*Piet van Zyl was plantation manager at Tokai from 1982 to 1994.

"You're in the forest, within your own awareness of bird calls and frog chirps and sounds of streams and crackling noises in the forest and smells… and it's a quiet time... it's a therapeutic time." (Interview 33)

"People need a place to walk their dog, to go for a jog, in the shade, in summer... they need those kinds of cultural environments..." (Interview 7)

Some associated their sense of enjoyment with the diversity of patterns and changing colours, sounds and scents across seasons ('landscape pattern').

"We keep quiet and just listen to every sound and you know the trees when the wind blows through it, it's really magical..." (Interview 5)

"I like the way they [the trees] are spaced and they cut off all the lower branches… it just gives you canopy... and you get light and shade... the smell is lovely... the rotting undergrowth after the rain... omygosh... that's my favourite thing... that smell is really nice… like a peaty sort of smell." (Interview 18)

The forest invoked fond memories of times with friends and family and the importance of social-relation benefits. For some users Tokai was a place where family and friends met. For some, engaging in activities was important but these users also took pleasure in seeing and greeting fellow recreationists, emphasising a 'sense of community' meaning. (Plate 5.6)

"Just in that area… picknicking... braaing [barbequing]… playing cricket against the pines trees... and it was great fun... I think our party sometimes numbered 20." (Interview 17)

"A lot of the people are nice and polite and I enjoy the interaction... I enjoy seeing people and saying good morning… it's nice... being friendly and having people being friendly to you." (Interview 18)

Plate 5.6. Social gatherings in the Tokai arboretum (Photo: Ernita van Wyk)

'Links with the past' and cultural heritage benefits were reflected in a variety of expressions. For example, the ashes of some of the early foresters and their family members as well as relatives of forest users were scattered or buried in locations of special significance, in the arboretum and in the pine plantations (Peter Good* and Piet van Zyl pers. comm.).

Mushroom foragers felt that the food-hunting experience links them to early human foraging habits.

"There's something about the flavour and novelty of wild mushrooms… and in a sense there is something exotic… something umm... grounded, about that. I think it links us back to a time when all human beings were hunter gatherers and foragers." (Interview 33)

Some users regarded Tokai as significant because the country's first forestry school was built here. It was therefore seen by some as the original home of commercial forestry in South Africa.

"Forestry in Tokai is very special. The very first forestry school was here. It's historical... our forefathers realised that they needed to plant species of trees here that grow fast because indigenous trees do not grow fast." (Interview 36)

The historical use of horses and mules in early association with commercial forestry was also noted by some respondents as an important cultural heritage benefit and they wished to retain the equestrian character they associate with the landscape. (Plate 5.7 and 5.8)

"And so it actually started there; that's the home of forestry in South Africa. And in those days they were doing all their logging with mules... so it's very nice to retain that heritage." (Interview 12)

Plates 5.7. (left): H.M. (Geoff) Good, Tokai forest manager 1932 to 1958 on horseback (Peter Good, pers. comm.). Plate 5.8. (right): Timber extraction with mules in Tokai, with George, a mule handler, leading a mule, 1948. With kind permission from Peter Good.

Cultural benefits (ecosystem services) featured prominently in responses, but provisioning services were also mentioned. Food and fibre aspects were especially recognised by mushroom foragers as a form of 'sustenance' even though it is not their main or only source of food.

*Peter Good's father, H. Geoff Good, was forester in charge of Tokai from 1932 to 1958.

"The pine ring mushroom... it has an orange colour... it grows under the pine trees... and the Boletus... you can eat that one too. I bring them from the forest and cook them with a little butter. Then they are fresh and we eat them straight away." (Interview 27)

"[We] would go out and bring in food for the table... food for the family. When you've had great success you phone your friends and say 'can I bring you some mushrooms' and so you can generously share and make many different dishes at home." (Interview 33)

Following initial exclusion of the public, the plantation forestry era was for the most part characterised by a co-evolution of plantation context, agency meanings and user meanings that were mutually reinforced over a number of decades. As the agency sought to assert itself as a public service provider in addition to being a timber producer, accommodation of recreation meanings was emphasised through adjustments in the regulatory instruments as well as through development of physical infrastructure to enhance access and benefits to recreational users. The priority meaning for the agency through this era remained commercial timber production ('commodity' meaning) but the agency realised that recreational meanings and benefits could be accommodated under the umbrella of commercial timber production. By the late 1900s Tokai plantation forest had become established as a timber-producing plantation but also became valued as a recreational resource with diverse meanings and benefits experienced by users. The agency and users developed a relationship reinforced by adjustment of the rules that continued to evolve in support of agency and user meanings. Over time this resulted in a social-ecological system defined by a consistency and reliability ('robustness') gained through the co-evolving relationship between congruent meanings, benefits and regulatory instruments. The robustness of the system was to exert an important influence on how some interpreted and responded to the change brought about by a number of driving forces in the latter part of the twentieth century.

5.3   Government policy reform

As forestry expanded and was increasingly adopted by the private sector, Government sought to revise its historical role as a timber producer. In 1997 national Government issued a White Paper on Sustainable Forestry Development in South Africa. This policy provided the foundation for national forest policy reform. Amongst many issues underpinning the need for reform, the policy emphasised the need for Government to reposition itself as a role player in the sector. It sought to encourage more and a greater diversity of role players in commercial forestry so as to encourage a more competitive forest industry.

"Government currently has a major stakeholding in industrial forestry. Restructuring or privatisation of these holdings will be treated in line with overall Government policy, in consultation with all interested parties." (White Paper on Sustainable Forestry Development in South Africa 1997; Section 2.5)

Whilst it affirmed benefits of commercial forestry, the policy acknowledged environmental costs associated with forestry and stated inadequate historical land-use planning policies to be largely responsible for inappropriate afforestation in the past. The need for consideration of environmental and biodiversity aspects by the forestry sector was therefore to be strongly reflected in the new policy.

- *The use of land in South Africa has been poorly planned, with resultant inefficiencies, inequities, and environmental degradation. In the forest sector, some consequences of*

inadequate landuse planning are seen in land disputes, the conflicts about water resources, a concern over the loss of land suited to crop agriculture and the loss of habitats for native species.

- *Afforestation constitutes a major change in the environment, with impacts on landscape and ecological processes of the same order as in crop and orchard agriculture.*
- *Afforestation should continue where justifiable, but should not proceed in areas important for the conservation of biodiversity.* (White Paper on Sustainable Forestry Development in South Africa 1997)

The Forest Act that followed in 1998 echoed environmental concerns related to forestry activities and, important for the interpretation of results presented here, the Act made provision for the Minister of Forestry to lease any State forest or part of it, thereby providing the enabling legal framework for the transfer of management of State Forest land to other agencies (Chapter 4, clause 27(1)). The Cape area was specifically targeted for the redirection of land under plantation forests.

"In June 2001 Cabinet approved the de-commissioning of 45 000 ha of State commercial timber plantation areas in the Western Cape as they were uneconomical and negatively affected profitability." (Stehle 2014)

These areas in the Western Cape were to be leased to conservation, community forestry, agriculture and human settlement. As part of these plans and following negotiations, the management responsibility for Tokai was transferred to South Africa's national conservation agency, SANParks, in 2005, such that Tokai plantation was incorporated into the Table Mountain National Park.

"The decision to phase out commercial plantations on the peninsula was not made by SANParks but by the government in 1999. As the Minister of Agriculture, Forestry and Fisheries, Tina Joemat-Pettersson* stated in Parliament last year, 'a thorough cabinet-endorsed process was followed that led to the decision to end commercial forestry at these locations, and assign the land to SANParks.'" (SANParks 2011; p. 1)

"On 1 April 2005, SANParks was 'assigned', in terms of the National Forest Act, the management of 1000 hectares of publicly owned land located within the Cape Peninsula Protected Natural Environment at Tokai and Cecilia by DWAF. This assignment flows from the original set of decisions in 1997, by National, Provincial and Local Government that all public and other conservation worthy land within the Cape Peninsula Protected Natural Environment should be consolidated into a National Park. TMNP has taken over the management of the Tokai and Cecilia plantations in terms of an 'exit lease' whereby the forestry company, MTO Forestry (Pty) Ltd., has the right to harvest about 600 hectares of plantations over a 20-year period. The lease excludes the replanting of trees in the areas cleared for commercial harvesting." (SANParks 2009; p. 1)

5.4 The Tokai system in the conservation era

Another factor that was to impact on the Tokai system was a growing knowledge of the uniqueness of indigenous Fynbos vegetation. This spawned a strong conservation lobby for development of systematic approaches for biodiversity conservation assessment, planning and management. From the early 1900s there were concerns about the survival of Fynbos (Jarman 1986). As scholars studied this vegetation type, they drew attention to the high levels of species richness and endemism (Goldblatt 1978; Kruger & Taylor 1979; Bond 1983; Myers 1990; Cowling *et al*. 1992). They raised awareness

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*Tina Joemat-Pettersson was South Africa's Minister of Agriculture, Forestry and Fisheries from 2009 to 2014.

not only of the unique nature of the Cape Fynbos but also of threats to Fynbos posed by agricultural expansion, urban sprawl and the spread of invasive alien plants (Wood *et al*. 1994; Richardson *et al*. 1996; Milton *et al*. 1999). Distinctive and rare Fynbos types such as coastal renosterveld and Cape flats sand Fynbos were defined through further scholarly works (Cowling *et al*. 1986; McDowell *et al*. 1991: Wood *et al*. 1994; Cowling *et al*. 1996; Wood & Gibbs 1997).

"South Coast Renosterveld is a small-leaved shrubland confined to the semi-arid and sub-humid coastal forelands of the southern and south-eastern Cape, South Africa. The flora of this vegetation type is biogeographically complex and includes numerous local endemics, many of which are geophytes. Much of the renosterveld is being converted to cereals and artificial pastures; conservation status is critical." (Cowling *et al*. 1986; p. 363)

"On the Cape Peninsula the dominant vegetation is mountain Fynbos, while on the Cape flats and in the Darling/Dassenberg area sand plain Fynbos and strandveld predominate. These areas have been identified as three distinct centres of diversity and endemism." (Wood *et al*. 1994; p. 261)

"With 2 285 species of higher plants crammed into 471 km^2, the flora of South Africa's Cape Peninsula is exceptionally rich. Similar sized areas in other Mediterranean-climate region biodiversity hot-spots support between 4.7 and 2.7 times fewer species." (Simmons & Cowling 1996; p. 551)

With this knowledge conservationists advocated the need for greater and formal protection of these vegetation types.

"After Union [in 1910] and indeed up until recent times, influential lobbies continued to secure additional areas and stronger legislation for protected areas." (White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity 1997; p. 16)

Despite the development of public infrastructure supportive of conservation in South Africa (National Parks Act 1976; Conservation of Agricultural Resources Act 1983; National Environmental Management Act 1998; South African National Water Act 1998), translating policy into action was problematic because around the world the tools to achieve conservation practically were still in their infancy. Internationally, early efforts had been made to rank conservation areas according to importance (Margules & Usher 1981; Pressey & Nicholls 1989; Rebelo 1992; Rebelo & Siegfried 1992). But there were challenges. Some scholars felt that the results of such analyses did not inform policy adequately.

"If political [conservation] targets are necessary, then they should be based on scientifically sound reserve design goals and protocols." (Soulé & Sanjayan 1998; p. 2061)

In addition, where the tools were becoming available adoption by managers was poor.

"The main reason for the low level of adoption of these tools is simply that land managers have been unaware of them. Where this has not been the case, low levels of funding, lack of understanding about the purpose of these tools and general antipathy towards what is seen as a prescriptive approach to conservation all play a part." (Prendergast *et al*. 1999; p. 484)

Globally the slow adoption of conservation planning tools led to situations where reserve selection did not result in achieving the best possible conservation outcomes.

"The first reserves were sited on a biologically ad hoc basis. But reserves selected in this way, and hence the reserve networks to which they contribute, are likely to be suboptimal for protecting biodiversity." (Prendergast *et al*. 1999; p. 485)

This scenario was reflected in South Africa including the Cape region.

"Prior to the 1980s natural area conservation was haphazard. The first realization that conservation was required occurred in 1938 when land was acquired at Cape Point for conservation, but conservation efforts then focussed on large mammals." (Rebelo *et al*. 2011; p. 28)

A consequence was that some Fynbos vegetation types were historically incorporated into protected areas whilst others remained as remnants on private land or on public land zoned for activities other than conservation (Milton *et al*. 1999). During this time conservation planning was emerging globally as a new science and mechanism to systematically identify critical areas and targets for conserving biodiversity (McKenzie *et al.* 1989; Peres & Terborgh 1995; Williams *et al*. 1996; Howard *et al*. 1998; Davis *et al*. 1999; Noss *et al*. 1999; Shafer 1999; Margules & Pressey 2000).

"For the reserve approach to be efficient and cost-effective, not only must individual reserves be sited accurately, but reserve networks must also be configured to optimize their conservation potential. This idea has spawned numerous methods for selecting the most effective (network of) reserves in a given region, and their development is now a sizable sub-discipline of theoretical conservation biology." (Prendergast *et al*. 1999; p. 485)

Conservation scientists and managers in South Africa had the opportunity to participate in the development and application of these planning approaches. While conservation planning initiatives were being developed and tested in various biomes across South Africa (Wessels *et al*. 1999; Fairbanks & Benn 2000), the development of biodiversity assessment and prioritisation tools was strongly influenced by scientists working on Fynbos (Cowling *et al*. 1999; Balmford 2003; Cowling *et al*. 2003; Pressey *et al*. 2003), and special efforts were made to promote adoption of the tools and their outcomes (Younge & Fowkes 2002). During this time the City of Cape Town became a leader among South African municipalities in the application of systematic biodiversity assessment (Margules & Pressey 2000). This supported motivations for selecting sites for protection, and facilitated collaboration with private land owners for the incorporation of relevant land parcels into formal conservation arrangements. The conservation lobby with regard to Fynbos in particular, was strengthened by emphasis given to the economic value of Fynbos.

"Natural resource-based tourism is one of the greatest income generators in the region, which is renowned for its beauty and floral diversity as well as other nature pursuits such as whale watching and angling. The total economic value of the Cape Floristic Region is estimated to be at least R10,000 million per year (US$1=R7 in 2000), equivalent to over 10% of the regional Gross Geographic Product." (Turpie *et al*. 2003; p. 233)

New insights into the role of biodiversity in sustaining ecological resilience and ecosystems services (Elmqvist *et al*. 2003; Luck *et al*. 2003) furthermore strengthened the notion that human well-being

depends on the protection and maintenance of biodiversity. Conservation scientists anticipated that biodiversity benefits would be lost unless public infrastructure was created to support Fynbos conservation. They lobbied successfully to Government and conservation agencies for the expansion of protected areas, the control of spreading alien species and, the re-establishment of indigenous vegetation in priority areas such as around Table Mountain (Cowling *et al*. 2003). The global conservation sector supported the lobby by accepting a nomination in 2004 for the Cape Floral Region to receive status as a UNESCO Serial World Heritage Site (whc.unesco.org; Accessed: August 2014).

National policies (regulatory instruments) were devised to reduce threats and support the structured assessment (Rouget *et al*. 2004), protection (Protected Areas Act 2003), plans for expansion (National Protected Area Expansion Strategy 2008) and management (National Environmental Management of Biodiversity Act 2004) of biodiversity. Conservation planning became an influential mechanism whereby conservation policy could be translated into action.

"The National Spatial Biodiversity Assessment (NSBA) relates to many South African laws and policies in various sectors such as the Biodiversity Act (no. 10 of 2004) and the Protected Areas Act (no. 57 of 2003), which together give us powerful tools for achieving management and conservation of biodiversity in production landscapes. A key provision in the Biodiversity Act allows the Minister or a Member of the Executive Committee to list threatened and protected ecosystems. This gives us a powerful mechanism to address biodiversity conservation effectively and efficiently, at the ecosystem scale. The Act does not specify how threatened ecosystems should be identified; the NSBA, together with existing systematic biodiversity plans at regional and local scale, provides an excellent starting point for this, based on best available science." (Driver *et al*. 2004; p. x)

These forces, originating from changes at national and global scales, converged, such that by 2005, the Tokai system was influenced both by a strong conservation movement as well as the decision by national government to transfer, in the public interest, some plantation forests to conservation agencies. The biodiversity lobby had much support and this, together with the simultaneous intention to withdraw commercial forestry from selected areas, set the scene for new, biodiversity-related meanings to direct revision of public infrastructure. Because the decisions and revision of infrastructure took place primarily at the national and international levels, recreational users of the Tokai plantations may not have been aware of the pending implications for landscape change at the level of Tokai. The new rules dictated that the pine trees must be permanently removed from various areas in the Cape, including Tokai, and replaced with Fynbos. When SANParks inherited the Tokai pine plantations on 1 April 2005, an agreement was signed with a private forestry company to harvest Tokai's pine trees over a period of 20 years.

For some decades up until this time, the City of Cape Town Municipality Biodiversity Management Branch had identified and promoted lowland Fynbos as a high priority Fynbos vegetation type for protection as part of the Cape Town municipal scale conservation plan.

"Conservation planning was first initiated for lowland areas in the southwestern Cape by Jarman (1986). In 2002 the first systematic conservation planning study was done to identify a City-wide biodiversity network that incorporated all conservation areas and Core Flora Sites. Several milestones have occurred in the acquisition of the reserve network. This includes the proclamation of the Table Mountain National Park on the Peninsula in 1998." (Rebelo *et al*. 2011; p. 28-30)

Another, more recent conservation plan for the City was devised (Laros & Benn 2007). For those promoting an appreciation of Fynbos, this created a chance for the City of Cape Town Municipality, together with the South African National Biodiversity Institute's (SANBI's) Threatened Plants Programme, to emphasise, to the managers of Table Mountain National Park in particular, the need to reinstate and conserve lowland Fynbos in the Tokai system and to highlight for society the meanings associated with a future heathland landscape for Tokai.

"Tokai is seen as an area of application and is currently the best and most viable (biggest in area) of the Cape Flats Sand Fynbos sites available for Fynbos restoration efforts. Thus SANBI is providing a service to the recovery and restoration initiatives for rare and endangered plant forms." (Interview 1)

These factors created an opportunity for some stakeholders in the biodiversity sector to negotiate and define a new biophysical setting for the future Tokai based primarily on biodiversity meanings.

"Well from my perspective, which is a biodiversity management perspective, we would like to see it [Tokai] as a core flora site, conserved for biodiversity." (Interview 30; City of Cape Town Biodiversity Management Branch)

Plans for the creation of the new setting included reconstructing the under-conserved and rare heathland vegetation type 'Cape Flats Sand Fynbos'.

"Huntley and Ellis (1984) investigated the conservation status of 189 mapped vegetation types in the five major biomes of Africa, south of the equator. Their results showed that lowland Fynbos is one of five vegetation types with the least area protected within national parks or nature reserves." (Jarman 1986; p.7)

"Today, 61% of the city's natural vegetation is transformed, with disproportionately high transformation in the lowlands, as a result of agriculture and urban sprawl. Not all of the Core Biodiversity Areas are in good habitat condition, especially in the lowlands; 28% of the lowland Core Biodiversity Areas are in poor condition and need ecological restoration compared to 1% in the uplands." (Holmes *et al.* 2012; p. 5)

"The area [within the City of Cape Town] of vegetation types conserved is 1–32% for lowland [Fynbos], compared to 16–99% for mountain [Fynbos]." (Rebelo *et al.* 2011; p. 29)

The call for a new Tokai landscape that reflects biodiversity meanings more strongly, accorded well with the SANParks mandate to conserve and restore, where feasible, rare and threatened vegetation types.

"The core objective of Government, when assigning the Tokai and Cecilia plantations to SANParks, was to manage conservation-worthy land in the national interest. Key to the SANParks biodiversity conservation mandate is the rehabilitation of threatened and endangered ecosystems." (SANParks 2009; p. 12)

"The lower areas of Tokai to, more or less, the western boundary of the Manor precinct, accommodate Cape Flats Sand Fynbos. According to SANBI's priority rating for this vegetation type, it is 'critically endangered', which means that very little of this vegetation type remains and all efforts should be made to conserve existing remnants but also to rehabilitate areas previously hosting this vegetation type." (SANParks 2009; p. 12)

"Here in Tokai we have Cape Flat Sand Fynbos… critically endangered… so... as SANParks it is our mandate to conserve natural vegetation and that we give a high priority to threatened ecosystems and vegetation and species... and because it's so special we have to save it." (Interview 32)

The possibility of restoring this unique and rare vegetation type led SANParks and Table Mountain National Park to define a vision for the new Tokai context. SANParks considered that the new Tokai landscape should reflect large-scale ecological processes together with the appropriate species and habitat complements.

"For these ecosystems to survive in the long-term, it is important that ecological corridors are established to link the different vegetation types. Different types of ecological corridors exist, namely, riparian corridors (along river systems) and terrestrial corridors (overland). In the case of Tokai, both need to be established to ensure the survival of the lowland ecosystems and the specific vegetation types." (SANParks 2009; p. 12)

"Tokai represents one of the last opportunities to effectively link ecological processes from the mountain to the lowlands." (SANParks 2009; p. 10)

In line with this vision, SANParks identified, on my request, features and management objectives for the future Tokai in accordance with IUCN protected area categories. SANParks highlighted selected aspects of three IUCN categories, namely, a national park (Category II), a habitat/species management area (IV) and a protected landscape/seascape (V) (SANParks pers. comm.):

(II) *An area set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities;* (IV) *To maintain, conserve and restore species and habitats.* And; (V) *A protected area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value.* (www.iucn.org).

SANParks together with their partners in the Tokai Fynbos restoration initiative furthermore considered that re-establishing Cape Flats Sand Fynbos at Tokai was especially important because of the opportunity that held to restore landscape-level ecological function (SANParks 2009), and which they felt could not be achieved elsewhere.

"The restoration of Tokai represents one of our last opportunities to link ecological processes from Table Mountain to the Cape Flats, as well as to rehabilitate a sustainable area of critically endangered Cape Flats Sand Fynbos." (Hitchcock *et al.* 2012; p. 30)

"So... when you think of the renosterveld in Table Mountain, it's a tiny piece and it's fragmented...there's some on Signal Hill... there's some on Devil's Peak... but this [Tokai] is one unit where we can have a corridor from the mountain to the plains... so you've the whole complement... so you've got a mini-version of what Cape Town once looked like." (Interview 32; SANParks)

The change in public infrastructure, set at the national level, dictating the permanent removal of pine trees at Tokai, when finally implemented at the level of Tokai from 2005, came as a surprise to some.

"The fact that thousands of people were shocked and horrified, when they saw the pine trees being cut down, indicates that nobody really knew about it much." (Interview 2)

"I got this leaflet in my post box one morning from 'Cool Forests' that said that the Tokai pine trees are going to be permanently removed and so on. I read it and my heart just about stopped. I thought the State forest is going to be there forever." (Interview 4)

This was so in particular because the Government Press Release of 2003 (Kasrils 2003)* reinforced the notion that, despite the national decision to withdraw commercial forestry from some areas of the Cape, the plantations of Tokai would continue to function as a commercial enterprise whilst accommodating recreation meanings much in the same way as during the plantation forestry era.

"In terms of the transfer, SANParks will continue to accommodate MTO's commercial forestry activities, but will manage the plantations on a multiple use and sustainable basis within a broader conservation framework. We have made it very clear that a balance must be achieved between the interests of the Cape Town community and the important conservation objectives which SANParks is expected to achieve. The Department has emphasised that the intention is not to remove plantation forests. The plantation areas provide for high impact tourism activities, diverting significant volumes of visitor traffic and thus helping to conserve very sensitive ecosystems. Conservation and commercial timber production would therefore co-exist on the same area, managed in an integrated and mutually beneficial manner by a single management authority." (Kasrils 2003)

The surprise in response to the permanent removal of the trees was heightened for some, as the press release (Kasrils 2003) declared that SANParks had been in agreement with the approach to retain the plantations in Tokai and to promote biodiversity meanings as well as to retain the Tokai plantations to sustain recreation meanings associated with the pine plantations.

"SANParks for its part has indicated that they would retain the commercial forestry areas, as an integral part of their conservation efforts. They have committed to preparing a publicly accepted plan, which will strive to find a balance between conservation, timber production, outdoor recreation and the cultural landscape values." (Kasrils 2003)

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*Ronald Kasrils was South Africa's Minister of Water Affairs and Forestry from 1999 to 2004.

At this time, there was again a shift in how the resource was perceived. In the plantation forestry era, timber was first regarded as the resource and this evolved into a perspective whereby the plantations were seen by foresters and recreationists as the resource. With the entry of SANParks as the managing agency a new context was defined for Tokai. And with that a new perspective on the resource emerged. SANParks in particular viewed the resource to be the Tokai landscape and the different indigenous vegetation types it supports and may support in the future. According to this understanding the transformation from a treed landscape to an almost entirely heathland landscape meant that the attributes of the resource would be altered intentionally to prioritise the meanings negotiated by proponents of Fynbos conservation. For others, some meanings would no longer be associated with the resource.

SANParks consulted with the public in 2006 and incorporated public comments into their site plan for Tokai (SANParks 2009). Although the resource was set to change in many ways, in particular to emphasise biodiversity meanings, the agency sought to sustain some of the 'old' meanings developed during the plantation forestry era. The agency did this by stating an intention to retain, upgrade and enhance selected existing features of Tokai, for example heritage attributes such as the Tokai Manor House and outbuildings, associated offices and residences as well as the arboretum.

"The Tokai Manor precinct, consisting of the historic Tokai Manor House and outbuildings, old reformatory, Arboretum and a variety of offices, residences and service buildings is designated to accommodate a high volume of visitors and a range of visitor facilities, uses and activities. Currently, the entire precinct is run down and in need of rehabilitation, upgrade, landscaping and renovation and a detailed precinct plan is required to indicate how and where this will happen." (SANParks 2009; p. 13)

The picnic-and-barbeque site would be retained but re-aligned to accommodate an ecological corridor linking the mountain and the lowland ecological processes (SANParks 2009)

"The current picnic area needs to be realigned to allow for the establishment of the terrestrial ecological corridor to link the lowland Fynbos to the mountain Fynbos areas. This re-alignment provides the opportunity to upgrade and improve the quality and level of service of the Picnic-Braai area, for both current and future users." (SANParks 2009; p. 20)

To accommodate some of the past meanings, it was stated that areas of shade would be provided by the arboretum and by riparian areas. Temporary (medium term) shade would also be created by replanting fast-growing pine species in 'transitional areas' in selected areas along the urban edge and next to the arboretum.

"This concept provides for certain designated 'transition areas' to be replanted with non-invasive exotic trees in limited areas along the periphery and to consolidate existing planted areas. This is a long term conservation strategy which accommodates both shaded recreational needs and heritage concerns for maintaining planted landscapes along the Urban Edge, whilst not undermining the core biodiversity objective or the rehabilitation potential of these designated 'transition areas'. 'Transition areas' are proposed for lower Tokai along the urban edge periphery; and alongside the Tokai Arboretum to create a consolidated shade area'." (SANParks 2009; p. 19)

After 20 years the pines in transitional areas will be harvested and not replanted (SANParks 2009).

In line with SANParks' intention to retain some landscape features to accommodate past meanings, there has also been a suggestion that heritage aspects relating to, for example, the equestrian character of the area, may be retained.

"We've been negotiating with SANParks to have an area set aside, which they've done, we're just negotiating with them how it's going to be run, for an equestrian precinct – so an area there where people can exercise horses and use horses." (Interview 12)

According to this framework (SANParks 2009), and apart from changes to the resource, the rules of access and use were also adjusted. Access was facilitated in some areas but in other areas access and use became more restricted compared to the levels of access and use in the plantation forestry era (SANParks 2009).

"Historically people walked anywhere in the pine plantation. In planning the conservation area of the Tokai Park, it was decided that a core area would be established to allow animals such as 'Grysbok' to survive. Paths along one quarter of the canal were closed to allow water birds and animals (including the Cape Clawless Otter) refuge." (Hitchcock *et al*. 2012; p. 32)

"In that pine plantation you can just walk where ever you want you know and the dogs run under the trees." (Interview 4)

All recreation activities in Tokai were allowed to continue, although pathways have become formalised as areas of pine trees are clear-felled, in order to limit impacts on recovering Fynbos. Under SANParks management, a new walkway was created along the periphery of lower Tokai, including recreational areas ('jungle gyms') for children. Changes to the resource attributes as well as changes in access, i.e., new access and use of some areas and more restricted access and use in other areas, meant that some meanings and benefits from the plantation forestry era could be accommodated, but only some of them and not to the same extent as when the context was defined by plantation forestry. For those who held positive meanings in association with Fynbos, the changes brought greater opportunity to experience meanings and benefits associated with a heathland landscape. The framework offered by the new management agency (SANParks 2009) reflected an attempt to accommodate meanings from the plantation forestry era, by providing continued access to the resource, by sustaining existing resource attributes, e.g., the arboretum, by creating new resource attributes such as shaded areas (e.g. restoring riparian Afromontane forests) and by encouraging recreationists to use alternatives such as green belts around the City (where old meanings can be substituted), while promoting biodiversity meanings through rehabilitation of rare and threatened Fynbos types.

"These mandates require SANParks to focus on the conservation of biodiversity, but also to accommodate recreational activities, heritage resources as well as future use and access to the Park by the public." (SANParks 2009; p. 17)

"Recognising that Table Mountain National Park is a nationally protected conservation area, there are within the city areas, 18 km of established public open space that form part of the Constantia and Tokai greenbelt system which can be planted with shade trees for recreation." (SANParks 2011; p. 3)

As the pine plantations were being removed and replaced by heathland vegetation, some stakeholders were willing to reorder their meanings and expectations of benefits. For them, the change became perceived to be beneficial. For others, the change introduced a threat to the meanings they held in association with Tokai and they anticipated a loss in benefits they had enjoyed in the past. Most of the respondents interviewed felt that the change in context brought a combination of negative and positive changes, with some meanings and benefits being lost and others gained.

"Yes, it won't be as shady as it was before but, we will recover some of the Fynbos types we have lost over the years." (Interview 20)

"Yes, and I loved the river and those huge trees, those trees were just amazing to look at. But I can understand it…because now you look at the river and you see it's flowing a bit more." (Interview 15)

Removal of the pine trees created more open and distant views. Some respondents emphasised 'scenic beauty' and aesthetic enhancement as a meaning and benefit they associated with the new heathland landscape context. (Plate 5.9)

"It is quite a shock when you see these trees going but it has opened up this amazing view of the mountain and you can see down into False Bay and things like that... it is really lovely... you know... it opens up a 'space'." (Interview 19)

Plate 5.9. Some respondents mentioned the opening of views with the removal of the plantation trees. In this photo, Constantiaberg, with remaining plantation, can be seen in the background and Fynbos under restoration in the foreground. (Photo: Claudia van Wyk)

Some users emphasised 'wildlife sanctuary' and 'ecological value' as important meanings associated with the heathland-dominated landscape. (Plate 5.10 and 5.11)

"With the Fynbos coming back, we're talking about hundreds of species per square metre! We fully support the removal of the pines because we understand how essential this would be for the ecology." (Interview 16)

Plates 5.10 and 5.11. Indigenous fynbos recovering in lower Tokai following the removal of pine trees. (Photos: Ernita van Wyk)

Linked to the meaning 'ecological value' and the notion of restoration, 'knowledge systems' emerged as an important benefit. Some respondents saw re-establishment of Fynbos as an opportunity for learning how best to restore indigenous vegetation.

"Tokai has various niche habitats, allowing researchers to learn 'how to do this'. It allows for the development of a protocol for when species disappear. For example, finding the most efficient methods to yield best success in growth and restoration of target species." (Interview 1)

Links with the natural heritage heathland ('links to the past') that would have existed in this area prior to European colonisation were also mentioned.

"And that's what I want to see - a pre-settler landscape... and pines don't form part of that landscape." (Interview 23)

The plan to clear-fell the entire 600 ha Tokai plantation over a period of 20 years starting in 2005, created immediate effects over a larger spatial and faster temporal scale than before. The relatively fast change in the biophysical context and consequences for user activities and experiences in Tokai resulted in negative sentiments expressed by some respondents. Visual (aesthetic) impacts, impacts on wildlife and erosion following clear-felling were concerns mentioned in interviews.

"Tokai was always a really nice place to go cycling because it had shade but they chopped it down so now you don't want to take tourists to a place that looks like it's been napalmed... because they don't clean it up... I don't think they take care when they take it [the trees] out." (Interview 7)

"And once they started cutting, we had a huge proliferation of rats and snakes. We had five puff adder bites and the one horse died. So this wildlife that adapted [to the plantation forest] has literally had to move out." (Interview 28)

"And... the erosion is huge [after tree harvesting]... soil washing onto tracks... new streams being formed... it's just such a great shame." (Interview 35)

Respondents spoke readily about the meanings and benefits they thought are being reduced or that will no longer be accommodated with the removal of the pine trees. Apart from the immediate visual consequences following the felling of pine trees, some felt a loss of 'dependence', or 'recreation satisfaction' as well as much reduced freedom of movement in the area (reduced 'sense of purpose').

"I loved it... I loved riding in those trees... the forests and the pines... I find that the pathways under pines, especially as the pines get bigger... seem to be protected, so your riding experience is a lot softer... this is what I really miss the most... is that the pathways are now eroded quickly and it is more and more difficult to find stretches of path where you can do fast work with your horse." (Interview 18)

"As dog walkers we don't always use that [new clay] path because we like to wander in and out of the forest... they're closing a lot of the little paths because they want the Fynbos to grow but we would like a couple of them to remain open so that we can go across especially so that we can avoid peak times on the clay path... it's nice to let the dogs run and meet other dogs and we don't always want to just stick to the paths and that's why I go to the forest." (Interview 26)

The loss of regulating services (benefits) provided by a shaded, wooded environment were emphasised by some respondents as they felt that the trees stabilised the soil and protected paths and tracks used for recreation. Lack of protection from the sun and wind (reduced 'local climate regulation') emerged as a source of dissatisfaction among some respondents with regard to the transformation from plantation forest to open heathland.

"Mountain biking exists because of trees. It's a sustainable way of having a trail because you shelter the trail from the elements... [the trail] is not susceptible to wind, so the trees form a wind break, it's got shelter from direct sunlight... it's got shelter from direct rain... and so all these things bring your maintenance frequency down... so... there has been a bit of a shift now in terms of how Tokai works in terms of maintenance where it's been a voluntary system before, it no longer can be. It's [now] got to be a full time thing, staff have to be employed... it's got to be run like a business." (Interview 16)

"My husband suffers from skin cancer so we are limited to the little section of forest remaining." (Interview 15)

"..you can't ride you know, it's summer, it's thirty degrees [Celcius]..you can't go cycling in that kind of weather ..it's dangerous from a heat stroke point of view..Tokai was always a really nice place to go cycling because it had shade." (Interview 7)

Some respondents accepted the change begrudgingly as they felt that resisting the change would be futile. They felt that there was no effective way to influence the transition from pine plantation to a heathland-dominated landscape. And some were left with few, if any, alternative options because relocating from the area was considered too costly. Some respondents felt that they had no choice but to use the resource in its transformed state.

"Well..I can't see it [action] making a difference..I feel a decision has been made.'" (Interview 24)

"I'd have to [ride in Tokai] because I live here, what else can I do? We could truck our horses to Noordhoek once or twice a month but that takes time." (Interview 18)

In order to retain the benefits they had accessed in the past some users indicated they achieved this by adjusting the time of day during which they use the heathland landscape to avoid being exposed during the hottest part of the day. With less shade, some users confined recreation times to mornings and late afternoons.

"...you've got no shade to walk under, so you've got to change your walking habits to early morning and late evening." (Interview 10)

In lower Tokai (the most accessible part of Tokai) most of the pathways that used to traverse the plantation were closed to protect the Fynbos under restoration. A new perimeter pathway was installed to confine use to areas outside of the recovering Fynbos. The new pathway made the area more accessible to some users (e.g. mothers with babies in prams). At the time of writing the pathway still traversed limited shaded areas with pine trees not yet harvested.

"The walkway has resulted in many more people using the forest i.e., young families, with kids, prams, etc. and mountain bikers and joggers" (Interview 8)

With users being restricted to fewer pathways and choosing to recreate during the cooler times of the day, some felt crowded and anticipated tensions between especially dogs and horses.

"I think the lower forest is very crowded. Over the weekend, at 8 am in the morning or at 5 pm at night is a poor time because everybody is there and the possibility of accidents and dogs chasing horses and people falling off." (Interview 28)

Some users showed resistance by changing landscape attributes to facilitate previous meanings, such as the access and freedom of choice users previously had in the plantation forest. For example some paths across the Fynbos area had been closed by logs across the paths but these logs were moved aside by some users to re-open the access to pathways used when the plantation existed there.

"The other day we were walking on a designated path in the Fynbos area, and I saw a woman coming from the other direction and she says, 'I've walked here for so many years, I don't see why these logs should stop me now, and every time I come past I push them away'." (Interview 29)

"So we've tried to rationalize the paths... because there were people walking everywhere under the pines and so there's been a bit of a problem with a few users who insist on opening up some of the paths that's been closed." (Interview 30)

Some respondents organised groups of people with shared meanings to engage the conservation agency or to use the popular media to create and publicise resistance, initially to the decision to remove the pine trees from Tokai and later to challenge the way in which SANParks proposed to provide shaded areas for the future Tokai.

"We have formalised a rider group, the Tokai District Riders Association, and we've been negotiating with SANParks is to have an area set aside for an equestrian precinct." (Interview 12)

"We set up 'Shout for Shade', and then sent leaflets out. We distributed something like 20 000 leaflets in all the suburbs around here. Our main weapon is publicity." (Interview 2)

Some respondents engaged the debate through communications in the popular press in their capacity as concerned individuals or groups. Some resisted change while others offered support for the envisaged changes in the landscape.

"And when I read this I was so incensed, it fuelled me to write a letter." (Interview 4)

"You know it was at the time that... you know when the Cool Forests organisation was quite active, and so I wrote letters counter-acting what they were saying." (Interview 13)

Some respondents mentioned alternative resources to use, other than Tokai, to sustain their meanings, and that were within reach from their homes. But Tokai was a preferred landscape, either because the alternatives were not shaded environments and therefore could not substitute or because Tokai was the closest and most convenient place for frequent access to a recreation area.

"Near our house there is a green belt. We walk there occasionally because it's only two blocks away... but we're not mad about walking there... we prefer to walk in a treed environment." (Interview 17)

"Other places used are Silvermine, Newlands forest, Cecilia forest and Groot Constantia and Scarborough beach, all good options but Tokai is a convenient option, as we live three minutes' walk from the forest and the dogs get walked every day." (Interview 8)

Some respondents felt it was no longer possible to fulfil the meanings and secure the benefits they associated with Tokai and so they invested in finding resources, sometimes further away, to accommodate their meanings and to experience similar benefits. The mushroom foragers for example, have tried to use resources further away from Cape Town but they anticipated that that option would become unaffordable because of the rising cost of fuel and the time it takes to travel to alternative locations.

"I tend to find other places now. There are about 120 km of mountain bike track out at Durbanville and I often go." (Interview 22)

"If Tokai were gone and I'm looking for pine-associated mushrooms, I'd have to go further to Jonkershoek... Grabouw... but with petrol prices escalating... I would much rather have local foraging." (Interview 33)

In contrast to seeking alternative landscapes for recreation, some users felt that, because the meanings they have prioritised are accommodated by the heathland landscape, they would prefer to recreate in the new heathland landscape. (Plate 5.12)

"I'll definitely be using it more. It's far more pleasant to walk in Fynbos than in a plantation." (Interview 13)

Plate 5.12. Users recreating in the open sunny conditions on the new perimeter path in lower Tokai. (Photo: Ernita van Wyk)

The framework developed in Chapter 2 suggests that rules, or, regulatory instruments ('public infrastructure') are developed collectively by the users and by the public infrastructure providers. Together they negotiate contexts and meanings, order meanings and come to agreement on the distribution of costs and benefits. Rules and policies are formulated and affirmed upon these deliberations and decisions. Public infrastructure is therefore an outcome of stakeholder negotiation. In this way the stakeholders jointly influence the rules and the attributes of the rule-making process and shape the attributes of the resource to conform with their preferences. Perceptions of the public participation process are thus considered to affect behaviour of those who use or seek to use the resource.

The public engagement process initiated by SANParks in 2006 stimulated some users of Tokai to learn about the biodiversity meanings of the Tokai Fynbos. This helped to develop appreciation and support for the motivations underpinning the decision to restore lowland Fynbos in Tokai.

"I never made a distinction between mountain Fynbos or sandstone Fynbos or sand Fynbos. I didn't know the difference... it was all Fynbos and to me... it was only over the last few years that I've... you know... got an understanding of the difference and I was never really aware of that." (Interview 4)

"When we went to one of the meetings, and [a botanist] said 'the reason is that there are these seed beds that are buried for 50 years and we would lose them forever..' then you start looking at it in a different way... once it was explained to us... to my husband and I, we could see a different thing in it." (Interview 15)

Responses also reflected criticism of the process leading up to development of new infrastructure and of the manner in which the new rules were to be implemented. Some respondents indicated that they had an expectation of more serious integration of public perspectives into the change process. There was a perception that national parks generally should be regarded as public resources and that this should have promoted greater public influence on the development of public infrastructure and how it was to be implemented.

"The bulk of the people are ignorant, they don't know about the value of Fynbos'. Which is probably true, they don't know about that, but at the end of the day the bulk of the people have to determine the use of a public facility." (Interview 2)

"If you read the modern IUCN literature... no national park can have a management plan without full consultation with their neighbours. People have to have inputs. If the people don't like the plan, the plan will change and it may then not be the best biodiversity plan but it's a workable solution because the people accept it." (Interview 6)

Some respondents accepted that the change in public infrastructure had come about in the national interest and realised that, as users, it was not possible or feasible any longer to try to change the decision to remove pine trees from Tokai.

"Table Mountain National Park had an open day. They had some maps on the walls and they had some things explaining what was going to be done. I walked around and got chatting to one of the TMNP staff and he said to me 'you know there's no point in protesting, because the trees have already been sold, and money has exchanged hands." (Interview 4)

"We believe there is no way to save the pines and nor maybe in the interest of the mountain, should we save the pines. So, once we abandon the idea of saving the pines, we then have to decide, what do we put in their place." (Interview 2)

Some therefore turned their attention instead, to influencing the manner in which the new rules were to be implemented in Tokai.

"Initially all the campaigns focused on trying to preserve some areas with pine trees because everybody knows how long it takes for trees to mature. [But] they had made a decision and for us now we've come to the conclusion to try and save the pine trees is basically a lost cause. So in our proposal we've proposed something different... something for the future generation, for our children." (Interview 4)

"And that is now where the discussion is. We accept that the pines have got to come down, but we say there must be much more shade trees, and we can plant indigenous shade trees." (Interview 2)

In 2012 some users prepared a proposal to Table Mountain National Park management in which they proposed an adjustment to how the new rules (public infrastructure) could be implemented.

"We value Fynbos but we are saying that the balance is already way wrong against trees. We're basically saying: replace the transition areas with what we call 'parkscape' which is indigenous trees, permanent... they don't get cut down... and where the public can sit and enjoy all the things that they used to, and we've done it in such a way that we've slightly increased the area under Fynbos." (Interview 2)

Some respondents felt that the context for implementing the rules in the Tokai landscape should at least have been defined in part by the fact that Tokai is an urban resource albeit as part of a national park.

"The rules of an urban national park ought to be different to the rules for a park out in the middle of... it's not like Kruger [National Park]... it's different, the fact that it is in an urban setting, means different rules apply." (Interview 2)

"The park has the mandate to conserve the natural environment but TMNP is special because it is a park and a mountain in the middle of a city." (Interview 20)

They felt that it was important to retain some resource attributes such as shade in order to sustain some of the benefits that users experienced in the plantation forestry era. They also felt that the need for areas that offer shaded relaxation and recreation would become greater in the future with expected increase in the population of Cape Town.

"In 2010, the city's population was estimated at 3.7 million, with an annual increase of 55,000 people, mainly through immigration from other provinces." (Holmes *et al.* 2012; p. 1)

Some respondents felt that the decision to remove pine trees from Tokai was not effectively communicated by the agency and they assumed that this signified unwillingness to engage users.

"At first it was just like... rumours... it was never very clearly articulated or expressed. The public had to find out via hear-say; and so, what happens with that kind of thing, you discover it and you feel that it's being hidden, and you feel that it's very underhanded, so you start to feel angry." (Interview 4)

"The main thing, and what got everyone's back up, is that I don't think they've kept us in the loop. They didn't tell us... there was a communication problem." (Interview 15)

"There's a notice board in the forest but there's no information on there... on the boards there is no contact information. For something like this which has such a huge impact on the community... they should have a community liaison officer or somebody who is appointed to do that... you know... it's disgraceful." (Interview 35)

Some respondents felt that the agency was non-responsive or dismissive of proposals from users wishing to engage the agency around the manner in which the combination of old and new meanings were to be reflected in the future Tokai landscape.

"And basically he was saying to SANParks that the staff at TMNP are not responding to what the public wants." (Interview 2)

"Then I heard about the public participation process, so I put all my ideas in a document and I drew maps and I submitted that. I don't even know if they read it to be honest. I felt and a lot of people felt, no matter what you say, it's just completely dismissed." (Interview 4)

As a consequence, some users felt that their meanings were not being acknowledged or considered.

"These people [management agency] are dismissing everything that you're saying; and I think if they had maybe acknowledged people's sadness or 'upsetness' or whatever you want to call it... if they'd acknowledged it, and said we understand how you feel but please try and understand. But they didn't, they dismissed it, so I think that made it even worse." (Interview 4)

"I get the feeling that SANParks doesn't really care. I think they feel it [removing the pine trees] is environmentally the right thing to do and they will do it regardless of how the local community is experiencing the forest." (Interview 24)

"I think if they gave greater acknowledgement they'd also have less hysteria because by the time people fling themselves into the SANParks doorstep and threaten to chain themselves to a tree, it's all got way beyond discussion." (Interview 28)

When dialogue did take place between users and the management agency, some respondents felt that prejudices within the agency shaped their engagement in ways that discouraged both the expression of and appreciation for user meanings.

"I think people don't so much mind the reasoning as the way perhaps it's been handled... I think they need to understand more about people's enjoyment of nature." (Interview 24)

"And the mistake that I feel that they [the management agency] made is that they said that we're a bunch of emotional, ranting, raving... and that we were ignorant, 'misinformed' and that there's no scientific basis for our protest. I think that actually made it worse. You know because then you start to feel not only are you taking away our lovely forest, you are also calling us misinformed and emotional, ranting raving twits. It's almost as though you're not allowed to have feelings, you have to decide everything on a scientific basis." (Interview 4)

Responses from agency personnel provide some justification for the feelings expressed by users.

"I don't think a conservation agency should be busying itself with putting shade for people to walk in the middle of the day in summer, when it's the most critically endangered ecosystem in the country... and the most under-conserved." (Interview 30)

"Often emotionally charged, what is sorely lacking in many of the views expressed is the hard facts about the reality of the situation. All these facts were made widely available during the public process run in 2006/7 by South African National Parks on the future of Tokai." (SANParks 2011)

"So... when we were putting the plan (SANParks 2009) *together... the first thing that we said that we know that recreational activity isn't limited by trees... meaning that people walk and mountain bike and horse ride in parts of the Park where there are sunny conditions... and they get very well used... so you know... trees per se don't prevent a recreational activity from happening."* (Interview 34)

"This notion of 'perceived rights'... before the early 1990s... the plantation wasn't open to recreation by people... it was only in the mid-1990s when [the forestry company] undertook a recreational policy and then opened up the picnic site and all those things... and so people jumped on board thinking that people have been here for 50... 60 years." (Interview 34)

"So, taking down the pines...it's going to happen. It was commercial plantation and they're going to harvest those trees for the money. Everyone was saying 'Tokai Plantation' but the plantation is going so we needed to change that mindset and the name 'Tokai Forest' was even worse because it's not even a forest." (Interview 32) (Plates 5.13 and 5.14)

Plate 5.13 (left) a sign for Tokai Forest before the change in public infrastructure. Plate 5.14 (right) a sign for Tokai Plantation after the incoming agency became the land manager of Tokai. (Photos: Ernita van Wyk)

Because some users perceived that the consultation process was not designed to acknowledge or incorporate their meanings they felt their participation was being manipulated to indicate support for what the agency was doing. Consequently they did not trust the agency's participatory process.

"What happened was TMNP came up with a policy that they wanted to promote the restoration of large areas of Fynbos, and they manipulated the public process to get what they wanted. They don't understand the depth of public responses." (Interview 2)

"A lot of people think that SANParks is going through the motions... with the public process... what they need to do legally in order to do what they want." (Interview 24)

"So I think they are doing what they have to... to meet minimum requirements in order to just tick the boxes to say they've done it." (Interview 35)

Perceptions that the agency's participatory process was not genuine were enhanced when some users observed low levels of commitment to mitigation that was expected to sustain some of the meanings associated with the plantation forests.

"And they have started to plant indigenous trees... but they're not cared for... they're not looked after... they're not given any water in the summer and the soil is poor and sandy... so I don't see how they're expecting this transition to work successfully... you know... unless you actually support the changes." (Interview 35)

For some respondents, these developments have led to a sense of mistrust of the intentions of the agency in general.

"Unfortunately in National Parks they've got their own hidden agendas. They pay lip service to what these pressure groups have to say. They say one thing and do another thing. So from my personal view I don't think National Parks is trustworthy." (Interview 10)

A sense of mistrust in some respondents was further fuelled by agency's claims that the change in the resource enjoyed wide public support.

"And you know in the newspaper, when this first came out, their 2009 management framework, there was a big article...sort of um... introducing this framework... a big article with a picture... and it said in that although the minority is not happy, the majority is delighted. And then you read about this compromise proposal in the newspaper and everyone is supposedly delighted and I thought: 'what spin-doctoring... what utter rubbish!" They made it up, they completely made it up and people were not happy and soon after that, in 2010, I organised a survey and I can tell you the majority of the public was not delighted. They were extremely upset. There was a small percentage of people whom I interviewed who were happy, and most of them were disgusted." (Interview 4)

Recent statements by the agency affirm their claim that stakeholders have reprioritised their meanings to give greater priority to Fynbos biodiversity meanings and that as a consequence, users of Tokai are behaving in ways that are supportive of the new heathland landscape.

"Initially there were a lot of mixed reactions... it has been a huge learning curve and a long process but SANParks is slowly winning over stakeholders and changing mindsets. It turns out that more people are using the area now that it has been restored, than ever before." (SANParks 2014)

5.5   Summary

In the preceding sections, I used historical information, policy documents and a selection of quotes to illustrate how meanings evolved over time and became prioritised and reflected in public infrastructure and how stakeholders behaved as a result. The full range of meanings and benefits as expressed by respondents is summarised in Tables 5.2 (meanings) and 5.3 (benefits).

Table 5.2. Summary of meanings associated with plantation forests, Fynbos and reduced meanings as a result of the permanent removal of pine trees from Tokai.

Range of meanings highlighted by respondents	Meanings – plantation forest	Meanings – heathland (Fynbos)	Meanings reduced as a result of permanent removal of plantation
Dependence	X		X
Therapy	X	X	X
Links with the past	X	X	X
Sense of community	X	X	
Identity	X	X	
Sustenance	X		
Commodity	X		
Planning, care and management	X		
Landscape intimacy	X		
Landscape pattern	X		
Sense of purpose	X		X
Wildlife sanctuary	X	X	X
Scenic beauty	X	X	X
Sanctuary for worship	X	X	
Romantic love	X		
Ecological value		X	

Table 5.3. Summary of benefits associated with plantation forests, Fynbos and reduced benefits as a result of the permanent removal of pine trees from Tokai.

Benefits highlighted by respondents	Benefits – plantation forest	Benefits – heathland (Fynbos)	Benefits reduced as a result of permanent removal of plantation
Cultural services			
Recreation and tourism	X	X	X
Cultural heritage	X	X	
Educational values	X	X	
Social relations	X		X
Spiritual and religious values	X	X	
Sense of place	X		
Knowledge systems	X	X	
Aesthetic values	X	X	X
Inspiration	X		
Provisioning services			
Food and fibre	X		X
Genetic resource	X	X	
Water		X	
Regulatory services			
Local climate regulation	X		X
Regulation of human diseases			X
Erosion control			X

The framework I presented in Chapter 2 depicts a robust social-ecological system as one in which the resource users and public infrastructure providers jointly negotiate a biophysical setting that reflects the prioritised meanings they attach to the resource. Prioritised meanings are incorporated into the public infrastructure and this, in turn, has implications for how the resource is configured and managed, how users perceive benefits and how users behave.

In the case of the plantation forestry era of Tokai, the management agency initially resisted the adoption of recreation meanings, but, over time, and as the agency realised that it could gain stakeholder support for its image as a public service provider, the agency accommodated recreation meanings and benefits alongside the meanings it prioritised for timber production. This was reflected in how perceptions of what constituted the resource changed from 'timber' to 'plantation' or Forest as new (recreation) meanings were accommodated. It was also evident in the provision of physical infrastructure that serviced resource users. As perceived benefits were realised, behaviour supported the negotiated prioritisation and distribution of benefits, and the public infrastructure, as was clearly evident in the results. Supportive behaviour, although more individual than collective, contributed to managing the resource in order to yield the desired benefits as shown in, for example, the pattern of timber harvesting, the manner in which stakeholders were kept informed, and in the willingness to provide the necessary physical infrastructure. When these reinforcing processes are operating effectively the social-ecological system can be considered robust: it is resistant to change while at the same time able to accommodate negotiated change, and there is reliability and consistency in the accommodation of meanings and the distribution of benefits. At the time that national policy changed and SANParks was to take over as the managing agency the Tokai social-ecological system was robust.

More than a hundred years following the establishment of plantation forestry at Tokai, the introduction of new public infrastructure that originated at various levels and, primarily, outside of the Tokai social-ecological system, emphasised biodiversity meanings and called for the permanent removal of the pine plantations. The conservation agency defined the context for the future Tokai landscape according to the scarcity and uniqueness of lowland Fynbos, which they argue can only be regenerated at Tokai. Whilst many accepted this motivation, some stakeholders felt that, in conjunction with Fynbos restoration, the agency should at the same time have given greater priority to those meanings and benefits that developed during the plantation forest era, in particular those meanings associated with mature, shade trees in the landscape. In other words, some stakeholders called for a greater degree of accommodation of old meanings and the benefits associated with a landscape reflective of those meanings, alongside the development of a landscape that reflects predominantly new, biodiversity meanings. The way in which meanings were perceived to be handled led some stakeholders to protest. There was uncertainty around the prioritisation of meanings and the distribution of benefits and about how the new landscape would reflect the combination of old and new meaning prioritisations. This resulted in a variety of resistance behaviours and the abandoning of the use of Tokai by some. There was diminished trust in the participatory process and in the agency, based on perceived unreceptiveness and unwillingness to acknowledge or consider user meanings and user suggestions for how old and new meanings may be incorporated into the implementation of the new rules (public infrastructure). The accommodation and ordering of meanings, the distribution of benefits and the processes whereby they were negotiated became less reliable and less consistent and this challenged the robustness of the Tokai system. It will be some time before the new Tokai social-ecological system will become robust.

Change is an inevitable property of dynamic social-ecological systems. In the context of this study, I suggest that change will always require a reprioritisation of meanings. This was evident in the development and expansion of meanings in the plantation forestry era which led to incremental adjustments in the public infrastructure. It was also reflected in the Tokai system 'disturbance' brought on by a strong conservation lobby and which called for the evaluation and reordering of new and old meanings. The study shows that when there is a process that allows meanings and public infrastructure to co-evolve it results in supportive behaviour that reinforces both the process and the infrastructure; in other words it fosters robustness of the SES. In the later phase it also illustrates that when meanings are not carefully considered and taken into account in the process of formulating public infrastructure the system becomes unstable as the ordering of meanings and public infrastructure are contested by some and supported by others: the SES becomes less robust. As some users re-order their meanings and engage the process of forming the new public infrastructure and others abandon using the resource, behaviours will become more supportive and co-evolutionary and the SES is likely to become more robust over time.

CHAPTER 6

DISCUSSION AND CONCLUSIONS

MEANINGS, ROBUSTNESS AND INSTITUTIONAL DESIGN: IMPLICATIONS FOR MANAGING CHANGE

In Chapter 5 I presented results from a historical narrative analysis illustrating co-evolution of meanings and infrastructure, the effect of this on the expectation and realisation of benefits, and implications for behaviours and for social-ecological system robustness. In particular Chapter 5 highlighted a change scenario whereby the reprioritisation of meanings and revision of public infrastructure gave rise to behaviours supportive of the change as well as behaviours signifying resistance to the change. The results illustrate loss of robustness of the system as a consequence of reduced reliability in the co-evolution of meanings and public infrastructure. However the credibility of these findings depends upon the appropriateness and effectiveness of the method as well as the strength of the case material for the purpose of testing the study propositions. Credibility of the findings also depends on the applicability of the conceptual framework for deriving insights in relation to the study propositions, given the choice of methods and case material.

In this Chapter I reflect on the appropriateness and effectiveness of the method used to elicit stakeholder meanings and expectations of benefits accruing from the resource and to illustrate the dynamic interaction between meanings and behaviours. I also consider the suitability of the choice of case study (Chapter 3) and whether it provided the material necessary to validate the conceptual framework developed in Chapter 2. I then discuss the effectiveness and limitations of the framework in the context of its application to the chosen case material as well as the potential for application to other examples of social-ecological change. I highlight a number of issues that emerged from the analysis of case material and discuss the implications for managing change. To place implications in context, I present hypothetical scenarios for agencies that seek to foster robustness in the social-ecological systems that they must manage. I conclude with final remarks and directions for future research.

6.1   Appropriateness and effectiveness of the methods

The narrative method and associated techniques explained in Chapter 4, stimulated reflection and descriptive story-telling by respondents. This method used to generate data was selected on the assumption that conversations around meanings are necessarily rich in descriptions of context, meaning and motivation. From an information processing point of view, this approach produced interviews typically longer than the expected 40 minutes which meant more time was required for transcription and coding than was anticipated. However the method facilitated stakeholder expression such that it allowed for discussion of context and categorisation of meanings, perception of benefits and emergent behaviours. In particular, the method encouraged respondents to elaborate on the motives underlying behaviours. This was essential for understanding not only why people held certain meanings in favour of others but also for exposing what motivated the strength of those meanings and thereby to illustrate the interaction between meanings and behaviours. In this way the method supported and verified the

proposition that stakeholders fundamentally allocate and order (prioritise) meanings to natural resources based on their experience of benefits within defined contexts and that this, in turn, reinforces meanings and shapes behaviour. In addition, this study highlighted the prevalence of priority allocation to non-material benefits enjoyed in association with the particular landscape (Chapter 5). It was important that the method allowed stakeholder use of both material and non-material ecosystem services (benefits) to emerge because of an historical tendency by scholars to place greater emphasis on material ecosystem services. But more fundamentally, it was important to be able to illustrate material and non-material benefits because the aim of the study was, in part, to expose how meanings are ordered by stakeholders to emphasise a range of preferred benefits.

The method accorded well with the interpretive goal to 'understand' rather than to 'explain' or 'predict' in the knowledge generation process (Hudson & Ozanne 1988). This approach was necessary to develop insights into how stakeholders prioritised their meanings but also why the participatory approach that was adopted did not inspire wide support and eroded trust in the management agency. Because stakeholders felt so strongly about how change would affect the benefits and meanings they attached or could attach Tokai in the future, and because many felt that their 'voices' had not been heard, a methodological approach that encouraged free expression was welcomed. Importantly, for this study, narrative interviews created data from which change in the interplay among context, meanings, public infrastructure and behaviours could be interpreted. Both incremental change during the forestry era years as well as more abrupt change with the introduction of public infrastructure prioritising biodiversity meanings could be detected and described from the data generated.

Once meanings and perceptions of benefits were expressed, two typologies, a meaning typology and the Millennium Ecosystems Assessment's ecosystems services (benefits) classification (MEA 2003) typology were used in this study. The meaning typology developed for this study was based on published literature, and the categories were sufficiently detailed and descriptive to detect and categorise meanings that emerged from expressions in the interviews. The ecosystem services classification provided a useful way to relate meanings to ecosystem services (benefits) and the perceived loss of benefits associated with change in the prioritised meanings and in the resource (Dickie *et al*. 2014).

Within the context of a study focusing on historical narratives, methods should deliver credible information that spans a sufficient time period for changes of interest to be detected. Because research findings always reflect, at least to some degree, the method of inquiry (Babbie 2004) it is important to interrogate whether the methods generated data suited to the analysis of historical narratives and to suggest ways in which the reliability of research results could have been strengthened or tested. The interviews conducted during 2012 for this study provided information to reflect contemporary ideas and meanings. Stakeholder expressions bore credibility by virtue of the study seeking opinion in the form of narrative to expose meanings. According to this view, all respondent contributions were valuable in that they illustrated personal meanings and preferred benefits, irrespective of whether stakeholders supported or opposed the change in the state of the resource and associated benefits.

The study also required respondents to reflect on events and facts from the past. It would have been useful to enrich historical information with greater use of archival material, such as more extensive extracts from historical policies, books and letters. This could have affirmed some of the historical data by triangulation (Guion *et al*. 2011). But, as no formal process was established to support and record past interactions among resource users and between users and the responsible agency, little additional archival material was available for review. While the merits of using multiple case studies to validate interpretations are well established (Eisenhardt & Graebner 2007; Yin 2014) I chose instead to commit to developing a substantive conceptual scheme and to validate and strengthen it using in-depth understanding based on a single case (Strauss & Corbin 1998; Flyvbjerg 2006; Siggelkow 2007). I considered the development of a more in-depth and confident interpretation of the conceptual underpinnings of a scheme in favour of applying the scheme to generate more generalised insights across a greater number of cases. Therefore, even though the Tokai history is unique in its details it provided evidence that was credible and allowed validation of the conceptual framework which represents general concepts and relationships in a scheme applicable to more than one case.

6.2   Suitability of the Tokai case study

To test the proposition directing this study and to validate the framework it was necessary to find a case study that exhibited both slow and abrupt change and that, consequently spanned a period long enough to accommodate the need to study slow change. It was also necessary to select a case that exhibited strong place attachment among stakeholders.

The Tokai case study offered rich historical material covering a period of more than a hundred years. It provided information that reflected change in the forestry era as well as the more recent change in meaning prioritisation brought about by a strong biodiversity lobby that resulted in change in national public infrastructure. The Tokai history therefore provided a sufficiently long time line with accessible information about context, meanings, behaviours as well as public infrastructure adaptations and adjustments. The case material was therefore appropriate for the purpose of illustrating the co-evolution of meanings and the experience of benefits over a period of incremental change (the plantation forestry era) and a period reflecting resistance founded upon the promulgation of new national public infrastructure. With this material I was able to show that a change in context, meaning and benefits without effective public opportunity to express and co-evolve meanings caused a 'collapse' of social capital (trust) among some users and the management agency at the local level. Van der Leeuw & Aschan-Leygonie (2000), Agrawal (2003) and Davidson (2010) emphasise the importance of a long-term perspective because phenomena may appear to be stable when observed over time scales that are shorter than the time scale over which change in the phenomena occur. In addition, meanings are embedded in both a contemporary as well as historical context, emphasising the importance of a long-term perspective on how people develop, prioritise and re-affirm meanings that are significant to them, and behave as a result. In the Tokai case, some interviewed residents had lived in the area for a long time allowing recollection of change and stability in the resource and in meanings over a large part of their own lifetime. Importantly, the Tokai historical and contemporary material was not only sufficiently accessible over an appropriate time period to detect change, but the material was also rich enough for the study to detect change in the interactions and causal relationships between meanings, the state of the resource, perception of

benefits, behaviours and public infrastructure response to the manner in which stakeholders purposefully promoted certain meanings and benefits which they had prioritised. The Tokai case material was therefore suitable for testing the propositions, put forward in Chapter 2, around the relationship between meanings, benefits and behaviours and the manner in which meanings direct the formulation of public infrastructure such that the public infrastructure and the state of the resource continually reflects co-evolved meanings and facilitates behaviours that accord with the prioritised meanings.

6.3   Validation of the conceptual framework

The conceptual framework (Chapter 2) was constructed around the proposition that benefits, meanings, behaviours and the public infrastructure that supports and regulates these co-evolve, leading to a robust social-ecological system. The findings (Chapter 5) illustrate these dynamic interactions over an era of slow, incremental change and over a period of more abrupt change, with implications for social-ecological system robustness.

During the plantation forestry era recreation behaviours diversified as users discovered and constructed new contexts for recreational activities and experienced new benefits from the resource. And the way the public infrastructure was continually adjusted reinforced these meanings and behaviours. This strengthened linkages among users and with the managing agency thereby enhancing robustness. The study shows that when the biodiversity lobby effected a change in the national public infrastructure, stakeholders constructed supportive or resistance behaviours based upon the meanings they prioritised rather than those of a collective. These responses strongly affirmed the proposition that behaviours are driven not only by the benefits (ecosystem services) users wish to experience but more fundamentally by the personal meanings that underpin those benefits and the potential this has to weaken robustness of the social-ecological system. And, conversely, that where these meanings are shared albeit implicitly, as was the case during the forestry era, system robustness is enhanced. Results also indicated the importance of context and the role of context in meaning construction, reinforcing the notion of complex interactions between perception of context and benefits, meanings construction and behaviour.

Application of the framework also exposed issues of institutional design. The findings emphasised need for a more meaning-oriented design and implementation of a local process to understand the motivations underpinning the new context and reordering of meanings. This highlighted the importance and role of a co-evolutionary process that promotes shared understanding of new contexts, appreciation for a basket of meanings and the prospect that certain sets of meanings may not enjoy priority as before. When the public infrastructure changed to prioritise biodiversity meanings, the process of engaging stakeholders was not set up to intentionally encourage diverse viewpoints to emerge on the issue of change in meanings, in public infrastructure and in the resource. The study shows that that if it becomes necessary to reform public infrastructure, participatory processes should facilitate and encourage collective reflection on new contexts, new meanings, new benefits and new patterns of benefit distribution and access. It is through such reflection that co-evolution becomes possible thereby enhancing system robustness. Stakeholders seek situations that will help them reflect, affirm their own and learn about how others perceive context, and in particular, the change in context and about the

meanings held by others before they decide if and how they will reorder their own meanings. In particular, because meanings are culturally and historically situated stakeholders are moved to seek acknowledgement of past rights and associated meanings that they feel should shape contemporary perceptions and how stakeholders behave in relation to it (Macey 2000; Roth & Lee 2007).

This study as and others (Spaeder 2005; Bjerkli 2010) show that an engagement process that failed to consider user meanings and benefits associated with the resource, especially those meanings and benefits of the past, led some stakeholders to distrust the agency. Users concluded that the agency intended to promote a certain set of meanings without allowing negotiation that might influence how meanings are to be accommodated and what benefits would be derived from a new configuration of the resource. For example, some questioned the agreement to the rate at which trees would be removed and requested a slower clear-felling process that would limit erosion and to allow users a more gradual visual transformation from plantation forest to heathland, as has happened in other parts of the world where forested landscapes are regarded as public resources (McCool *et al.* 1986; Bell 2001). Many had suggestions for a resource configuration that could satisfy both shaded recreation and biodiversity meanings which they would have liked to table but felt that the agency did not create opportunities to do so. Whilst the engagement process did invite wide stakeholder attendance, it was not set up to facilitate discussion around meanings. Importantly, it was the manner in which the agency was perceived to dismiss submissions and suggestions from those who wished to retain some of the meanings from the plantation forestry era that fuelled stakeholder mistrust and increased resistance behaviours. This was the case especially because of the expectations created by Minister Kasrils in 2003 that meanings from the plantation forestry era would be allocated a priority position in future. Weaknesses in the engagement procedure caused some stakeholders to consider that the process was unjust and that the distribution of benefits was not fair (Lawrence *et al.* 1997; Smith & McDonough 2001; Blader & Tyler 2003) and this contributed to loss of robustness in the system. As the agency (SANParks) started to appreciate the diverse perspectives users held for the resource they showed willingness to be more accommodating, rather than seeking a single objective solution (Hummel 1991; Funtowicz & Ravetz 1993). And as opportunities for shared understanding of meanings and expected benefits are enhanced, prospects improve for rebuilding social capital needed for system robustness.

Opportunities for stakeholders to engage participatory processes for co-evolution of meanings are especially important in situations where levels of uncertainty are high (Kinnaman & Bleich 2004). In the Tokai case, stakeholders were uncertain about the implications of new public infrastructure for their meanings and for how the new configuration of the resource was likely to affect future distribution of benefits. In turn, the behavioural responses to what some thought to be a 'single objective solution' created uncertainty for the agency. The agency failed to appreciate that they were creating a multifaceted resource and as a result their focus was on rehabilitation of a very specific plant formation such that they lost sight of the longer term objective they had of a public resource. Uncertainty was also heightened because the change in public infrastructure (policy) and more particularly the way in which the agency gave effect to this change, brought about an abrupt transformation of the resource. During the plantation forestry era the agency detected and inferred stakeholder meanings by observing behaviours and responded by gradually adjusting the public infrastructure (rules and physical infrastructure).

During this era the consideration and incorporation of meanings was purposefully slow and incremental, allowing the agency to reflect on, 'sense' and evaluate user meanings before adjusting the public infrastructure and the state of the resource. It also allowed enough time for the agency to evaluate user behaviours in relation to adjusted public infrastructure. This slowness and reflection enhanced the development of relational connectedness (the strength of social linkages) and relational capital (trust and sense of commitment) (Nkhata *et al.* 2008) between the agency and users. Cilliers (2006) suggests that complex systems require enduring structures and hence the importance of 'slowness' (interpreted as 'reflectiveness'). He argues that systems in which memories and experiences are accumulated more slowly over time among actors who reinforce what is significant to them (prioritised meanings in the context of this research) are better able to cope with disruptive change. The findings show that an institutional arrangement emphasising slow and co-evolved biophysical setting and meanings led to the development of linkages between the public infrastructure provider, the public infrastructure (the rules), the resource and the resource users. Slowness facilitated incremental change informed by interactions among the public infrastructure provider and users and this led to constructive relationships underpinning the evaluation of user meanings and behaviours in relation to agency meanings. When new meanings were perceived as being 'imposed' by the new agency, a view reinforced by the rapid removal of the plantations, some stakeholders resisted in an effort to reinstate a 'slowness' (Cilliers 2006) that would allow collective reflection on and negotiation of meanings to be better reflected in the change process and the outcomes.

Given these findings, the framework developed in this study may be used by both managers and users engaging protected areas. In these situations users are required to "make sense of complexity and uncertainty" and to develop awareness of changes in the resource, the context, meanings and public infrastructure that affects civil society stewardship of natural resources (Child 2004; McCool *et al.* 2013). The framework implies that users frame their dialogue with the management agency to reflect issues around the resource, prioritisation of meanings and benefits and behaviours. Similarly, managers may employ the framework to design a participatory process focused on negotiating context and meanings thereby enhancing perceptions of procedural justice and robustness. From a manager's perspective, 'managing change' can be interpreted as anticipating change in context and how the corresponding change in public infrastructure and change in the distribution of resource benefits is likely to challenge meanings and shape stakeholder response. The framework may also be of use, to managers, when interpreting stakeholder submissions and making distinctions between benefits, meanings, context and behaviours.

Part of the 'anticipation' of change must include the ability to detect and interpret drivers of change at different scales. Local landscapes are important scalar units for the allocation of meaning (Terkenli 2001; Stedman 2003; Hunziker *et al.* 2008) because 'landscape' is defined as what is relevant to the human experience (Vaccaro & Norman 2008) and is the scale at which actors organise their meanings and actions to achieve purposeful change (Gobster *et al.* 2007; Wagner & Gobster 2007). But complex social-ecological systems are commonly affected by dynamics at scales smaller and larger than the social-ecological system of individual interest. This study showed for example how meaning prioritisation at the national scale during the late 1800s resulted in the creation of plantation forests. Over time, the small scale of Tokai and

processes occurring at that scale gave users a sense of 'ownership' and resulted in the development of a robust Tokai social-ecological system as users and the agency saw their meanings incorporated into the approach to management defined by the public infrastructure. However a weakness in this robustness was exposed when it emerged that co-evolution had not formalised a collective with a collective identity that could act in support of the prioritised meanings they held for the system. This weakness was emphasised when users were not able to respond as a collective to engage the reordering of meanings at the national and international scale. As a result they were not ready as a collective, to engage the new set of meanings promoted by conservation planning processes that filtered from the national to the municipal scale and which ultimately found application at the scale of Tokai. As a result of these changes, a small scale resource and landscape (Tokai) is being transformed. Detecting change that will bear influence on one scale of interest requires an awareness of connections across scales (Walker & Salt 2006), connections that were not formally constructed during the forestry era. The conceptual framework facilitated an interpretation that highlighted the effects of drivers and meanings at various scales on the SES of interest which led to behavioural responses at the local scale and of the connections across scales. This promotes the idea that the framework can be used to raise awareness of and reflect on drivers and potential drivers emerging remotely but which may bear influence on the SES of interest.

The conceptual framework facilitated an interpretation that reflects the complex and dynamic interactions between meanings, behaviours and robustness in a complex social-ecological system. Conclusions could be drawn from a period of slow, incremental change as well as from a time of more abrupt change in meanings, in public infrastructure and in the resource. Using the framework it was also possible to distinguish the effects of the pace of change and implications for promoting robustness. Finally, the framework allowed for the effects of drivers originating at various scales to be discernable. In essence the framework allowed for a valid and rich representation of a social-ecological system in which meanings and behaviours are instrumental variables affecting system robustness during periods of slow and fast change and the framework is likely to find application in systems with similar attributes. The study further emphasises that achieving and sustaining support for an ordering of meanings requires a formalised process of collective deliberation.

6.4   Managing change through cycles of stability and instability

Cilliers (2006) observed that stability and enduring structures are necessary for the existence of complex systems. Anderies *et al*. (2004) and others (Janssen & Anderies 2007; Janssen *et al*. 2007) have referred to this stability as robustness. This study set out to understand the role of meanings in constructing, sustaining, or even weakening robustness and which causes SESs to become unstable. Thus an understanding of how meanings influence system robustness through cycles of stability and instability is necessary to be able to reflect on the past and the present and to strategically craft adaptations for retaining and enhancing system robustness in a complex and uncertain future.

A framework devised by Nkhata *et al*. (2008) provides a heuristic useful for interpreting the influence of meanings, behaviours and social-ecological system robustness in a dynamic pattern over time. Their framework is based on theories of resilience and social relationships that

underpin collaborative arrangements in social-ecological systems. In this framework, the potential for change in a social relationship is mediated by two variables, relational capital and relational connectedness. As actors interact repeatedly with each other, multiple states can be generated for relationships and these states are characterised by different behavioural strategies and outcomes (e.g. compliance, avoidance, tolerance or contestation). Trust and commitment form the two key attributes of relational capital. Trust is a state in which a party believes that the other parties will not act against its interests and commitment denotes the energies and resources invested by parties in a long-term relationship. According to the Nkhata *et al.* (2008) framework relational connectedness is characterised by social and professional bonds, connections among the activities of actors and how the resources of actors are tied together. The two variables together describe change whereby relationships grow, mature, collapse and reorganise based on mutual adaptations in behaviour. By using the Nkhata *et al.* (2008) framework, it is possible to interpret how meanings, the perception of benefits and institutional arrangements influence relationships and the emergent behaviours over time. Importantly, it also provides a conceptual basis for imagining the future and for highlighting implications for enhancing system robustness.
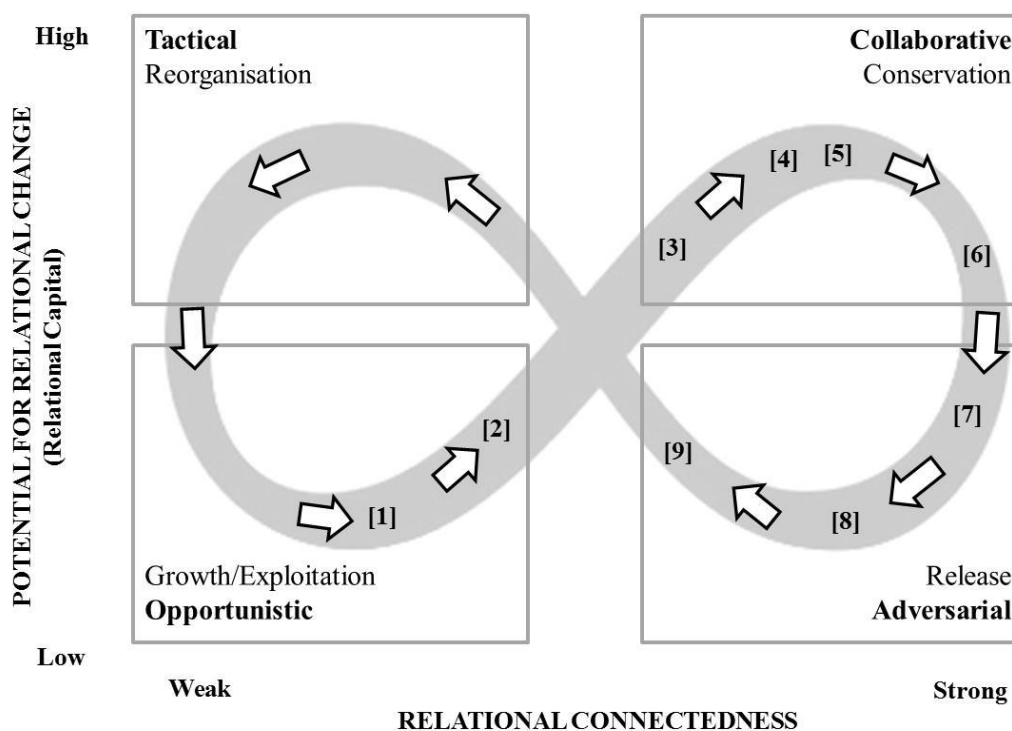
Figure 6.1 An adaptation of the Nkhata *et al.* (2008) framework for analysing change and behavioural styles in long-term social relationships.

According to this framework, relationships progress through phases of an adaptive cycle. In the Tokai example there were few public users and relational capital and connectedness among users and the forest agency were low during the early years (late 1880s to 1970) of forest plantation establishment and expansion (Fig 6.1 **[1]**).

[1] *"Many years ago, the plantations were not accessible to the public. During the summer, no public was allowed in…it was a closed area."* (Interview 36)

Resource use increased over time and during the 1970s forestry policy changed to explicitly promote the public use of state-owned plantation forests. This signified an acknowledgement that recreation meanings and meanings associated with commercial timber production could be prioritised simultaneously within the plantation context (Fig 6.1**[2]**).

[2] *"..but over the years they realised that the kinds of people who come are not smokers, they're not coming to make a fire, they're coming to enjoy the outdoors and so they were welcomed."* (Interview 36)

The state forestry department also enhanced the context for accommodating recreation meanings and benefits by introducing additional infrastructure such as new hiking trails, obstacle jumps for horse riders and overnight huts. These developments fostered trust and commitment (increasing relational capital; Fig 6.1**[2]**) and the perception of a shared plantation resource increased the connections, bonds and activities between users and the forestry agency (increasing relational connectedness). This forest policy environment also signified that the forestry agency regarded the plantation forests as a 'public trust resource', a resource held and managed, at least in part in this case, for public purposes but subject to regulation by the managing agency (Rose 1998). As a consequence the agency became responsive to user meanings and adapted institutional arrangements (policies and rules) and physical infrastructure to reflect their shared meanings. Many users invested resources, in the form of buying property in the area in order to have ready access to the forest. Over time uses (e.g. walkers) were given largely unrestricted rights of access and use by the agency (Fig 6.1 **[3]**).

[3] *"That's actually why I bought the house.. and I had my own little gate and I used to just walk out of my garden and step into the forest and go for a walk and I just loved it."*
(Interview 4)

Although the forestry department did not conduct formal public engagement processes during this time to reflect on meanings and benefits, mutually collaborative behaviours and adjustments in public infrastructure reinforced perceptions of congruent meanings between recreational users and the forestry agency. The affirmation of congruent meanings became especially prominent as Tokai grew in popularity as a local recreation destination in particular for city dwellers seeking shaded places for recreation. As the agency continued to accommodate user meanings, relational capital and connectedness grew such that the relationship reached a 'conservation' phase. In this phase, although there is no evidence that a 'collective' had formed, ongoing interactions and feedbacks between the user group and the forestry agency created and sustained robustness through the accumulation of relational capital and connectedness (Fig 6.1 **[4]**).

[4] *"And that's one thing that is different in forestry here Tokai…how can I say..you can't just cut down trees…you first have to let the public know: 'listen here, there's an area here which we're going to cut…"* (Interview 36; forester)

The agency continued to accommodate user meanings and benefits and users in turn demonstrated supportive behaviours through continued use of the resource in accordance with the policies espoused by the forestry agency (Fig 6.1 **[5]**).

[5] *"We have been here 40 years. Initially when there were a lot of trees, we used to walk in it, you know… exercise. Our kids ran around there.. played games…we used it for general recreation.."* (Interview 11)

Because of the levels of relational connectedness and capital, the agency and users were conscious of and responsive to emerging needs which is perhaps why formal public engagement processes were not conducted during that era and would only be activated where major change in public infrastructure was being considered. In hindsight, formalised engagement may have resulted in a collective identity that would provide a foundation for collective action both in support of the forestry agency and later for the conservation agency. A fundamental change arose when management of the Tokai area was transferred from the Government forestry agency to its conservation agency which held very different priorities and this challenged system robustness. A change of this nature can be disruptive to the extent that relational capital 'collapses', relational connectedness weakens and the SES becomes less robust. If 'collapse' is to be avoided and robustness sustained, the agency would need to give particular attention to strengthening relational capital and relational connectedness using public participation processes designed to encourage reflection and appreciation of meanings and where possible to accommodate such meanings in the new order.

When management of Tokai was transferred from the government forestry agency to the conservation agency in 2005 there was no formally constituted collective with shared meanings with which the agency could engage in discussions. Under the influence of its mandate and with support from stakeholders who were not necessarily users of the area but who shared its prioritisation of meanings, the agency re-prioritised meanings for the Tokai landscape, affording greater priority to conservation and biodiversity than meanings associated with the shaded Tokai plantation context. Although a public process was conducted, many users felt that it was not designed to allow them to influence the collective re-ordering of meanings or the manner in which a mix of old and new meanings would be reflected in the reconfigured resource (Fig 6.1 **[6]**).

[6] *"TMNP say 'yes we did consult, there was a public participation process'. What happened was TMNP came up with a policy that they wanted to promote the restoration of large areas of Fynbos, and they manipulated the public process to get what they wanted. They don't understand the depth of public responses."* (Interview 2)

During the plantation forestry era, the incremental adjustment of public infrastructure to accommodate user meanings promoted a sense of public stewardship of what was considered a shared resource by both stakeholders and the agency. As this strengthened over time users considered that they had been granted 'rights of use'. When public infrastructure was altered to prioritise biodiversity meanings the new management (conservation) agency did not acknowledge the sense of public ownership of the resource and the established user rights of access to the resource that developed during the plantation forestry era (Fig 6.1 **[7]**).

[7] *"This notion of 'perceived rights'..before the early 1990s...the plantation wasn't open to recreation by people...it was only in the mid-1990s when [the forestry company] undertook a recreational policy and then opened up the picnic site and all those things...and so people jumped on board thinking that people have been here for 50...60 years."* (Interview 34; SANParks official)

Perz *et al.* (2014) argue for the importance of clarifying tenure and rights especially during times of rapid change and for making the distinction between allocated ownership and a 'sense of ownership' as espoused by behaviours in practice at the local level. Implied in this is that the formalisation of meaning prioritisation is necessary to affirm the priority positions of shared meanings of the collective. In the Tokai case the ordering of meanings had never been 'formalised' with a result that the new agency would have received differing orders from different stakeholder groupings.

The conservation agency, despite many years of operation during which relationships with the public were tested (Freitag-Ronaldson & Foxcroft 2003; Whyte *et al*. 2003) appeared not to appreciate the implications of relational capital and connectedness that had developed over 60 years at Tokai, for their proposed transformation of the landscape. Consequently the participation process was technologically rather than socially oriented in its design and implementation. As a result the agency process fostered confrontation rather than construction of new relational capital and connectedness. Lack of social acceptance among some and the associated adversarial behaviours and contestation (since 2005 and ongoing) had a destabilising effect on the social-ecological system, rendering it less robust in the transition from a forested to heathland landscape. 'Collapse' became inevitable (Fig 6.1 **[8]**).

[8] *"Unfortunately they* [the conservation agency] *pay lip service to what these pressure groups have to say. They say one thing and do another thing. So from my personal view I don't think National Parks is trustworthy."* (Interview 10)

One response to the adversarial relational state is that some users (particularly those who feel their meanings are not threatened) reorganise as they recognise emerging opportunities associated with a new institutional and landscape context (Fig 6.1 **[9]**). Connectedness is low but the potential for change is high as new relationships are forged and relational capital may be renewed.

[9] *"But... we have to go forward and we plan to work with the agencies in a consultative, participatory way."* (Interview 28)

Application of the adaptive cycle framework indicates the development of a robust system whereby the interplay among meanings, benefits, behaviours and public infrastructure became reinforced over time. It also shows how erosion of relational capital made the system less robust as it entered a phase of adversarial relationships. When public infrastructure is revised and new meanings prioritised, typically not all meanings can enjoy the same priority (Hall *et al*. 2013) and therefore cannot all be accommodated to the same extent. Consequently tension among stakeholders is a normal attribute of change. Using the adaptive cycle framework, it is

constructive to reflect and consider if and how the change process may have been managed differently to ameliorate tensions and to speculate about what could be expected options for the future for an organisation required to foster and sustain robustness. One might argue that as meanings and behaviours became strongly reinforced in the forestry era (conservation phase in Fig 6.1) that the system, even though it was robust, and thus would have become more efficient, was also more rigid, less flexible and as a result would have been vulnerable to disturbance (Walker and Salt 2006). The longer an SES stays in the conservation phase the less willing stakeholders are to accommodate fundamental change and others authors have highlighted this phenomenon (Jansson *et al.* 2007). And, perhaps, stakeholders become complacent about the infrastructure that governs use and the need to sustain relational capital reducing their sensitivity to early warning signs of change. Had stakeholders of Tokai, particularly the users, been sensing the drivers of change, in particular those originating at scales larger than the Tokai SES of interest, they should have mobilised collectively to initiate an earlier process of jointly reflecting on and accommodating the meanings that reflect the common good over the range of scales from local to national and even international. That they did not is at least in part a consequence of weakness in identifying with the Tokai basket of meanings as a collective.

This interpretation, based on the adaptive cycle framework, suggests that the Tokai system is in a phase of reorganisation, characterised by weak connectedness and strengthening relational capital at least among some stakeholders. Relationships are being constructed among stakeholders founded on a new set of meanings and benefits associated with a reconfigured resource. In the present state of low relational capital and connectedness (reorganisation phase going into the exploitation phase in Fig. 6.1) two scenarios emerge. In the first option, the agency sets out to construct relational connectedness and relational capital with stakeholders whose meanings and behaviours accord with those of the agency. In this scenario the agency is comfortable with losing relational connectedness and capital with those whose meanings and behaviours are not aligned with those of the agency. In the second scenario the agency shows appreciation for the 'urban context' of the Tokai landscape and purposefully sets out to construct an SES that is inclusive and accommodates meanings and behaviours for the common good within the constraints of its national responsibilities. Currently it appears that the management agency (SANParks) is approaching the development of public infrastructure in a manner that accords with the second scenario, albeit rather reluctantly and under the direction of a process that is inappropriately designed for this purpose. The outcome is likely to be somewhere in between the two scenarios. There are potentially significant consequences, at least in the short to medium term, because of the loss of relational capital and connectedness. And, even though robustness may be re-established for the Tokai SES if this is too centred on biodiversity meanings it will be difficult to reconstruct support in the urban context that characterises Tokai. Such losses of trust of stakeholders can lead to ongoing resistance even beyond Tokai, making it difficult for the agency to service its public benefit function.

The second scenario is one where the agency will play a more active role in designing and implementing a co-evolutionary participatory process that explicitly aims to develop relational capital aspects such as trust among stakeholders over the long term. The agency can achieve this by promoting stakeholder meaning articulation, acknowledging all meanings regardless of their priority position given the new public infrastructure. The second scenario would be characterised by the collective agreement to develop and implement public infrastructure in a

manner that acknowledges Tokai as a public resource in an urban context while at the same time enabling the attainment of the conservation objectives in the reconfigured resource (Chiesura 2004). The agency's management five year planning cycle provides for public comment but given that relational capital and relational connectedness are vulnerable (as demonstrated in this study) they must be continually reinforced, something that cannot be achieved through an 'event' once every five years. Because the transition from forestry to conservation management has reduced relational connectedness and relational capital, the agency should consider how to create opportunities to increase and sustain these between those five-year 'events'. This study shows that it is important in the process of stakeholder engagement, and of reconstructing social capital, to acknowledge past meanings and benefits even if they will not receive priority in the future, and to consider alternative options for realising them. The study also shows that it is not only the willingness of the agency to engage in the dialogue with users but, particularly because meanings are held personally, also the manner of dialogue about meanings that influences how users perceive the intentions of the agency and develop trust in it. By implication, what is needed is the formulation of policy guidelines that would require the agency to acknowledge contextual differences (urban context in the case of Tokai) and the associated diverse benefits among its landholdings. This would cause management to become more aware and accommodating of stakeholder meanings, helping it to sustain the social capital required for the effective management of public resources.

This study emphasises the historical development of Tokai as an 'ordinary landscape' (Brown *et al*. 2005; Lennon 2005; Lawrence *et al*. 2010) and that historical meanings allocated to Tokai have resulted in a contested transformation to a place intended for biodiversity meanings. The notion of 'ordinary landscapes' was developed by scholars in geography who recognise landscapes that are valued by people but that are not necessarily worthy of protection from a biodiversity, monumental heritage or visual significance point of view. The idea is based on the assumption that "ordinary, everyday landscapes and related experiences are essential to the formation of human meaning." (Groth 1997; p. 3). Historical geographers refer to these as 'cultural landscapes' or places valued by a group or groups because of their long and complex relationship with that land. They are the places of peoples' livelihoods, identities and belief systems. (Parks Canada 2000; Ceccarelli & Rössler 2002). And Sauer (1941), for example has emphasised change in these systems: their origins, the manner of stabilisation of one culture area against another and the decline or collapse of succeeding cultures. Although Tokai was originally set up and operated as a commercial timber production venture, it evolved to become an 'ordinary landscape' of which timber was only one facet. For many users, the Tokai resource represented an 'ordinary landscape', such that the landscape co-evolved with stakeholder meanings and benefits. The long-term development and reinforcement of Tokai as an ordinary landscape with meanings associated with outdoor recreation, together with Tokai's broader urban context, created a situation challenging for those wishing to transform the meanings and the landscape to a predominantly biodiversity resource and for those wishing to sustain the meanings of the past. The robustness of the forestry era Tokai SES challenged by a fundamental change in public infrastructure emphasises a need for designing collective processes to elicit, acknowledge, reflect, evaluate and order old and new meanings to foster relational capital, connectedness and procedural justice. This would enhance appreciation for and acceptance of new meaning prioritisations. In doing so it would reduce conflict and promote system robustness. Sustaining system robustness by instilling a sense of consistency and

reliability in the agency's accommodation of meanings and benefits within an accepted policy framework (public infrastructure), will foster public support for the agency.

This thesis shows that in defined contexts stakeholders seek to sustain and protect landscapes intended to accommodate the meanings they hold and that these extend beyond biodiversity (Clark & Stein 2003). The evolution and maintenance of landscapes that are not focussed on biodiversity is evidenced in Europe (Vos & Meeks 1999, Naveh 2001; Buckecker *et al*. 2003), in the USA (for example meadow-forest landscapes; Magee & Antos 1992) and Scandanavia. In Norway, deforestation, spanning about 3600 years, starting 4000 B.C., led to heathland invasions that are sustained in the contemporary context for farming (grazing) and cultural heritage purposes (Prøsch-Danielsen & Simonsen 2000). In these situations, users have defined the meanings and contexts that are significant to them and they have invested in protecting and maintaining landscapes to support the basket of meanings that they have prioritized (Hurley 2013). It is pertinent to highlight that biodiversity conservation meanings compete with other classes of meanings and following from this is it prudent to appreciate that in most instances biodiversity meanings cannot be accommodated if other meanings are not. Biodiversity meanings are therefore co-dependent on other meanings and for biodiversity conservation to enjoy public support, flexibility will be required in order to balance the goals of biodiversity protection and allowing people to connect with biodiversity as well as other values (Lockwood *et al*. 2010). Ultimately protected area legitimacy is based upon societal approval and not legitimacy as conferred by the state (Murphree 2004; Stern 2008). This understanding directs conservation agencies to continually try to sustain supportive constituencies and by reflecting on biodiversity meanings as well as other meanings upon which the realisation of biodiversity meanings are co-dependent. Perhaps the challenge awaiting the conservation agency is to re-establish perceptions of Tokai as an 'ordinary landscape' with biodiversity conservation rather than forestry as a primary determinant of utility, meaning and culture.

Upon reflection, although the Nkhata et al (2008) framework is useful for interpreting behaviours dynamic over time and advancing ideas about designing institutions for enhanced robustness, it is inadequate to explain the Tokai experience. The question remains, if social capital (relational connectedness and relational capital) was constructed among stakeholders during the forestry era, why did those attributes, desirable for robustness, not exert greater influence on the new management agency and the process that led to the transformed resource state? Implied in the framework (Fig. 6.1) is that the social capital constructed and reinforced during the forestry era should have contributed more towards mitigating system collapse when meanings were fundamentally reprioritised. This prompts me to question what factors may have promoted a greater degree of collective action in relation to the rapidly changing SES.

Some scholars emphasise the importance of collective action (behaviour) in the management of shared resources, where collective action can be understood to be the organisational endeavours of a group of individuals (stakeholders) in the management of use of a shared resource for collective benefits (Mosimane 2012; Mosimane et al. 2012). Collective action is dependent upon the efforts of stakeholders to establish an identity that is held collectively in relation to the shared resource (Mosimane et al. 2012). Collective identity is in turn, characterised by shared understanding that enables members to contextualise their appreciation of individual and collective meanings and the implications for the distribution of benefits, as the collective

develops. Mosimane (2012) defines 'identification' and 'affective commitment' as two key variables that underpin collective identity. Identification implies that an individual would associate with others who express interests and attitudes that are compatible with the collective and would accept meanings of the collective as their own. When individuals identify with the collective they may also become involved in activities relating to the collective. Affective commitment implies an emotional attachment and a sense of belonging to the collective identity and to members of the collective (Mosimane 2012). These insights highlight the importance of the 'collective' in the management of shared resources and the notion that collective identity, and therefore collective action (behaviour) is continually expressive of the tensions between individual meanings and the meanings of the collective.

The case study shows that during the forestry era, stakeholders coalesced around particular sets of meanings. Although users identified with the resource, they did so more as individuals, each connecting strongly with their own meanings and contexts, or as small groups with meanings organised around a shared activity such as mountain biking or horse riding. Users may have developed relational capital and relational connectedness as suggested by the interpretation based on Fig 6.1, but the connectedness was stronger between individuals and their connection with the resource and others who shared their meanings than among stakeholders as a collective. Similarly, there is evidence that trust (capital) developed between users and the agency but this was not strengthened through formal arrangements and agreements. Thus, stakeholders identified differently, their activities (involvement) were organised in relation to personal and individual interests and their affective commitment was to the specific meanings they held rather than to the collective meanings stakeholders had of the 'shared resource'. The forestry agency at times became involved in the activities of users, for example by constructing hiking paths and huts, and engendered an appreciation in users of plantation forestry purpose and meanings, but there is no evidence that it formally encouraged development of a 'collective' identity and shared set of meanings. Even though the public infrastructure at that time co-evolved to continually reflect both user and agency meanings, it was not designed to formally develop a 'collective' defined by identification and affective commitment to the collective meanings associated with a shared resource. Links with the agency were informal and users were connected more through their personal use of a common resource rather than by their connectedness with and appreciation of a basket of meanings reflecting the common good aspects of the shared resource. Based on this I argue that while users appreciated the priority given to commodity meanings, they identified with and were committed to their own benefits rather than to those of a collective. As a result stakeholders had no collective identity and when new stakeholders appeared and meanings were prioritised nationally and public infrastructure adjusted accordingly, stakeholders at the level of Tokai were not ready to mobilise as a collective (collective action) in response to change. This is evident in the formation of reactionary groups such as 'Cool Forests' and 'Shout for Shade'. There was no collective that identified strongly with and was committed to shared meanings and values; a group characterised by strong relational connectedness and relational capital. Such a collective would have been prepared to respond tactically and strategically to sudden change.

The study also shows that the new (conservation) agency identified strongly with meanings held by plant conservationists and conservation planners outside of the Tokai user group. As a result the agency was able to mobilise collective action and start to develop a collective identity with

stakeholders around biodiversity meanings for Tokai with support at the national, municipal and even at the local level. But initially, this identity did not include non-biodiversity meanings that had developed among users as part of the local Tokai context. When the change occurred the agency did not have a collective with a 'Tokai user identity' with whom it could engage. The conservation agency had developed strong relational connectedness and collective identity around conservation meanings that for most users were remote from the Tokai context. As a result, the agency's conception of the 'shared resource' did not include non-biodiversity meanings or if it did, they were not made explicit. This was evidenced by user opposition behaviours to emphasise non-biodiversity meanings and the agency's reactive response to re-incorporating them.

This interpretation highlights that managing use of a shared resource requires that stakeholders hold a collective identity evidenced in their identification with and affective commitment to the meanings and values that direct use of the shared resource. Because access to and use is shared and users attach different meanings to the resource there needs to be relational connectedness and relational capital among stakeholders to allow for prioritisation and willingness to forgo some benefits for the 'collective' or greater good. The case study shows that the process of change did cause some, but not all, stakeholders to become more conscious of the shared nature of the resource and the need to accommodate differing meanings for the greater good. In other words the process has led to a more 'collective' identification with and commitment to meanings and values associated with the shared resource. There are also signs of relational connectedness and capital evolving as different users acknowledge and accommodate each other's meanings. But, the advances are fortuitous rather than arising through conscious design.

New insights can be drawn from applying the ideas around collective identity. Whilst it is important for stakeholders to develop appreciation of their own meanings and those of others as indicated by the framework in Chapter 2 (Fig. 2.1), they should also develop relational connectedness such that they are able to contextualise, identify with and develop affective commitment to the basket of meanings that represent the 'collective identity'. Only then are stakeholders motivated to see personal meanings in the context of those prioritised by the collective and behave in ways that accord with collective values. Arguably agencies wishing to enhance and sustain robustness in dynamic SESs should give explicit attention to building and sustaining relationships (relational connectedness) through sharing meanings as a way of constructing relational capital. Collective identity is strong when stakeholders are relationally connected by their common resource and the meanings they share for the resource (Fig 6.2).
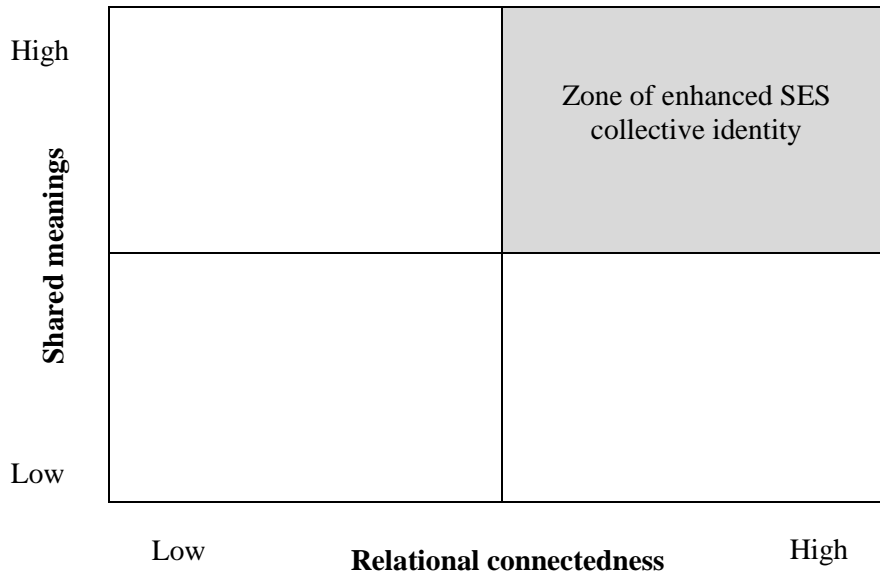
Fig 6.2. Shared meanings and relational connectedness sustain collective identity in relation to a shared resource.

I suggest in Fig 6.2 that high levels of relational connectedness, established through formal and informal processes, encourages stakeholders to identify with and develop a sense of belonging to the collective and commitment to the meanings held by the collective. When they do this they align public infrastructure and their behaviours with the values of the collective which contributes to maintaining system robustness and the 'enduring structures' that Cilliers (2006) envisaged as necessary for managing complex systems and in particular for devising purposeful and strategic adaptations to change.

6.5   Conclusions

The research contained in this thesis is concerned with managing change in social-ecological systems, in particular in relation to resources, like Tokai, that are managed in the public interest. I postulated that behavioural response to change is shaped by anticipated and realised benefits and fundamentally by the meanings individuals and groups of stakeholders attach to those benefits. When change involves a reordering of meanings it also restructures the distribution of benefits. Some stand to gain while others lose and this directs stakeholder support or resistance to the change. Cilliers (2006) suggests that for complex systems to persist they must be able to change slowly, in other words they should be robust (Anderies *et al*. 2004). With these ideas as foundation, I adapted a framework developed by Anderies *et al*. (2004) to illustrate this conception of robustness and response to change in a social-ecological system. This positioned me to test the propositions that (1) stakeholder preference for certain benefits and their behaviour is fundamentally directed by meanings and (2) that insights around meanings and behaviours and their influence on the formulation of public infrastructure can be applied to design and direct institutions to foster robustness and thereby to also anticipate and engage change strategically. But, to do so requires collective reflection and relationships that allow appreciation for diverse meanings and sustain a willingness to order meanings for the common good. It requires a common identity.

An interpretive philosophy, focused on improving understanding, directed my methodological approach and I used narrative techniques in interviews which enabled me to elicit stakeholder expressions relating to meanings, benefits and behaviours. The Tokai case study facilitated collection of data that spanned a sufficient period of time to detect and describe slow, incremental change during an era of plantation forestry in Tokai as well as disruptive change brought about by a fundamental and abrupt prioritisation of biodiversity meanings. I conclude that the Tokai example was appropriate for the study and that it allows consideration of implications for other social-ecological systems founded on shared resources.

The framework I developed (Chapter 2) was helpful in illustrating the role and importance of meanings in how resource users perceive benefits and in shaping behaviours. Application of the framework also exposed issues of institutional design. The findings emphasised need for a meaning-oriented engagement process to promote shared understanding among stakeholders of new contexts, appreciating a basket of meanings and, acceptance that certain sets of meanings may not enjoy priority as before. The study shows that that when new meanings direct change in the public infrastructure, participatory processes should facilitate and encourage collective reflection on emerging contexts, meanings, benefits and new patterns of benefit distribution and access. It is through such reflection that co-evolution becomes possible thereby enhancing system robustness. And, because new meanings emerge and prioritisation changes continually, and particularly because sometimes these changes occur under conditions that cause stakeholder uncertainty, enduring structures and processes are required to facilitate gradual change and support robustness. The study shows that robustness is also influenced by perception of fairness (procedural and distributive justice) of the process whereby meanings are elicited and reordered and benefits distributed. I conclude that the framework is potentially useful to both managers and users when incorporated into adaptive management. Users can frame their dialogue with the agency in terms of meanings, benefits and context and the agency can use the framework to design engagement processes that promote perceptions of justice in the negotiation and prioritisation of context and meanings and that enhance the credibility of technical interventions (Ludwig 2001). The framework can also be helpful in directing stakeholder attention to meanings and changes that may appear to be remote from the SES and scale of interest, so as to encourage strategic anticipation of change. This is important for being purposeful when planning to influence the direction of change with the aim of enhancing robustness of the SES (Walker *et al*. 2004).

Importantly, the framework illustrates how meanings and meaning prioritisation influence the formulation of public infrastructure. This contrasts with other studies (with some exceptions, for example see Zinn & Manfredo 1998) that have focussed on values, collective action and behaviours as responses to rules and less as a purposeful input into the process of deriving regulatory instruments. For example game theory and theory of community show the influence of community action but they tend to focus on response to rules and give less attention to normative inputs into behaviours in relation to change or in relation to the processes that generate the rules of the 'game' (Lejano & de Castro 2014). Similarly, much of the integration of social change aspects into resilience thinking has regarded normative aspects such as cultural values, agency, human purposefulness and tough trade-offs among stakeholders as being somewhat external to, and mostly as outcomes of, SES dynamics (Davidson 2010; Cote &

Nightingale 2012). I show in this thesis how meanings and values are integral in the generation and mediation of support for institutions, and therefore are not merely reactionary responses to institutional rules and policies.

Despite its strengths and usefulness in relation to the study propositions, the framework I developed in Chapter 2 is not sufficiently explicit about how agencies can sustain robustness during cycles of system growth, collapse and reorganisation. I show that the interpretation based on the framework developed in Chapter 2 can be enhanced by a framework developed by Nkhata *et al.* (2008). By applying the Nkhata *et al.* (2008) framework I was able to generate an interpretation to indicate that robustness can be sustained by constructing and fostering relational capital and relational connectedness through a change process and that system collapse can be mitigated even when robustness becomes vulnerable in the face of disruptive change in meaning prioritisation. The combination of the two frameworks in addition allowed for the construction of future scenarios for when the system recovers from a state characterised by weak relational capital and reduced robustness, creating opportunities for strategic response to reconstructing social capital required to sustain robustness. Finally, the study exposed a shortcoming in the initial interpretation by indicating that it is necessary for social capital (and thereby robustness) to be constructed within the context of a collective identity (Mosimane 2012). I suggest that high levels of relational connectedness encourage stakeholders to identify with and develop a sense of belonging to the collective and commitment to the ordering of meanings held by the collective. Only then will stakeholders be motivated to align their behaviours with the meanings and values of the collective. Together, the three frameworks enabled development of deeper insights into user behaviour within the context of the findings of the study.

The study illustrates that meanings are persistent and strongly influence how stakeholders respond to change. Consequently, changing the prioritisation of meanings can elicit behavioural responses that range between disruptive and supportive. This positions meanings as an important dimension of adaptive management. Where stakeholders hold shared meanings and appreciate the ordering of those meanings they relate to each other and align behaviours to be consistent with their shared meanings. A collective identity is established that reinforces relational connectedness and the meanings shared and prioritised by the collective. When adaptive management for shared resources gives explicit attention to meaning prioritisation and relational connectedness the social-ecological system will retain robustness necessary to manage the disruptive nature of change.

6.6   Future research

This research has illustrated the relevance of robustness for managing change in social-ecological systems. In particular it has demonstrated the role meanings play in behavioural responses to change. And it suggests that meanings may also exert strong influence in determining relational connectedness and consequently in developing and sustaining a collective identity that causes behaviours to become aligned for the common good.   With this understanding I elaborate three directions for further research:

- This study suggests that the organisational culture (Nyambe 2005; Stokowski 2013) of the conservation agency, at least at the scale of Table Mountain National Park and in the urban context of Tokai in particular, was not conducive to participation in discourse around the meanings of Tokai. Such conditions make it difficult to sustain or construct relational connectedness and relational capital required to achieve a collective identity in which stakeholders support the prioritisation of meanings even when this may not accord with their preferences. If organisational culture is this important, how might a conservation agency incorporate it into adaptive planning and management processes (Johnson 1999; Nkhata & McCool 2012)?

- This research has shown that meanings become reinforced over time and as they do, they become powerful drivers of response (behaviour) to change. And, because individuals prioritise their meanings differently, they are therefore potentially strong determinants of relational connectedness and relational capital and consequently influence the capacity of stakeholders to develop collective identity. This understanding suggests that it would be constructive to develop deeper insight into the relationships between these variables and into how these can be managed to promote robustness in social-ecological systems. How is robustness influenced by the relationship between meanings, relational connectedness and relational capital and the development of collective identity?

- Although the framework I developed and the others to which I have referred are helpful in portraying how systems may be understood and how system robustness and resilience arise they are not explicit on what management should do, and how it should do it. For example, how can agencies promote shared meanings and relational connectedness when stakeholder constituencies vary widely and may even include people who have not and will never access the resource? And despite progress with adaptive management and wide acceptance of the importance of the concepts embodied in these frameworks they are not appropriately reflected in policy and management. This suggests need for research that would enable more effective links between theory and practice in governance and management. How can meaning expression, meaning ordering and the development of collective identity be incorporated and operationalised in adaptive management   culture   and   practice?

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ANNEXURE 1

PUBLISHED JOURNAL ARTICLE

Meanings and robustness: Propositions for enhancing benefit sharing in social-ecological systems

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Abstract: Given increased pressure on natural resources to deliver benefits, complex trade-offs and the regulation of behaviours in relation to benefits is of key concern. Behaviours that signify resistance to the rules according to which benefits are allocated prompt us to consider causal links and feedbacks between benefits, perceptions of benefits, meanings attached to the benefits, and the regulatory instruments that mediate the distribution of benefits. An understanding of how meanings influence the perception of benefits exposes the complexity inherent in how people perceive and allocate value to natural resource benefits. Meanings are personal, sometimes overlapping, context dependent and variable across space and time. A challenge in directing resource user behaviour in common pool resources is that the relationship between the resource and resource use is typically not interpreted to include the manner in which users associate resource benefits with meanings. We propose that collective ordering of meanings and associated rules help to direct behaviours and in doing so they contribute to the purposeful maintenance of desirable elements of a social-ecological system (i.e. robustness). Using an example, we illustrate how tensions around benefit sharing are rooted in the emergence and changing prioritisation of contexts and meanings over time. The importance of eliciting, ordering and sanctioning of meanings

is emphasised. We conclude by discussing the implications for robustness and benefit sharing in social-ecological systems and we comment on the usefulness and limitations of the framework.

1. Introduction

It is widely acknowledged that equity and sustainability are important goals in natural resource management (Smith and McDonough 2001; Brock and Carpenter 2007). Behaviours are indicative of how users perceive equity and sustainability as they realise what and how much they stand to benefit, or not, from the allocation and distribution of benefits. As demands for benefits grow, benefit sharing is increasingly characterised by complex trade-offs among beneficiaries (Rodríguez et al. 2006; Janssen and Anderies 2007; Nkhata et al. 2012). As pressures grow and competition between potential beneficiaries intensifies, it is common for users to challenge the rules and decisions that underpin benefit sharing schemes. An important issue in the management of these situations is that contestation and even supportive behaviours appear at times to be difficult to anticipate, recognise and understand. An appreciation of factors that underpin behaviours is therefore important for the management of benefit sharing schemes. The better we are able to understand the determinants of behaviour, the greater the prospect for designing benefit sharing schemes that encourage support rather than contestation. We acknowledge that the motivations for contestation of the rules that direct benefit allocation may originate from a variety of sources. In this paper, we emphasise two issues and offer propositions to enhance our ability to appreciate and direct behaviours in a social-ecological system (SES) in which users and decision makers are concerned with benefit sharing.

The first and most fundamental proposition is concerned with how users value the resource. We argue that perceptions of the value of benefits is an important factor underlying persistent contestation of, or support for the rules that influence benefit sharing. The valuing of natural resources has traditionally been considered from an economic perspective (de Groot et al. 2012). A problem with economic analysis (i.e. the allocation of scarce resources amongst competing ends) in a benefit sharing context is that it assumes collective agreement on benefits or 'desirable ends'. This is because economic approaches are more concerned with

quantifying how much ecosystem structure should be converted to economic products and less concerned with the manner in which users perceive benefits and agree upon baskets of benefits (Farley 2012). A related issue is that non-material benefits, which are not easily measurable in economic terms, tend to be under-valued in attempts to illustrate the economic value of ecosystem services to human wellbeing (Daniel et al. 2012; Tengberg et al. 2012). In this paper we argue that value allocation is fundamentally shaped by meaning and context and that when users assign positive meaning to an ecosystem service, that service is perceived to be a human benefit. We also suggest that attention to meanings offers insights into why individuals take the positions they do when supporting or resisting the rules that govern benefit sharing schemes.

The second proposition is that SESs with benefit sharing schemes in which the rules and outcomes are continually contested, are less able to maintain social acceptability, and so become less reliable in the face of change. We propose that robustness (the maintenance of desirable elements) in SESs can be advanced through the collective design of rules that promote and reflect an understanding of meanings and their ordering within defined contexts; and that this may lead to resource users making behavioural adjustments that are in greater accordance with the rules. We argue that the regulatory instruments (rules) should be an outcome of how resource users collectively reflect on the meanings associated with ecosystem services, and the supply and demand for those services.

In this paper, we use an SES framework proposed by Anderies and colleagues (2004), expanding it to advance an understanding of the role of benefits, meanings and behaviours as elements that qualify the relationship between the resource, resource users and regulatory instruments. Using an example we illustrate the difficulties that emerge when systems are not collectively designed to promote opportunities to articulate and order meanings. We use insights around meanings as a way of valuing natural resources, as a basis for a novel proposition in relation to collective institutional design in SESs. We conclude by discussing the implications for robustness and benefit sharing in SESs and we comment on the usefulness and limitations of the framework.

2. Perceptions of resource value: meanings, benefits and behaviour

The Millennium Ecosystem Assessment (2003) and related scholarly works on ecosystem services have made significant conceptual advances in describing and quantifying benefit streams that explicitly link ecosystems and human wellbeing. Although a diversity of approaches is emerging, there is agreement that the manner in which users allocate value to resources and benefits is an important consideration when striving for equity, sustainability and efficiency in sharing benefits (Lockwood 1999; de Groot et al. 2002; Boyd and Banzaf 2007; Wallace 2007; Fisher and Turner 2008). But these scholarly works have focussed predominantly on the expert classification of ecosystem services for the purpose of economic comparison. They have not addressed the manner in which users

assign value to natural resources or how users perceive the benefits that flow from them.

Some scholars have proposed meaning as an element that fundamentally determines behavioural response (Stedman 2003; Davenport and Anderson 2005) and more generally as a way whereby people make sense of their world. This school of thought is based on the premise that human society is characterised by the use of meanings, or symbolic abstractions that denote significance to those who hold the meaning (Colton 1987). Scholars from the field of symbolic interactionism (rooted in sociology and social psychology) such as Mead (1934), Blumer (1969) and Greider and Garkovich (1994) provide foundational principles for the relationship between meanings and behaviour. Human beings act towards things on the basis of the positive or negative meanings assigned to those things. 'Things' can include physical objects, landscapes, other human beings, categories of human beings (e.g. environmentalists or community activists), institutions, ideals (e.g. integrity or independence) and activities and situations. For example, actors can assign meaning to any ecosystem element or service, whether it is classified as an abiotic input, an intermediate (process-oriented) or a final service, or some combination of those (Boyd and Banzaf 2007; Fisher and Turner 2008). The point we wish to convey is that from a behavioural perspective, the allocation of meaning to any ecosystem aspect will lead to a perception of that service or material as a benefit (positive meaning) or a perception that benefits are reduced (negative meaning) and that this will influence behaviour.

Meanings are held personally but are socially constructed, arising out of social interactions. Behaviour is not seen to be imposed by, and is not the product or outflow of social structures. Although meanings are understood to emanate from structures, i.e. the values, norms and cultures by which people define themselves (Saegert and Winkel 1990), behaviour is rather seen as conduct which is formed as actors handle and modify meanings as they encounter different situations or contexts (Blumer 1969). This perspective places deliberate emphasis on human volition and negotiation in the construction of meanings.

Because meanings are assigned, people and landscapes ('things') do not have inherent meaning. Rather, biophysical settings together with personal-social aspects specific to a situation give rise to context and provide the foundations upon which meanings are formed (Mishler 1979; Terkenli 2001; Gobster et al. 2007). This interpretation is similar to that of geographers who define 'place' to mean 'biophysical space imbued with meaning' (Tuan 1993; Vanclay 2008). Thus the construction and priority ordering of meanings is context-dependent, influenced by situational aspects which are themselves in part socially constructed. Through this process, landscapes and landscape attributes become the material manifestation of a system of meanings (Greider and Garkovich 1994). Robinson and Smith-Lovin (1992) state that "once an object becomes a symbolic representation of meaning for a person, it becomes important to maintain that meaning in order to sustain a coherent, cohesive view of the world" (p. 14). Thus meanings are dynamic, expressive of the interaction between natural and cultural forces and therefore

change over time (Antrop 2005). But, being rooted in values and beliefs, meanings have a persistence that gives them long-term continuity (Greider and Garkovich 1994). Scholarly works on 'place attachment' illustrate how meanings and context become tightly bounded such that place attachment tends to be persistent over time (Williams et al. 1992; Kaltenborn 1997; Davenport and Anderson 2005; Manzo and Perkins 2006; Walker and Ryan 2008).

Shore (1991) and Greider and Garkovich (1994) suggest that categories of shared meaning may emerge. One landscape or landscape aspect may embody multiple meanings that can be grouped due to meanings being shared by others in the same setting. Meanings convey significance in two ways. One component conveys distinctiveness, where one meaning is said to contrast with another, held either by the same person or held by others. The second component is concerned with the strength of the meaning held. When meanings are held strongly, they will prompt behaviours that give expression to that meaning and will serve to reinforce that meaning to be significant. When a group of people share the same meaning strongly, they may engage in collective action as a way of reinforcing the significance of their shared meaning, especially when that meaning, or set of shared meanings, is threatened by other meanings. If a proposed change conflicts with meaning, an actor may adjust, or reorder meanings in response to learning about the new context, or meanings held by others, and may then support the change. Alternatively, actors may insist on the priority position of their meaning and contest the change. Because different actors may hold different sets of meanings in relation to the same thing, a proposed change may evoke support from some and resistance from others. "Communities of shared meaning compete for how meaning will be assigned to a specific place or resource." (Williams and Patterson 1996, p. 512). Resource users therefore compete for which meanings will be assigned and given priority and which will subsequently be reflected in the regulatory instruments (rules).

The way in which a benefit is perceived can only be fully appreciated by recognising the manner in which meaning is personally constructed in association with a perceived benefit. For example, a forester earns an income (a benefit) from timber harvesting. For that person, the meaning of the plantation may be commodity, dependence and/or purposeful engagement associated with silvicultural practices, timber harvesting and sales. For a recreationist (e.g. hiker with dogs), the same plantation provides gains such as health through exercise and fresh air and the opportunity to express aesthetic and recreational values. For this person, sense of place (intimacy with the landscape) and scenic beauty and perhaps to a lesser degree purposeful engagement, may be more prominent meanings. If we take this view, then we can appreciate that within a defined landscape benefits are perceived and ordered through multiple and diverse meanings, and that when landscape attributes change, people respond not only to the change in benefits but also, and more fundamentally, to the meanings they may associate with the benefit (Hunziker et al. 2008). Another confounding factor in attempts to manage the sharing of benefits is that some meanings may be more easily substitutable

by changing landscape attributes, as compared to others. A shade tree removed can be replaced over time by a fast-growing tree species for those who associate shade comfort with the tree. But for those who attach heritage meaning to a tree, a replacement tree cannot invoke heritage meaning. Meanings are the fundamental drivers of the demand for benefits. As a consequence, actors will strive to sustain landscape attributes that provide the benefits that hold significant meaning to them.

We do not wish to suggest that the notion of meanings is the only concept that can explain behaviour in a shared resource scenario. However, this approach exposes the complexity inherent in how people perceive and allocate value in association with benefits, showing that meanings are personal, sometimes overlapping, context dependent and therefore variable across space and time. It also suggests that the popular concept of a benefit, or gain, is more fundamentally underpinned by the notion of meaning. If users perceive benefits through the allocation of meaning, then greater appreciation of meaning is necessary in order to understand the behaviours that underpin benefit sharing. Lastly, this approach provides a basis for value allocation which incorporates material as well as non-material value in relation to natural resources. We further wish to explore the incorporation of meaning, benefit and behaviour into ideas on institutional design to expose opportunities for enhancing stakeholder support for benefit sharing schemes.

3. Robustness in social-ecological systems

For this paper we wish to emphasise the linkages between the resource, meanings, behaviours and institutional design in SESs. We therefore draw on a definition by Janssen et al. (2007) who define an SES as composed of interacting biophysical and social components where (1) individuals have purposefully invested time and effort in developing and maintaining infrastructure that affects the patterns of resource use and distribution among stakeholders over time in the process of coping with diverse disturbances and (2) these biophysical and social components are embedded in a network of relationships among smaller and larger components. This interpretation emphasises the point that humans design some parts of the SES, for example the social rules that guide and constrain human action, whilst other parts of the system are self-organising, such as social networks and behaviours.

The SES framework proposed by Anderies and colleagues (2004) is a useful starting point to develop propositions about the relationships among resource users, between resource users and the resource and how these relationships relate to the regulatory infrastructure set up to direct user behaviour. Their framework is a 'minimal representation' of variables and linkages to broadly describe a social-ecological system. In that framework the resource is linked with resource users, public infrastructure providers (rule makers) and public infrastructure (regulatory instruments or institutions e.g. rules, trust, and physical infrastructure). The minimal representation provides opportunities for scholars to expand on elements and relationships of the framework across different natural resource contexts, and

to provide more detailed interpretations of subsets of relationships. Various authors have used this framework as a foundation to devise propositions and theories, mainly to develop ideas around vulnerabilities associated with the persistence of certain types of robustness (Anderies et al. 2007; Janssen and Anderies 2007; Janssen et al. 2007). We use an adaptation of the Anderies et al. (2004) SES framework (Figure 1) to emphasise and expand on the relationship between the resource (Figure 1A), resource users (Figure 1B) and the regulatory instruments (Figure 1C) designed to direct behaviours. We then use this interpretation to discuss implications for robustness in social-ecological systems that are also common pool resources.

Robustness is widely appreciated as a key concept when thinking about how SESs respond to change and is an important attribute of system resilience (Folke 2006). The concept is especially useful when wishing to address specific issues of design and decisions in a well-defined system (Anderies et al. 2013). Anderies and colleagues (2004) have defined robustness as "the maintenance of some desired system characteristics despite fluctuations in the behaviour of its component parts or its environment." (p. 7). Robustness in an SES therefore refers to the state of a system resulting from the purposeful design of an aspect of the system such that it
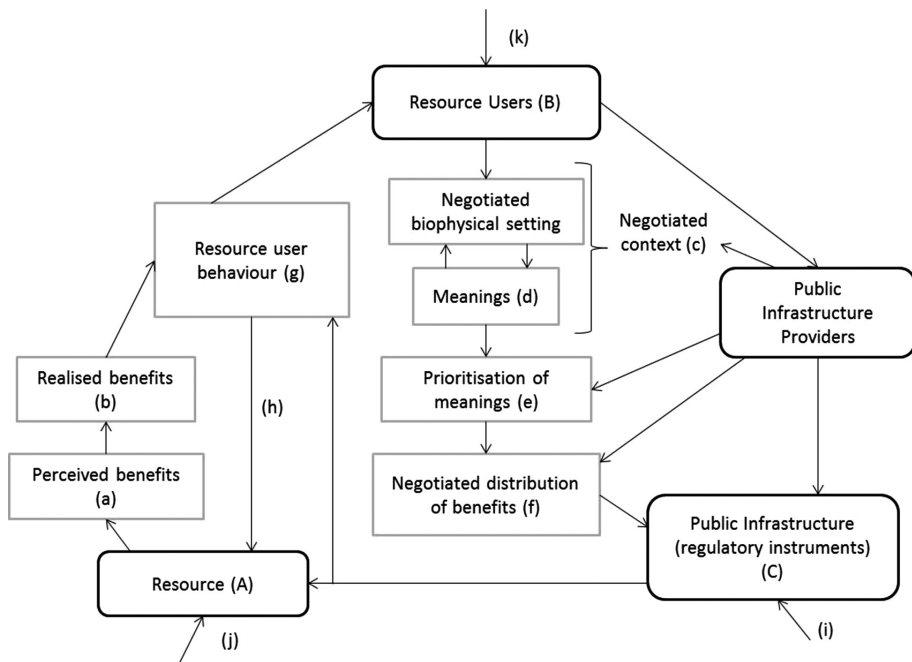

Figure 1: A conceptual framework, adapted from Anderies et al. (2004), showing resource user behaviour driven by the experience of benefits as well as the regulatory instruments that are designed to reflect a prioritisation of meanings and the negotiated distribution of benefits.

is consistent and reliable when subjected to change. The manner in which resource users relate to each other and behave in relation to the resource strongly influences the robustness of a social-ecological system (van der Leeuw and Aschan-Leygonie 2000). This is because coping with the uncertainties inherent in complex systems and making trade-offs among users requires on-going design of the formal and informal institutions that regulate behaviour, and individual and collective commitment to them. We argue that benefits are perceived as a consequence of the context and meanings users allocate to the resource. Following from this, we show that user behaviour is driven by the expectation of (Figure 1a) and by the actual experience of benefits (Figure 1b) as they relate to the constructed contexts (Figure 1c) and meanings (Figure 1d) associated with the resource (Figure 1A).

The intention of the collective design of the regulatory instruments is to facilitate shared understandings among users who have assigned different contexts and meanings to the benefits that emanate from the resource. This shared understanding is necessary to promote the negotiation and priority ordering of meanings (Figure 1e) to achieve collective action because commonly not all meanings can be accommodated nor can the necessary contexts for those meanings be created or sustained. Implied in this is that ordering meanings also serves to define the preferred contexts. During this process, stakeholders may be encouraged to accept that their meanings have been assigned a lower priority in the collective reordering of meanings, but would still behave in ways that are supportive of the rules that govern resource use. Once meanings are articulated and ordered (Figure 1e), and the distribution of benefits (who gets what) affirmed (Figure 1f), it is possible to design the formal and informal institutions (Figure 1c) that will regulate behaviours to align with prioritised contexts and meanings (Figure 1e). Legitimate resource use (Figure 1g) and the accrual of benefits flow from this process, which in turn affects the state of the resource (Figure 1h).

In common pool resources, ecosystem services and meanings can be diverse and therefore an array of user behaviours can result, which may or may not be compatible (Smith et al. 2011). Also, user demands on the resource can change and diversify rapidly. Disturbances may also originate from outside of the system such as policy changes (Figure 1i), ecosystem fluctuations such as floods or droughts (Figure 1j), or changes in the user group and user demands (Figure 1k) that may initially develop outside of the system (Dietz et al. 2003; York and Schoon 2011). The system is therefore dynamic and actors must continually cope with change in order to sustain system robustness. We propose that collective ordering of meanings and associated rules help to direct and regulate behaviours and in doing so these aspects contribute to robustness. We acknowledge that SESs may be characterised by different types of robustness. In particular robustness to one type of variability can lead to an SES developing vulnerability to new kinds of disturbances (Janssen et al. 2007). However, for this paper our aim is to contribute to an understanding of how a particular type of robustness can be developed. Next, we draw upon a case that has been treated in the scientific literature and the popular press to illustrate the conceptual framework.

4. Landscape change, meanings and behaviours

Cape Town is a coastal city at the foot of the iconic Table Mountain situated in the south western corner of South Africa. The City is renowned for easy access to outdoor recreation to visiting tourists and residents alike and a significant proportion of tourism in and around Cape Town is built upon this offering. The native vegetation consists of Mediterranean-type heathland ('fynbos') which does not offer much shade and so over the years people have come to enjoy spending time in commercial plantations of exotic conifer species situated on the mountain slopes within the City metropolis.

4.1. Evolution of collectively designed institutional arrangements

Fast-growing conifers were introduced into southern Africa following European colonisation in the 1650s to provide for a growing timber demand and to prevent over-exploitation of indigenous forests (King 1938; van Wilgen and Richardson 2012). In particular, formal plantations, primarily *Pinus* species, were established on a large scale early in the twentieth century. The plantations on the slopes of Table Mountain are some of the oldest in the country and when demand for this resource generated significant revenue from timber sold to repair ships after World War I, the government of the time created policies to encourage the expansion of plantation forests (Figure 1). Consequently indigenous forests received a greater degree of protection but the primary meanings associated with the plantation resource at this time reflected commercial benefits.

Initially recreational use was discouraged because of perceptions of the risk of fire and so users of the plantation forests, apart from forest managers were few. During the 1970s, responding to growth in public interest for recreation on state lands and plantations the Department of Forestry sought to actively encourage recreation in and public appreciation for plantation forests. This decision was based on the notion that the tax-paying public were 'owners' and should have access to and enjoy benefits from state-owned plantations (Olivier 2009). As a result, additional physical infrastructure such as hiking trails, overnight huts and picnic sites was created to facilitate recreational use. While some sections of the plantations were always being harvested on a rotational plan, the forests were extensive enough to always provide large areas for shaded recreation where trees were mature enough to create a closed canopy. Access was facilitated by the network of roads and tracks that existed to support forest management and the open structure of the plantations created a sense of personal safety. As people engaged and experienced the resource new meanings and associated behaviours emerged and the resource came to be defined differently by multiple users in ways that enhanced place attachment. Importantly, the institutional design evolved in a collective manner. As users responded to forestry policy and the development of infrastructure to further encourage recreation, the design of the social-ecological system reflected the collective meanings and benefits of both timber production and recreational use. During the latter part of the twentieth century, recreation

in plantation forests increased fuelled by urbanisation and improved social and economic circumstances (Bigalke 1983). In Cape Town, plantation uses included horse-riding, mountain-biking, dog-walking, hiking and mushroom harvesting. As a result heritage and recreation-related meanings and benefits, in addition to the utility and commercial benefits from plantations, evolved collectively and became entrenched as users continued to connect with these benefits over time. The plantations became integral to the context that defined resource use and the meanings people attached to the landscape. Policy and practice encouraged a sense of public ownership strengthening perceptions of plantations as common pool resources. This fostered system robustness that would be reflected in how users respond to policy changes that might affect the collectively designed institutional arrangements.

4.2. Robustness and resistance to change

As forestry expanded and was increasingly adopted by the private sector, government sought to redefine its role. In 1997 it issued without public consultation, a new policy that provided for the transfer of less profitable landholdings to national and provincial conservation agencies (White Paper on Sustainable Forestry Development in South Africa 1997; Louw 2012). This set the scene for conservation agencies to exert their influence in ways that would challenge the established collectively designed institutional arrangements of, among others, the Table Mountain SES. For those promoting an appreciation of 'fynbos' this created a chance to emphasise meanings associated with native vegetation in a number of places including urban settings like Cape Town (Rebelo et al. 2011; Anderson and O'Farrell 2012; Holmes et al. 2012). These motivations were stimulated by increased global awareness, particularly among scientists and conservationists, of the uniqueness of the flora of the Western Cape region and of the role of biodiversity in sustaining ecological resilience (Cowling et al. 1992; Goldblatt and Manning 2002).

Assessments of the economic value of biodiversity (Turpie et al. 2003) as well as analyses of the threats to biodiversity (Richardson et al. 1996) have been used to encourage support for conservation policy and practice. One of these threats was the self-seeding and spread of pine trees from plantations (Richardson 1998; Hoffmann et al. 2011; van Wilgen and Richardson 2012). In order to systematically conserve the 'fynbos', critical areas and targets for biodiversity conservation were identified (Cowling et al. 2003; Pressey et al. 2003). The scientists who studied 'fynbos' anticipated that the biodiversity benefits from this vegetation type would be lost unless public infrastructure was created to support 'fynbos' conservation. They lobbied successfully to government and conservation agencies for the control of spreading alien species, for the permanent removal of plantations, and for the re-establishment of indigenous vegetation in priority areas such as around Table Mountain. New regulatory instruments were devised to support biodiversity conservation, the benefits of which remain abstract to some (Conservation

of Agricultural Resources Act of 1983; South African National Water Act of 1998; National Environmental Management of Biodiversity Act of 2004; Table Mountain National Park 2009). The conservation-oriented policy that requires removal of plantations will change the landscape context, accommodating some meanings and behaviours while excluding others that evolved with the plantation forestry context.

Recreationists who use the plantation forests feel that the benefits and the meanings they associate with the plantation forests are threatened and that they are alienated from the process of renegotiating meanings. As a result many users have strongly resisted the decision to permanently remove the plantations. The counter-arguments have been the biodiversity gains (benefits) to be had by replacing the plantation forests with native 'fynbos'. Each is arguing for retaining or rebuilding the biophysical setting that can best support the meanings and contexts that they have prioritised. The debate is well documented (van Wilgen 2012; van Wilgen and Richardson 2012) and resource users and stakeholders have expressed their views through the local press.

"Urban people require woody shade and barrier plants to soften their homes and neighbourhoods. Today the mix of non-indigenous and other South African trees and shrubs make Cape Town the desirable city it has become. Without its non-indigenous woody plants Cape Town would be a hot dusty and wind-swept hell – with the south-easter in summer and the north-wester in winter making life most unpleasant. Unfortunately we have lost almost all our sand plain lowland Fynbos areas. By removing the plantations some people argue that they can return these areas to a low, scratchy, grey-green shrubland full of interesting and intriguing plants that, to thrive, will need to be burnt from time to time by hot fires, ideally in extreme weather conditions. So we are felling the pines to create, in my opinion, a wasteland." (Cape Times; February 2011).

"Although only a few areas have been burnt to date some 328 indigenous plants species of Cape Flats Sand Fynbos and 131 Peninsula Granite Fynbos species have been recorded. By any standards this is a spectacular tally made even more impressive by the 26 threatened IUCN Red List species found in the Cape Flats Sand Fynbos section. [This area] is the last opportunity to conserve Cape Flats Sand Fynbos as a viable ecosystem." And "A perfectly acceptable compromise would be to plant shade trees within 5 minutes' drive of the [restoration] area. This will provide shaded landscapes without compromising threatened Fynbos. Those who want shade can have shade. And South Africa can fulfil its legal obligation as a signatory to the Convention on Biological Diversity to protect 17% of terrestrial areas and to restore at least 15% of degraded areas." (Cape Times; March 2011).

Another issue affecting support for the conservation policy that requires removal of the plantations and restoration of native heathland rests to a large degree upon economic cost-benefit arguments. The economic value of native ecosystems had been highlighted (Turpie et al. 2003), the cost of clearing invasive alien plants had been estimated (de Wit et al. 2001; Marais et al. 2004) and pine plantation forestry is essentially being phased out of the Western Cape because it

is deemed more profitable in other parts of South Africa (Louw 2012). Still, on-going resistance to the decision to remove the pine plantations frustrates efforts to secure public support. We argue that resource users feel that some meanings, in this case those associated with cultural benefits, are not amenable to economic valuation or language. As a result attempts to apply economic arguments to remove the plantation forests have fuelled frustration and interactions have become adversarial, compromising co-design of institutional arrangements that attract wide public support.

It is commonly assumed that when a policy (regulatory instrument) is established, people will appreciate the rationale, adjust their meanings and behaviours, and support policy intent, in this case, biodiversity conservation. The quotes suggest that while users appreciate policy intent and wish to support 'fynbos' conservation efforts, many contest the idea that this should be achieved through removal of all pine trees. This is especially so because the rationale for removal was first expressed as the need to control spread of pine trees into 'fynbos', a goal that could be and has been achieved through other means as demonstrated elsewhere in South Africa (Forestry Industry Environmental Committee 2002). The proposed transformed landscape without pine plantations and with limited, newly planted tree avenues for shade, will not substitute for the benefits and meanings associated with extensive stands of pine trees. While the land management agency holds a dominant meaning defined by conservation of biodiversity, users hold multiple meanings, including conservation of biodiversity, that they feel were being sustained through their behaviours in the landscape. For many, conservation of biodiversity and the control of spread of pine trees could be achieved simultaneously. In this light we suggest that had the conservation agency been more appreciative of meanings and rights of use established over time and facilitated a collective design process that took meanings and rights into account they would have encountered less opposition and more support regardless of the final policy decision. Showing appreciation for the meanings held by users and purposefully sustaining contexts for accommodating those meanings and the associated benefits would have strengthened the design process by building the social capital which forms an essential foundation for biodiversity conservation, particularly where this is to be achieved in an urban setting. We propose that those who motivate for conservation should appreciate that conservation is one of a number of options and to succeed, public support combined with the achievement of conservation targets may be seen as a desirable longer-term gain for the agency. These ideas are in agreement with work asserting that promoting biodiversity importance is not sufficient for motivating public support for conservation (Brechin et al. 2002; Miller 2005; Knight et al. 2006).

5. Discussion

We argue in this paper that a major issue for collective design and one which has not been given attention in scholarly works is the conceptualisation of the relationship

between resource users and the use and benefits perceived in association with the resource. Some scholars emphasise that these factors significantly influence people's willingness to engage in, and their acceptance of and support for land stewardship and conservation initiatives (Manzo and Perkins 2006; Walker and Ryan 2008; Lokocz et al. 2011). However these issues have not been well understood as being embedded in a complex system of benefits, resource users and the instruments designed to direct behaviours. Despite the contribution economic approaches have made to understanding the role of biodiversity in human wellbeing they have yet to find wide public acceptance particularly because it has proved difficult to acknowledge meanings and incorporate socio-cultural benefits (Appleyard 1979; Williams and Patterson 1996; Oreszczyn and Lane 2000; Philip and MacMillan 2005; Farley 2012).

We propose that the adaptation of the Anderies et al. (2004) framework offers several conceptual advances. Firstly, explicit attention to meanings creates opportunities in the institutional design process for resource users to appreciate the fundamental motivations underpinning the different positions adopted by a diverse range of users. This prompts resource users to learn about and appreciate others' meanings alongside their own. It is therefore reasonable to propose that benefit sharing has as much to do with equity in the distribution of costs and benefits as it has to do with recognising a diverse basket of meanings across contexts and scales that determine how people perceive benefits. The example shows that in situations where meanings are contested the use of conventional expert-analytical approaches to decision-making such as risk and cost-benefit analyses would on their own, most likely not garner public support. This is because they are not set up to expose and take account of meanings and the complex relationship between meanings and the perception of benefits. Rather, they are designed to simplify and aggregate elements of interest as defined by experts (Stirling et al. 2007).

Secondly, the ordering of meanings is necessary in the design process for the sanctioning of certain meaning prioritisations. Conversely, when meaning re-ordering is not sanctioned, resistance to the regulatory instruments may persist, eroding robustness of the SES. An appreciation of a diverse basket of meanings among resource users encourages the ordering of values and meanings among them such that individual resource users may accept or tolerate a decision to favour a certain set of meanings even though it may not have been their preferred meaning or set of meanings within the particular context.

Thirdly, our framework sets out to describe a dynamic social-ecological system. In common pool resources in particular, the resource typically delivers benefits to a diverse user group. And as the example illustrates, new contexts and new meanings may emerge as situations change. We argue that given the dynamic aspects of the system, it is likely to be more robust if the design process continually and reliably reflects an appreciation, ordering and re-ordering of a range of values and meanings. We acknowledge the risks of proposing single 'solutions' (for example robustness) to issues relating to natural resource governance systems (Ostrom et al. 2007). However, our work as well as that of

others (Wilson et al. 2007) suggest that given the personal nature and the diversity of meanings and perceived benefits, it may be feasible to place emphasis on users, the meanings they hold, their influence on the design of the regulatory instruments and the potential for user self-organisation around the monitoring and sanctioning of behaviours.

This study asserts that meanings are exposed when actors participating in the process of negotiating desired contexts are asked to describe motivations associated with certain benefits. Those meanings may have more influence and explanatory power related to user behaviour than the resource or policies or management action that is being discussed. We further assert that indicators of meaning such as symbols and emotions can be expressed verbally (Kaltenborn 1997). While 'meaning' is difficult to measure since meanings are held individually and personally, designing interview questions or prompts that elicit responses from resource users to be expressive of meanings or sets of meanings can be developed. It has also been suggested that some sets of meanings are more common and have more knowledge and expressive power such that some classes of meanings may be easier to study than others (Lockwood 1999; McCool 2001). We hope that these methodological challenges encourage scholars to explore possible ways to resolve these difficulties, test the theoretical constructs proposed here and to present further cases to strengthen our understanding of how robustness is enhanced in social-ecological systems for improved benefit sharing.

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