

**Potential futures: Land management decision making in the Albertinia-
Herbertsdale area of the Gouritz Cluster Biosphere Reserve**

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Abstract

Land use change drives biodiversity losses, and UNESCO biosphere reserves serve as laboratories for solving complex problems in the uncertain Anthropocene geological era. Land users' decisions form turning points for land use, biodiversity conservation and future trajectories of land management. This qualitative study used grounded theory, one-on-one interviews and a futures thinking workshop to explore land user decision making in the mixed agricultural Herbertsdale-Albertinia area of the Gouritz Cluster Biosphere Reserve. The study included participants using a variety of land management approaches, ranging from conservation to intensive agriculture. This study found that land managers in the study area interact with multiple complex social-ecological systems, and land management outcomes can be unpredictable for diverse reasons. Informed by learning and risk mitigation as well as their motivation for their present and future, land users are integrating sustainable land management practices in their commercial land management decisions. Their risk adaptation strategies tend to be hands on, independent and practical, as well as action oriented. This can be limiting when adaptation requires abstract, collective or systemic changes. All the participants know that they are dependent on natural resources. They all value their community and social networks. They have a strong appetite for learning, and combine an understanding of the historical context of their land management with an understanding that positive futures will require dynamic and extensive changes at multiple scales. They desire more integrated land use planning at catchment and landscape scales. Collaboration and collaborative strategies emerged as important pathways to the desired future. These include landscape level planning, lobbying for political and legal change, building community, learning, sustainable land management and social integration. It emerged that giving people time to think about abstract or large scale issues is appreciated, and not currently routine. This provides a potential leverage point for collaborative environmental stewardship in this highly biodiverse region.

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Preface

"Whereas all experiences are about the past, all decisions are about the future."

Kenneth Boulding

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Chapter 1: Introduction and literature review

Biodiversity loss is occurring globally at an alarming rate (United Nations 2019, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services [IPBES] 2019), and affects every natural system at every scale, with interplays and feedbacks within and between scales (Biggs, de Vos, Preiser *et al.* 2022 p.3, IPBES 2019). Land (and sea) use change is the dominant direct driver of these losses (Jaureguiberry, Titeux, Wiemers *et al.*, 2022). Although some human societies previously lived in balance with nature, sensitised and responsive to intrinsic ecosystem indicators and feedbacks, as a result of globalisation, extractive development, pollution and climate change (Jaureguiberry, Titeux, Wiemers *et al.*, 2022) there are now no ecosystems on Earth in which humans do not or have not had considerable impacts (Folke, Biggs, Norström *et al.*, 2016). These impacts have caused the Earth system to destabilise and as a result we now live in a geological era dubbed the Anthropocene (Zalasiewicz, Waters & Williams, 2020).

Scientific and other academic disciplines historically differentiated humans from the natural environment (Folke *et al.*, 2016). Some disciplines defined humans as external to ecosystems or nutrient cycles, and some viewed natural resources as tools or commodities and ecosystem services as free and perpetual (Biggs *et al.*, 2022 p.4). Sustainable development, defined as "development that meets the needs of the current generation without compromising the ability of future generations to meet their own needs" (Brundtland, 1987) emerged from a growing understanding that the Earth has certain finite boundaries and that, within those boundaries, human activities could and were indeed likely to exceed the capacity of Earth's systems to compensate, and that this would lead to significant and likely irreversible impacts (Meadows & Randers, 2013). Some of these impacts, such as global temperature rises, desertification, loss of topsoil and species extinctions have already come to pass (United Nations Environment Program [UNEP] 2023, Intergovernmental Panel on Climate Change [IPCC] 2019), but there is still hope to slow and mitigate human-induced climate change and biodiversity losses and adjust human behaviour (Folke *et al.*, 2016).

1.1 Navigating anthropogenic challenges: a social-ecological lens

Social-ecological systems (SES) research has become an increasingly popular approach to understand and navigate complex challenges in the Anthropocene. The field evolved from the understanding that "people and nature are intertwined" and not separate (Biggs *et al.*, 2022 p.5), and that this connectedness and the feedbacks between the social and ecological components of a system are

central to determining how the system functions. Further, that these connections and feedbacks mean that analysing the component parts of the system in isolation will not allow full understanding of what the system is likely to or capable of doing, or how it may adapt to change.

Social-ecological systems (SES) are complex adaptive systems (CAS). Key features of complex adaptive systems (as defined by Prieser, Biggs, de Vos *et al.*, 2018) are: 1. Constituted relationally - they exist as part of a system of feedbacks and patterns between elements of the system. 2. Adaptive - CAS change when elements of the system change. 3. Dynamic - change is the norm within CAS and interpreting trajectories and processes is important. 4. Radically open - the boundaries of a system are fluid rather than defined - they may be chosen by agreement for a specific discussion. 5. Contextual - the system is part of its context and changing the context affects the interpretation of the system. 6. Complex causality and emergence- system interactions are not linear. Using the CAS worldview, researchers can identify and focus on aspects of a SES or the system itself, without losing sight of its connectedness with other systems. Thus, seeing SES as CAS allows a better understanding of the relatedness of people and nature, and their co-evolution, because CAS approaches allow for novel insights, and encourage researchers to look beyond their method or discipline.

1.2 Social-Ecological approaches to reconciling environmental stewardship and development

Environmental (or biosphere) stewardship refers to actions within Social Ecological systems to sustainably preserve Earth's life support systems (Rockström, Beringer, Hole *et al.*, 2021). Environmental stewardship is an emergent outcome of complex interactions and collaboration between diverse actors and processes (Winckler & Hauck, 2019). Such actors and processes can be simultaneously collaborating and in conflict and/or competition (Winckler & Hauck, 2019) in governance systems that are impacting natural resource systems, and being impacted by these systems (Biggs, Clifford-Holmes, Freitag *et al.* 2017, Schultz, Folke, Österblom *et al.* 2015).

A CAS based worldview acknowledges that the variety of landscapes and diversity of cultures globally means that people and places interact in context-specific ways (Biggs *et al.* 2021, Prieser *et al.* 2018). Understanding how SES work in these contexts requires consideration of diverse knowledge, including practitioner- and local knowledge, because people are part of SES. Engaging with knowledge bearers who are not academics, and with academics from different disciplines develops a more coherent understanding of a SES (Pascual, Adams, Diaz *et al.*, 2021).

Although environmental stewardship has been understood in different ways (Plummer, Baird, Farhada *et al.*, 2020), stewardship can be a useful boundary object to connect researchers and non-researchers

in a complex adaptive approach to conservation practices, and to promote dialogue on acceptable trade-offs. "... stewardship is a place-based concept integrating participation and relational values into environmental governance" (Winkler & Hauck, 2019). Environmental stewardship can shape trajectories of social ecological changes, through the processes and institutions through which societies or groups make decisions that influence the environment (Plummer *et al.*, 2020). Diversity of participants in collaborative processes can enhance stewardship (Plummer *et al.*, 2020) and helps promote flexible, efficient and novel solutions. Pluralistic approaches to environmental stewardship can help deliver more effective conservation outcomes, which are also more socially just (Pascual, Adams, Diaz *et al.*, 2021). While pluralistic approaches and inclusion of diverse stakeholders requires a diversity of methods and a variety of inquiry skills, it can increase mutual trust, build understanding in all participant groups and have helpful impacts on the SES in addition to the stated research outcomes (Balvanera, Daw, Gardner *et al.*, 2017).

IPBES (2022) explains that in order to make sense of the world and decide how to act, people use worldviews as a lens (see figure 1 below). Cultures and languages form the bedrock for worldviews, which influence the way people relate both to humans and nature. Anthropocentrism prioritises people, while ecocentrism values nature for its own sake (IPBES, 2022). Pluricentrism centres on the relationships between humans and nature, and cosmocentrism aims to live in harmony and interconnected with all forms of existence (IPBES, 2022). These differences in worldviews can result in conflict between people, but unless the worldviews are articulated this conflict can be difficult to understand or address.

Knowledge systems are embedded in worldviews. They are dynamic and entail knowledge derived in different ways. For example, scientific knowledge applies formal and replicable methods to derive explicit knowledge. Indigenous and local knowledge is based on multiple types of knowledge, and is built on specific places, includes tacit and practical knowledge, and often includes culture and social elements (IPBES, 2022).

Broad values, including values of nature, emerge from worldviews and knowledge systems (see figure 1 below). For example, people with anthropocentric worldviews might value nature as bringing them prosperity through their livelihoods such as commercial fishing, whereas people with ecocentric worldviews might derive value from their stewardship of nature by designating their land a protected area in perpetuity.

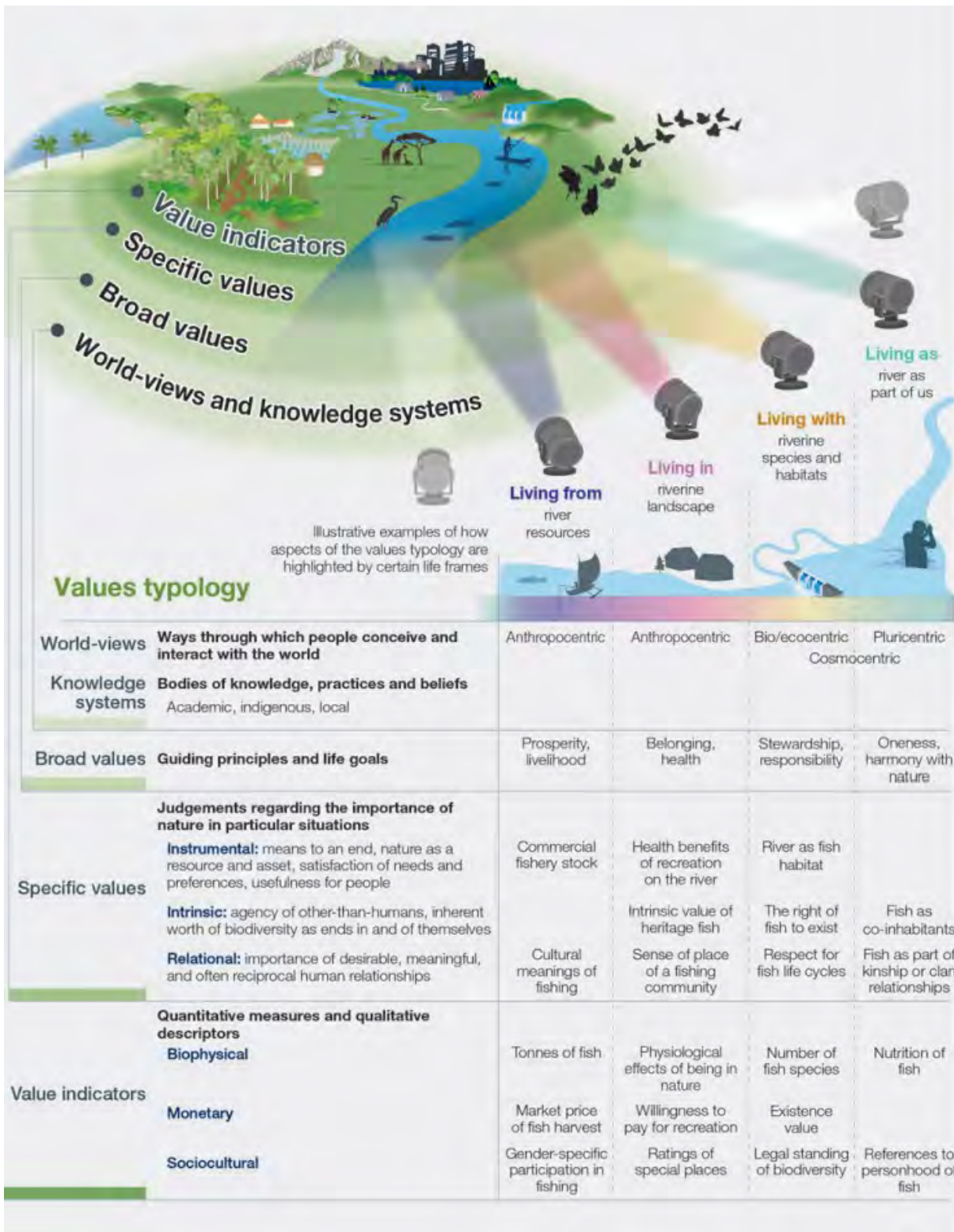


Figure 1. Typology of the many values of nature (IPBES, 2022)

Biodiversity losses do not only affect wild ecosystems and their fauna and flora, but also have profound implications for systems that are predominantly human-driven such as systems of agriculture, trade, food security, economics, politics, and population dynamics (Biggs *et al.* 2022 p.4, Rockström *et al.* 2021, IPBES 2019). Unsustainable agricultural practices also have a profound negative impact on

biodiversity. Tensions between stakeholders, weak institutions, degradation of ecosystems and economic pressure all have implications for biodiversity, ecosystem services and options for land management practices. While tension between actors does not necessarily prevent collaborative stewardship (Plummer *et al.*, 2020), developing a common understanding of what stewardship entails is essential (Plieninger, Bieling, Ohnesorge *et al.*, 2013). Regenerative, restorative agriculture is considered essential for slowing biodiversity losses and to support ecosystem services (Africa Regenerative Agriculture Study Group [ARASG] 2021, Rockström *et al.* 2021). Further, collaborative processes between fields such as ecology and agriculture are needed to inform new transformative strategies for sustainability that include multiple knowledge systems (Ewel 2001, Ruheza & Kilugwe 2012).

1.3 Biosphere reserves as an opportunity to understand pluralistic environmental stewardship

Biosphere reserves are perhaps one of the most well-established environmental stewardship approaches globally. In the 1970s, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) began its Man and the Biosphere Programme, and began to establish biosphere reserves. These Reserves were envisaged as dynamic environments for learning and novel environmental conservation practice (UNESCO, 2024).

More than seven hundred biosphere reserves have been established in 134 countries worldwide (UNESCO, 2024). Biosphere reserves now have three primary goals or focus areas: (1) conservation of biodiversity and cultural diversity, (2) economic development that is socio-culturally and environmentally sustainable, and (3) logistic support, underpinning development through research, monitoring, education and training (UNESCO, 2024).

Unlike traditional conservation reserves and protected areas where reserves are designated, fenced and where activities are highly controlled, biosphere reserves include land that is zoned in three different ways (see Figure 2 below). The core conservation zones which are protected by national or sub-national legislation, the buffer zones alongside the core areas where ecologically sound land management activities can support core areas, and transition zones where human communities are denser but ecological and socially sustainable economic activity is encouraged (UNESCO, 2024). These buffer areas (and even transition areas) may contain important biodiversity elements, and thus these areas may be equally important for stewardship, even if not legally designated as conservation areas (Coetzer, Witkowski & Erasmus, 2014).

Biosphere Reserve zones

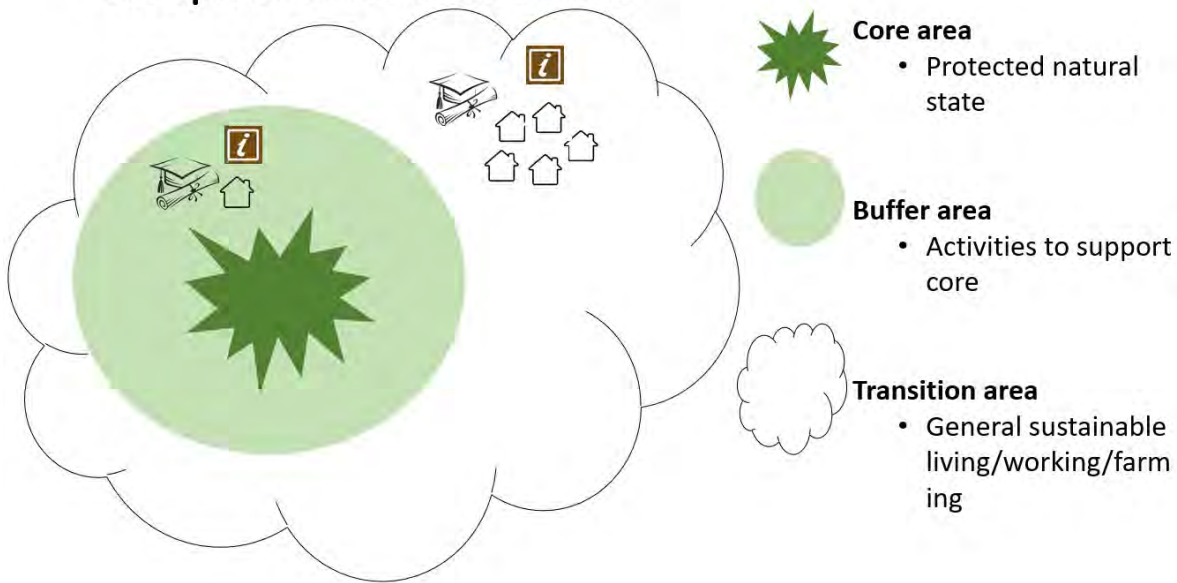


Figure 2. Schematic illustration of biosphere reserve zonation (my own artwork).

At the time that UNESCO pioneered the Man and the Biosphere program, conservation was seen as separate from development, and the concept of sustainable development was still emerging (Pool-Stanvliet, 2013). The Man and the Biosphere concept was groundbreaking in regard to including human development activities in its conservation model (Pool-Stanvliet, 2013). This experimental approach to conservation paralleled the rise of the SES concept and the associated importance of interdisciplinary and trans-disciplinary understanding and the CAS worldview (Reed & Massie, 2013), as well as the growing understanding that the business-as-usual model of global development was unsustainable following the 1987 Brundtland report (Pool-Stanvliet, 2013). Reed and Massie (2013) link the introduction of the concept of sustainable development to the fact that biosphere reserves explicitly addressed objectives such as maintaining local livelihoods and including local people in biosphere reserve decisions. This increased the complexity of decision-making for biosphere reserves considerably (Reed & Massie, 2013).

Despite (or perhaps because of) this complexity, biosphere reserves have and continue to serve as crucibles, supporting a wide variety of research, experiment and ongoing monitoring of adaptive programs (Barraclough, Reed, Coetzer *et al.*, 2023). The world network of biosphere reserves has made considerable contributions to sustainable development and protection of biodiversity (among other outcomes) (Barraclough *et al.*, 2023).

The Man and the Biosphere programme also explicitly included learning as part of its design, which has been identified as a key element in sustainability outcomes (Plummer *et al.*, 2020). In the first two

decades of the UNESCO Man and the Biosphere program, the program promoted learning primarily in the domains of natural sciences and ecology. In the mid-1990s, social sciences and social learning were given more attention in biosphere reserve development, and people and the human contexts of biosphere reserves became more central to their goals (in addition to the ecological focus) (Coetzer, Witkowski & Erasmus, 2014).

Social learning provides actors in a given landscape with new information, attitudes or skills through exposure in contexts other than a formal education process. These spaces may include communities of practice, social engagement, meetings, and other interactions. Social learning allows actors to recognise their own frames of reference for the world, and how these may constrain their options. A feature of social learning is "the emphasis on relational processes, which takes into account the fact that dealing with factual information about a problem is always embedded in a context of negotiated meaning" (Pahl-Wostl, Sendzimir, Jeffrey, *et al.*, 2007, pg. 11).

Some biosphere reserves have been more effective than others at integrating the UNESCO objectives successfully, although very few have achieved all the goals (Coetzer, Witkowski & Erasmus, 2014). Van Cuong, Dar and Hockings(2017) found that stakeholder participation was one of the most influential factors in biosphere reserve success, and that early and ongoing stakeholder participation can help address conflicting interests (Bouamrane, Spierenburg, Agrawal *et al.*, 2016) as well as improve conservation outcomes (Lotze-Campen, Reusswig& Stoll-Kleeman, 2008). Plieninger *et al.*(2013) suggest that biosphere stewardship has no final endpoint - it is an adaptive process navigating a complex SES landscape, and that dynamically managing biosphere reserves requires ongoing, context specific activity.

African biosphere reserves, in particular, face high anthropogenic pressures, commonly caused by weak institutions, competing interests, dependence on natural resources for livelihoods and population growth (Hugé, Rochette, de Béthune *et al.*, 2020). These challenges also provide an opportunity for African biosphere reserves to play an important role in better outcomes for people and nature, particularly in the area of landscape governance (Hedden-Dunkhorst & Schmitt, 2020), by providing a forum/fora for adaptive management, research, and decision support.

Widely used in natural resource management environments, adaptive management is seen as a way of understanding and managing complexity in social-ecological systems (Fabricius & Cundill, 2014). Fabricius and Cundill (2014, pg. 1) go on to explain: "although originally designed to incorporate continuous reflection, adjustment of management actions, and constant experimentation and repetition by managers, more recently the approach has been broadened to involve participation by those outside an organization to broaden the knowledge base and reduce conflicts".

Biosphere reserves are subjected to fragmented and even contradictory legislation in many countries, including South Africa (Pool-Stanvliet, 2013). Although the core areas are usually protected areas mandated by provincial or national legislation, the core areas often form a small percentage of the total area of the biosphere reserve. The buffer and transition areas constitute many land use types from commercial agriculture to urban sprawl, and thus what constitutes legal development in these areas is highly heterogeneous. Biosphere reserves must generate their own financial resources, which can play a role in directing their primary focus, and also can be a limiting factor in terms of their resources and capacity (Coetzer, Witkowski & Erasmus, 2014).

In light of these factors, biosphere reserves often do not have the capacity to enforce legislation or make large-scale decisions about conservation and stewardship practices (Coetzer, Witkowski & Erasmus, 2014). Rather, they are dependent on their capacity to engage successfully with residents and other stakeholders in their reserve areas and collaboratively co-create and agree on management plans and priorities that further their stewardship objectives (Coetzer, Witkowski & Erasmus, 2014). Their capacity to do so can be complicated by the way stakeholders perceive the biosphere reserve or their prior experiences with protected areas (Therville, Mathevet, Bioret *et al.*, 2018), as well as government agencies' precedents and legal mandates to include (or not include) stakeholders in natural resource management (see Figure 3 below).

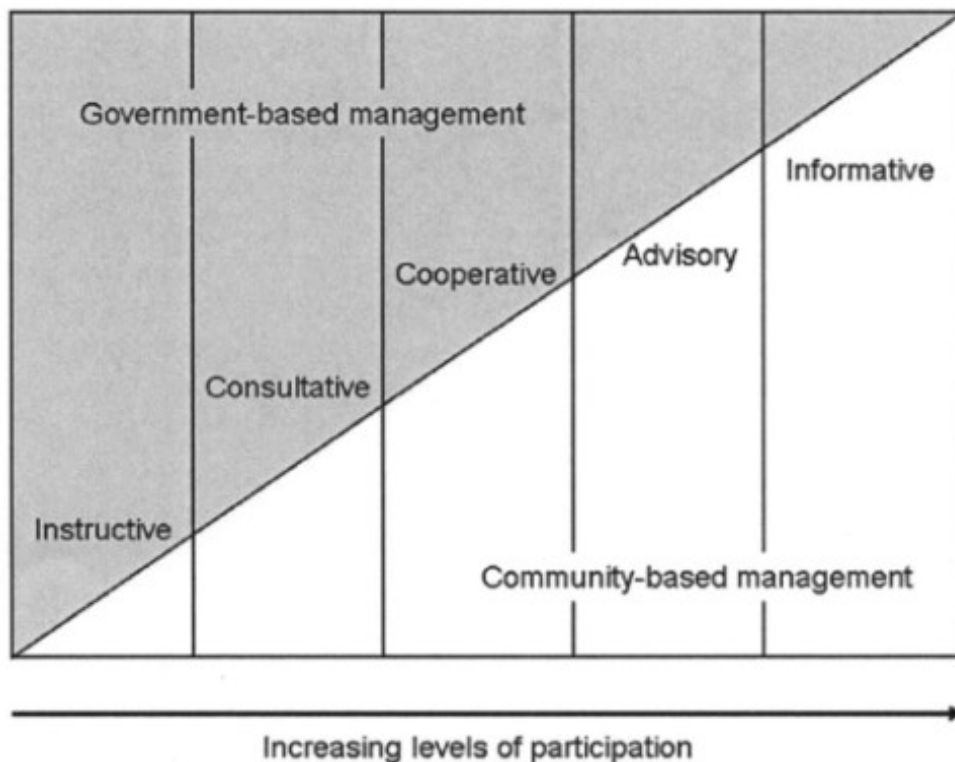


Figure 3. The participation continuum (Rodriguez, Gavin & Macedo-Bravo, 2010)

Drawing together diverse stakeholders is a key factor in managing biosphere reserves for sustainability (Therville, Mathevet, Bioiret *et al.* 2019, Onaindia, Ballesteros, Alonso *et al.* 2013). Due to the complex nature of the buffer and transitional areas and their contribution as habitats and havens, biosphere reserves must transcend traditional arrangements of land use and governance to co-create stewardship for the biomes and bioregions the reserves intend to conserve (Coetzer, Witkowski & Erasmus, 2014).

Although institutional and legal arrangements at national, provincial and municipal level do not always support the objectives of the biosphere reserves (Pool-Stanvliet, 2013), this does not mean that effective stewardship is impossible. Rather, it emphasizes the importance of effective and meaningful collaboration among diverse actors on all levels of community and government who are navigating a complex environment (Stoll-Kleeman & O'Riordan, 2017). Biosphere reserves are uniquely positioned to provide a space for meaningful engagement among stakeholders where the common stewardship and governance goals can be mutually agreed upon (Plieninger *et al.*, 2013). While biosphere reserves thus have no legal 'stick' with which to enforce decisions, they can provide a platform for communication and collaboration among diverse actors and interests, supporting adaptive governance by engaging state and non-state actors in flexible, learning based decision making and collaboration to manage SES and ecosystem services (Schultz, Folke, Österblom *et al.*, 2015) at multiple scales. Such adaptive governance systems can provide a pivotal point for changing the overall trajectory of stewardship practices (Baird, Schultz, Plummer *et al.*, 2019).

Developing coherent plans of action and building trust and co-operation among stakeholders is not always straightforward, but can be achieved (Albert, Zimmerman, Knieling *et al.*, 2012). Participatory activities that engage biosphere reserve stakeholders in meaningful discussions and co-created plans for the future can facilitate and multiply the benefits of a biosphere reserve, especially when stakeholders can see positive outcomes from their participation (Plummer *et al.*, 2020). Biosphere reserves can also support sustainable development in their regions and beyond by: 1) Fostering social learning and knowledge exchange within and between biosphere reserves; 2) Inspiring and co-ordinating collective action that supports local development and conservation; 3) Advocating for healthy adaptive and participatory governance within the biosphere reserve; 4) Fostering transparent, empathetic and responsible institutional communication to locals; 5) Embodying positive leadership; 6) Recognising and harnessing effective power of local communities (adapted from Stoll-Kleeman, De La Vega-Leinert and Schultz, 2010).

The barriers to community participation in biosphere reserve activities must also be considered. Rodriguez, Gavin and Macedo-Bravo (2010) found that power relationships, land tenure and resource rights and limited time and resources were barriers to participation that should be taken into account

in participatory processes in biosphere reserves. In addition, context-specific factors including community dependence on resource extraction, conservation costs and what the community perceives as acceptable levels of participation can also create barriers between biosphere reserve managers attempting to promote sustainable development activities and the residents of the biosphere reserve zones (Rodriguez, Gavin & Macedo-Bravo, 2010). This accords with the findings of Cockburn, Cundill, Shackleton et al. (2019), who found that contextual, institutional, social-relational, individual, and political-historical factors play a role in effective collaboration in multi-stakeholder landscape management. They found that social relational and individual factors had a higher influence on collaboration than political-historical and institutional factors.

To be effective, participative and collaborative processes need to enhance legitimacy through understanding and accounting for stakeholders' values and decision-making processes (Roldan, Duit & Schultz, 2019). How stakeholders make decisions, how these decisions affect their immediate and larger scale environments and what the outcomes can be from these effects is an important and challenging area of managing biosphere reserves for sustainability (Roldan, Duit & Schultz, 2019).

IPBES (2022) highlights that if transformative change is to be made for a sustainable world, considering global knowledge to action gaps is essential. To bridge these gaps, they outline that local values can and indeed must guide policy initiatives and instruments (Pascual, Balvanera, Anderson *et al.*, 2023). Given this, and that land use change is a dominant driver of biodiversity losses (Jaureguiberry *et al.*, 2022), local land user decision making, and the values that support it, plays an important role in biodiversity outcomes both in and outside biosphere reserves (Malek, Douw, Van Vliet *et al.*, 2019). Decision making connects key actors with natural resources and natural resource systems in a SES. Malek, Douw and Van Vliet (2019) found that the motivation and characteristics of land use decision makers shaped the decisions that they made. Further, they found that rural and lowland areas are under-represented in literature on land user decision making.

Malek *et al.* (2019) developed a model for understanding internal and external factors influencing land use decision making (see figure 4 below). Internal factors include worldviews and values (Pascual, Balvanera, Anderson *et al.*, 2023) as well as knowledge-to-action gaps (IPBES, 2022) and external factors are related to the decision maker's SES. These include political, economic, social, demographic, technological, cultural, biophysical, infrastructural and environmental factors.

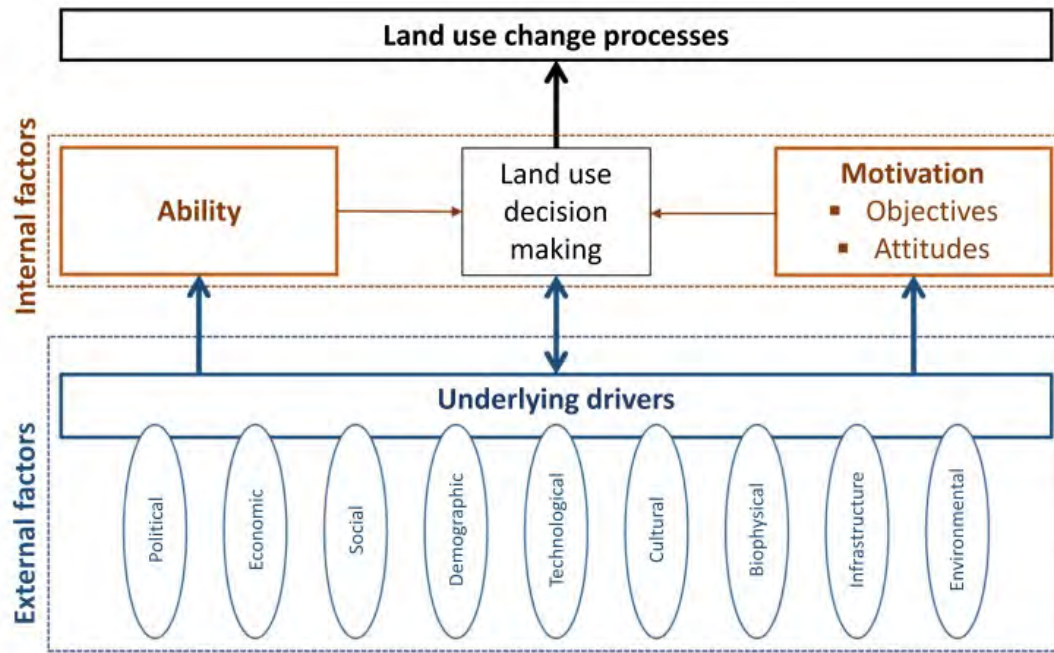


Figure 4. Conceptual model of processes influencing land use decision making (Malek et al. 2019)

Through their three focus areas (conservation, sustainable development and logistic support), and because they are located within local as well as global SES, biosphere reserves are well positioned to build environmental stewardship (Stoll-Kleeman & O'Riordan, 2017) taking local values and decision making drivers into account. They can also make contributions to improved environmental governance by engaging a variety of land use actors and institutions in innovative ways (Barraclough, Reed & Coetzer 2023, Barraclough, Schultz & Maren 2021). Lessons learned in individual biosphere reserves can be useful (when interpreted for context as recommended by Pascual, Adams & Diaz, 2021) throughout (and beyond) the global biosphere reserve network, which can amplify and accelerate positive impacts globally for risk reduction and sustainability.

1.4 Futures thinking and anticipation for biosphere stewardship

While it is understood that the future and the present are distinct, clearly articulating how this is so is notoriously difficult (Bengston, 2019). Incorporating anticipation and foresight into collaborative environmental stewardship can build resilience and improve decision making (Bengston, 2019). Futures thinking is one way to bring diverse stakeholders together to make more sustainable decisions (Biggs *et al.* 2022, Bengston 2019). By imagining the future, which is of its essence uncertain (see figure 5 below), participants can free themselves from some of the limitations to thought implied in current processes, and can project their values and preferences into a scenario. These potential futures allow participants to assess outcomes from a range of future trajectories, which can then inform

current decision making, potentially with more sustainable outcomes (Martin, Hellquist, Schlüter *et al.*, 2017).

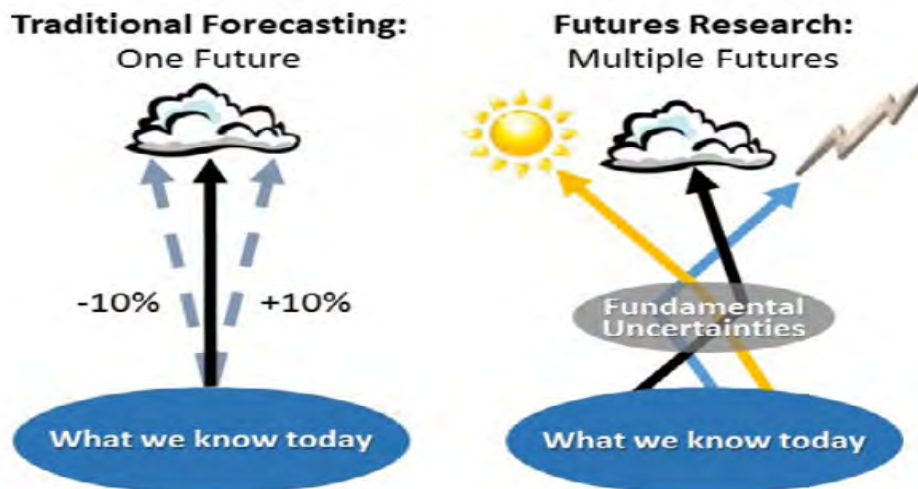


Figure 5. Futures research and traditional forecasting (Bengston, 2019)

One of the elements of futures thinking is risk. Holton (2004) discusses risk as follows: "risk is an intuitive notion that resists formal definition. Risk, as that notion is commonly understood, comprises two components: exposure and uncertainty. At best, we may define *perceived* exposure or *perceived* uncertainty. Accordingly, we can only hope to define *perceived* risk. There is no such thing as true risk." Perceived risk can drive decision making (Loewenstein, Weber, Hsee, et al., 2001) and as such it can be included in futures thinking as part of the fundamental uncertainties of the future.

1.5 Objective and key questions

This study aimed to investigate the broader question of: "What influences land management decision making in the Albertinia - Herbertsdale area of the Gouritz Cluster Biosphere Reserve?" To enable a better understanding of land owners and land managers' decision making, values and perceptions, this project explored participants' motivation, perceived risk, adaptation strategies, learning pathways and decision making criteria for land management into the future in a changing Albertinia-Herbertsdale area.

Specifically, the project sought to address the following questions:

- Why do participants manage land?

Understanding what led to their current activities and the reasons that they continue to manage land can help paint a picture of their values, objectives and attitudes involved in their land management decisions.

- What are their perceptions regarding social-ecological risks?

Perceived risks or perceived threats can indicate systems, objects or concepts that people value enough to want to protect or preserve. Perceived risk can also highlight knowledge and knowledge gaps regarding land management practices, drivers of change, and other factors influencing land management decisions.

- What are their adaptation strategies for their perceived risks?

This helps link what the land owners/managers know about land management, what they know about perceived risks, how they learn and adapt, their values and priorities, and their perceptions regarding the future they would prefer and how they propose to get there.

- How and from whom do land owners/managers learn?

Understanding where decision makers draw their knowledge and information from will enable a better understanding what kind of information and knowledge currently informs their land management decision making, as well as how to support their learning.

- How do land owners make decisions?

Understanding how participants make decisions can indicate how and from whom they learn, and how their perceptions influence the decisions they make. Also, their decisions are ultimately the turning points that impact land management practices.

- What future do participants envisage for themselves and their land?

This combines the land owners/managers' current knowledge, values, decision making criteria, perceptions of risk and their viewpoint of their SES with a focus on the future and how they see their possible options. This forms the basis for identifying leverage points for possible change. Exploring what participants wish to see increase and what they wish to see decrease in the future also triangulates their values and priorities and begins to suggest courses of action to bring about their desired future states.

Chapter 2: Study Site

As discussed, a key challenge for biosphere reserves is to engage the residents of the Reserve area and create meaningful collaboration for sustainable land management, conservation, learning and development. This means collaborating with a variety of land users with a variety of worldviews and values. Understanding these diverse stakeholders is important in making collaborative decisions. While the values and perceptions of land users are acknowledged by the GCBR to play an important role in long term sustainable land use (Roldan, Duit& Schultz, 2019), context-specific understanding of land-owner decision making is still under-studied (Malek *et al*, 2019).

South African landscapes have been managed for thousands of years (GCBR, 2024). The Nguni, the Khoi, the San and other nomadic people have all engaged in forms of land management, some of which resulted in conflicts over natural resources (GCBR 2024, Patterson, 2004). In the 17th century, Dutch traders established a settlement at present day Cape Town. Disputes between settlers and officialdom resulted in the dispersal of immigrant Eastwards throughout the country, especially people of Dutch and protestant puritan French Huguenot descent (Patterson, 2004). These dispersing communities brought new systems of land management, governance, and social organisation into the Albertinia-Herbertsdale area, among other places. Their language, culture, traditions and values are still echoed in their descendants there today (Patterson, 2004).



Figure 6. Map of the area explored by European settlers in the late 17th century (Western Cape Government, 2024).

There is evidence that parts of the GCBR region have been inhabited by humans for millennia. For example, Pinnacle point, a recently proclaimed UNESCO World Heritage site in Mossel Bay, has evidence of human habitation going back 170 000 years (Marean, Bar-Matthews, Fisher et al, 2010). Dispersing European settlers encountered indigenous Khoi herders and nomadic San people throughout the GCBR area (Western Cape Government, 2024), and later slaves and freed slaves who had been brought to South Africa from Asia also made their way into the GCBR region (Western Cape Government, 2024). Missionaries established mission stations in places such as Pacaltsdorp, Zoar and Amalienstein to minister to indigenous people and slaves, and settling European families established churches to succour their communities in places such as Herbertsdale (Western Cape Government, 2024).

Crop farming, as well as wheat and other grains, were initially common throughout the region from Bredasdorp to Swellendam as the settler families established their farms. However, later the farmers in this part of the region mainly switched to wool production, and grain production moved further East towards Albertinia (Schoeman, 2017). In the 400 years since European settlers arrived, the landscape has been changed significantly from the original wide variety of indigenous vegetation types (see figure 8 below), mainly through changes in land use by humans (Schoeman, 2017, Maree and Vromans, 2010).

As the largest South African biosphere reserve, the GCBR provides an excellent case study for understanding local land user decision-making in biosphere reserves. Farming activities of various scales occupy a large part of the buffer and transitional land areas of the Reserve, encompassing a variety of farming practices and products. They include dryland farming of wheat and canola, cultivation of citrus and macadamias, viticulture, dairy farming with pasture under irrigation, agroforestry, and raising sheep and cattle. This study focuses on the Albertinia-Herbertsdale area of the GCBR. The intersection of the Karoo, Coastal and Fynbos biomes in this area of the GCBR makes it highly biodiverse, with high levels of endemism and thus it is important for biodiversity conservation and a key priority for the GCBR.

The GCBR has adopted a non-confrontational approach to stewardship within its area, focusing on developing ecological corridors and landscape restoration (S. Du Toit, pers. comm., 2021). The GCBR offers free membership to people and who are residents within and outside the boundaries of the biosphere reserve. Membership includes access to information updates, and in some areas extension support services such as sourcing of bio-control agents, herbicide and fungus for alien plant control, as well as alien plant eradication teams for hire, and co-operative business development (in some cases). The GCBR also offer their members free assistance to develop management plans for biodiversity conservation.

The consensus among the GCBR staff is that land owners and land managers in the GCBR area are an essential part of the long term environmental stewardship within the Reserve. Further, their understanding of their environment is considerable although poorly documented, and that their values, decision making and understanding of biodiversity and its importance could be better understood (L. Zondagh, pers. comm. 2022). Better understanding how these actors see their land, how they make decisions and how they imagine their future can help the GCBR find ways to communicate more effectively and align their goals, and can ultimately help facilitate their efforts to conserve the tremendous biodiversity in the region (S. Du Toit pers. comm. 2022, Bengston 2019).

In some biosphere reserves, the residents and stewardship stakeholders perceive the biosphere reserve to be a polarised, conservation-centred institution whose values may not align with theirs (Zscheischler, Busse & Heitepriem, 2019). Understanding how land owners see the GCBR and their perception of the organisation's role in their activities can help the GCBR streamline communication with land users, and help to identify leverage points where the biosphere reserve might be able to convene stewardship activities. This may enable collaboration across landscapes to sustain livelihoods, enhance biodiversity conservation, and preserve cultural landscapes (Zscheischler, Busse & Heitepriem, 2019).

Although land owners and land managers in the buffer and transition areas of the GCBR are subject to a range of laws, constraints and limitations, they are autonomous decision makers with capacity to influence the biodiversity and ecosystem services of these areas. As such, their decision making has an effect on their immediate environment and their cumulative decisions have a broader impact on the GCBR SES. These impacts have implications for biodiversity and ecosystem services in the region now and in the future. In SES terms, farmers represent key actors who interact with natural resource units and systems (Ostrom, 2009), and form an integral part of governance systems. Their decisions thus represent key connections between natural resource units and systems, underlying key impacts and feedbacks between these different system components. They also potentially reveal key leverage points for intervening in the SES towards a more resilient, just and sustainable outcome; interventions that should be co-created and implemented by collaborative decision making. Although these decisions are generally acknowledged as important, access to decision-makers can be difficult due to the demands of their profession and rural location. In the case of the GCBR, such access was facilitated by a co-researcher who is both a farmer and the GCBR extension officer, who formed an entry point for meaningful engagement.

The GCBR covers 3 187 893 hectares straddling the border of the Western and Eastern Cape provinces of South Africa (GCBR, 2024). The GCBR domain extends from the town of Montagu in the West to the Western limits of the Baviaanskloof Mountains in the East. The GCBR extends inland from the Southern coastline to the Swartberg Mountains, and the town Prince Albert. The Albertinia-Herbertsdale area lies to the Northeast of the coastal town of Mossel Bay. This area has been identified as a key focus area for the GCBR. This area is designated as St. Blaize in the map of the GCBR

(Figure 7) below and Herbertsdale town falls immediately beneath the 'S' of St. Blaize.

Gouritz Cluster Biosphere Reserve Zonation

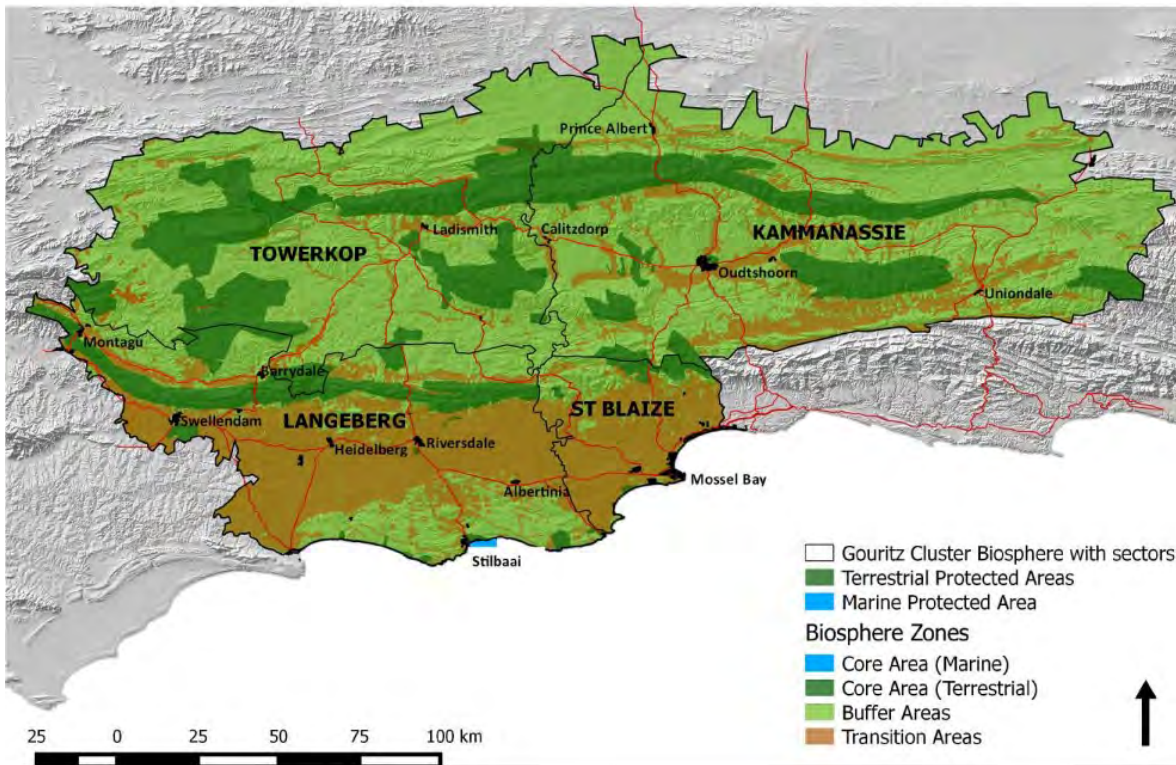


Figure 7. Map of biosphere reserve zones in the Gouritz Cluster Biosphere Reserve with the study area circled in yellow (GCBR, 2022)

Three of the nine South African biomes intersect in the GCBR domain. The Fynbos biome, which includes Renosterveld (SANBI, 2024), the Thicket, and the Succulent Karoo biomes (SANBI, 2024). Renosterveld is a veld type consisting of many shrubs with small, tough grey leaves including the characteristic *Dicerotheramnus rhinocerotus*, grasses, and a high richness of geophytic plants (SANBI, 2024). The fine grained clay and silt soils in Renosterveld are mainly fertile and hence have been extensively ploughed for grain crops (SANBI, 2024). Renosterveld occurs where rainfall is between 250 and 600 mm per year. Fynbos generally occurs on poorer soils (some areas with good soils having been almost completely transformed to orchards and vineyards), where they are leached by higher rainfall, generally above 600mm per year, and fire plays an important role in maintaining this biome. Fynbos includes members of the Restionaceae, Ericaceae and Proteaceae families in addition to others. Fynbos types generally have a very high endemism, being highly specialised to their specific area (SANBI, 2024). The Succulent Karoo biome occurs in areas with between 20 and 290mm of rainfall per year, and arid summers. This vegetation comprises many succulents including Mesembryanthemaceae, Crassulaceae, and some Asteraceae species. Historical sheet erosion has contributed to massive loss of topsoil in this biome and thus it does not support farming without extensive irrigation and/or supplemental feeding (SANBI, 2024).

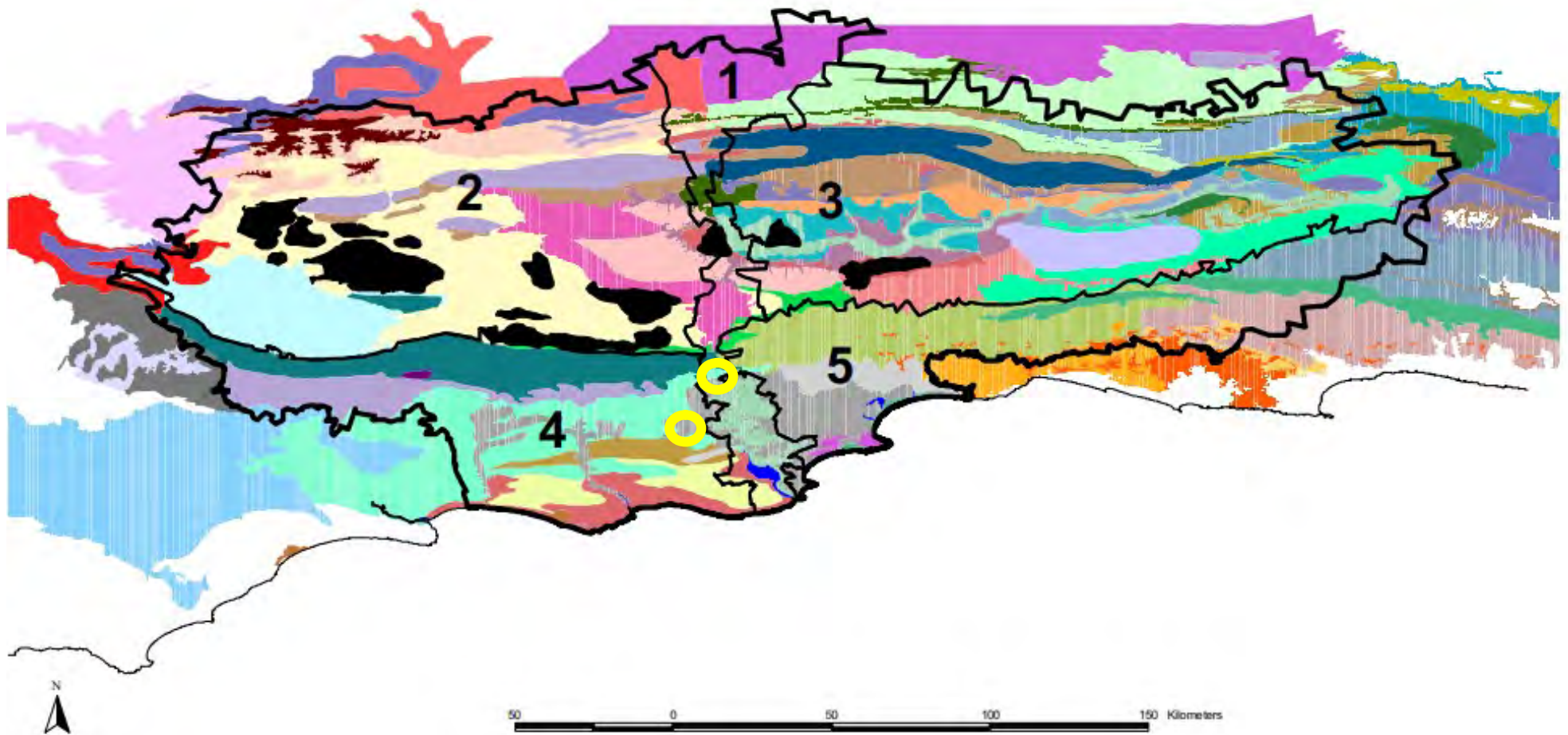


Figure 8. Vegetation map of the GCBR domain, showing GCBR management areas (Lombard & Wolff, 2004)

ENDEMIC VEGETATION TYPES

FOREST	Swellendam Afromontane Forest
FYNBOS	Albertinia Sand Plain Fynbos Canca Limestone Fynbos Suurbraak Grassy Fynbos
MOUNTAIN FYNBOS COMPLEX	Groot Swartberg Mountain Fynbos Complex Kamanassie Mountain Fynbos Complex Klein Swartberg Mountain Fynbos Complex Outeniqua Mountain Fynbos Complex Rooiberg Mountain Fynbos Complex Southern Langeberg Mountain Fynbos Complex
RENOSTERVELD	Cannaland Inland Renosterveld Kango Inland Renosterveld Montagu Inland Renosterveld Uniondale Inland Renosterveld
SUCCULENT KAROO	Little Karoo Broken Veld Oudtshoorn Broken Veld
THICKET MOSIAC	BARANDAS GWARRIEVELD BLOSSOMS KARROID THICKET CALITZDORP KARROID THICKET CANGO RENOSTER THICKET DE RUST KARROID THICKET HARTENBOS STRANDVELD HERBERTSDALE RENOSTER THICKET KANDELAARS KARROID THICKET MEIRINGSPOORT FYNBOS THICKET MONS RUBER FYNBOS THICKET OUDTSHOORN KARROID THICKET VANWYKSDORP GWARRIEVELD

NON-ENDEMIC VEGETATION TYPES

COASTAL	South Coastal Vegetation	THICKET MOSAIC	BAVIAANS DORINGVELD BEERVLEI KARROID THICKET GAMTOOS GWARRIEVELD ROBBERG DUNE THICKET STILL BAY DUNE THICKET WILLOWMORE GWARRIEVELD WILLOWMORE RENOSTER THICKET
FOREST	Knysna Afromontane Forest	THICKET SOLID	BAVIAANS SPEKBOOM THICKET GAMKA ARID SPEKBOOMVELD GOURITZ DUNE THICKET GROOT ARID SPEKBOOMVELD
FYNBOS	Outeniqua Plateau Fynbos Tsitsikamma Plateau Fynbos		
FYNBOS/RENOSTERVELD	Blanco Fynbos / Renosterveld Mosaic Langkloof Fynbos / Renosterveld Mosaic		
MOUNTAIN FYNBOS COMPLEX	Baviaanskloof Mountain Fynbos Complex Koo Langeberg Mountain Fynbos Complex Kouga Mountain Fynbos Complex Tsitsikamma Mountain Fynbos Complex Witteberg Mountain Fynbos Complex		
NAMA KAROO	Gamka Broken Veld Steytlerville Broken Veld		
RENOSTERVELD	Ashton Inland Renosterveld Matjies Inland Renosterveld Overberg Coast Renosterveld Riversdale Coast Renosterveld		
SUCCULENT KAROO	Laingsberg Vygieveld Prince Albert Broken Veld Robertson Broken Veld Touws Vygieveld Witrantjies Broken Veld		

Figure 9. List of vegetation types illustrated in figure 8 (Lombard & Wolff, 2004)

The Thicket biome is poorly documented (Poulsen, 2022), and comprises a variety of evergreen and deciduous trees, typically smaller than those of the same species found in forests, as well as succulents and other species. 20 percent of the plants are endemic to this vegetation type. Thicket occurs in areas which received 200 - 950mm of rain per year, generally where rainfall is distributed throughout the year (Poulsen, 2022). The GCBR area contains two of South Africa's three biodiversity hotspots, namely the Cape Floristic Region and the Succulent Karoo (Maree and Vromans, 2010). These hotspots adjoin Herbertsdale to the South and the North respectively. There is only one designated protected area near Herbertsdale (as can be seen in figure 7 above), and the rest of this highly biodiverse area is privately owned land. These land owners thus play a key role in biodiversity conservation in this region.

Herbertsdale also lies in the intersection of the five GCBR management areas (see Figure 8, above) (Lombard and Wolff, 2004). The GCBR domain consists of three biomes, with mosaics and overlaps between them. These are the Fynbos, Albany Thicket and Karoo biomes (Maree & Vromans, 2010). The region is home to a wide variety of endemic species of plants, vertebrate and invertebrate animals, and freshwater fish, as well as many birds endemic to South Africa (Maree and Vromans, 2010). These include the Amethyst, Southern Double-collared and Malachite sunbirds; Cape Mountain Zebra, Eland, and Bontebok; the endangered Riverine Rabbit; Leopard, Aardwolf, Golden Mole, Namaqua Rock Mouse; Parrot-beaked and Angulate tortoises; Loggerhead, Leather-back, Green and Hawksbill turtles; Cape Sand Frogs; Coastal Blue and the critically endangered Dickson's Opal butterflies; Galaxia zebratus fish; and a variety of others (Maree and Vromans, 2010).

Intensification of agriculture, urban development and population growth have increased the need for and use of water resources from the rivers in the GCBR, with associated declines in water availability and quality (Maree and Vromans, 2010). The largest of these rivers is the Gouritz river, which arises in the Klein Karoo near Calitzdorp, and crosses the Langeberg mountains and traverses the coastal plain to its estuary at Gouritsmond town. The Gouritz river forms an important ecological corridor between the Karoo and the coast (Maree and Vromans, 2010). The vegetation in the Gouritz River corridor has been extensively transformed from natural vegetation to pasture and ploughed land (Maree and Vromans, 2010). Historically the landscape in the region would have supported indigenous grazing mammals including Blue Buck and Quagga (Curtis, 2013) on primarily Renosterveld shrublands, but up to 95% of this veld type has been transformed (Poulsen, 2021) and the large game animals were extensively hunted by settlers (some to extinction).

Herbertsdale is a small rural town, with a population of just under 700 people (Census 2011) and falls into the Mossel Bay municipal district. Albertinia is much larger, with a population of 6300 people

(Census 2011), and falls within the Hessequa municipal district. Both towns have diverse populations, with a high incidence of poverty, particularly in previously disadvantaged population groups.

The following table shows the Census 2011 data for Mossel Bay and Hessequa Municipalities, which provide an overview of the socio-economic situation in these municipalities.

Table 1: Census 2011 data for Mossel Bay and Hessequa municipalities

Census data (2011)	Mossel Bay Municipality	Hessequa Municipality
Total population	89,430	52,642
Young (0-14)	23,1%	24,4%
Working Age (15-64)	66,8%	64,6%
Elderly (65+)	10,1%	11,1%
Dependency ratio	49,7	54,9
Sex ratio	95,8	94,1
Growth rate	2,24% (2001-2011)	1,77% (2001-2011)
Population density	44 persons/km ²	9 persons/km ²
Unemployment rate	22,9%	14,1%
Youth unemployment rate	29,9%	18,9%
No schooling aged 20+	29,9	4,6%
Higher education aged 20+	13,5%	10,4%
Matric aged 20+	31,9%	23,5%
Number of households	28,025	15,873
Number of Agricultural households	2,013	2,668
Average household size	3	3,2

Female headed households	33,9%	34,1%
Formal dwellings	85,9%	93,8%
Housing owned/paying off	60,7%	60,3%
Flush toilet connected to sewerage	83,1%	80,7%
Weekly refuse removal	92,6%	78,7%
Piped water inside dwelling	77,9%	81%
Electricity for lighting	93,8%	94,9%

Of the 4681 agricultural households in these two municipalities, livestock farming (2078 households), poultry farming (1882) and vegetable farming (1798) are the main activities, with 'other' activities (1580 households) and crop farming (797 households) making up the remainder of the activities (Census, 2011). It should be noted that the census data is more than a decade old.

Agricultural household income varies considerably. Census 2011 reports that fourteen percent of agricultural households earn no income at all (667/4679 households). The highest declared income bracket - households earning in excess of R307201 per annum - falls to just over five percent of households (245/4679).

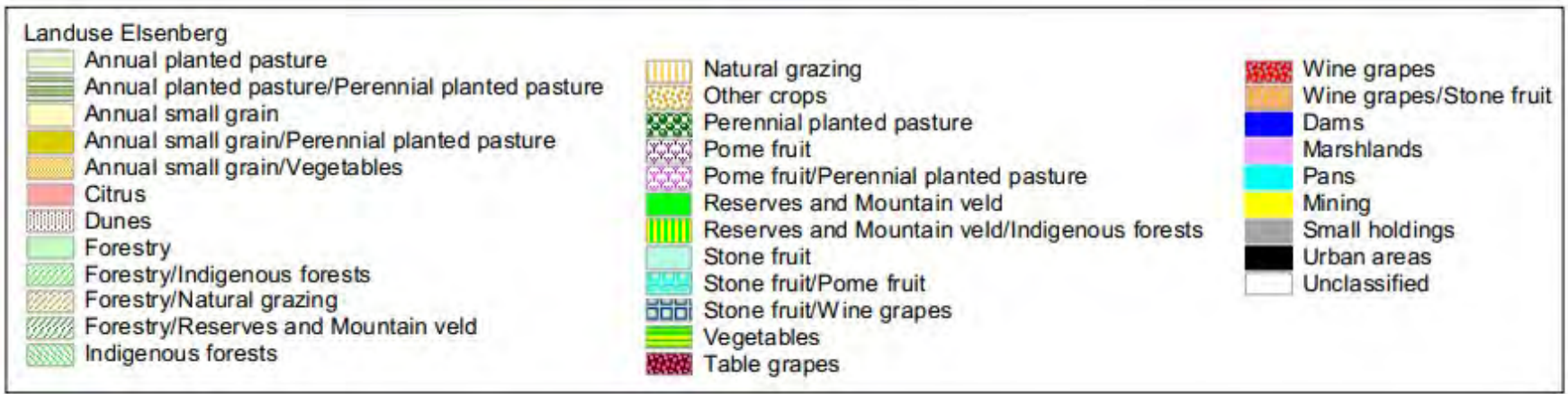
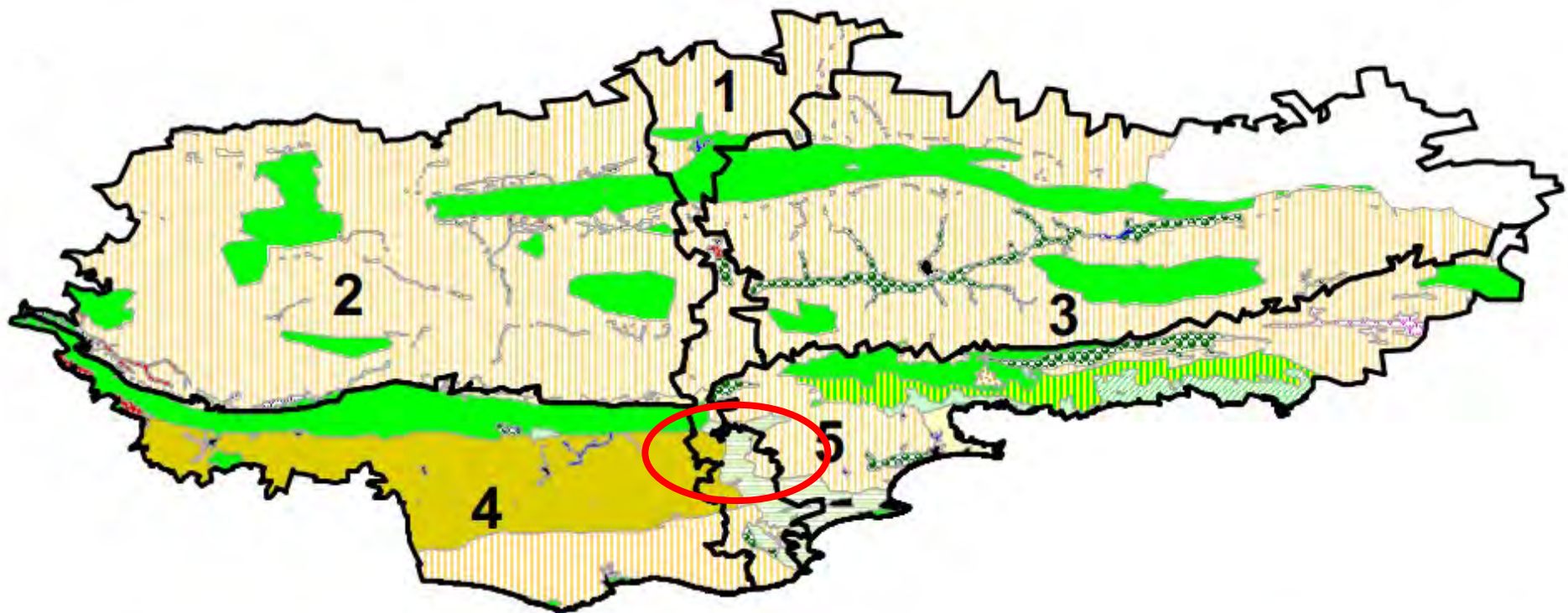


Figure 10. Map of GCBR showing agricultural land uses (Lombard & Wolff, 2004)

Engaging with farmers and other rural land owners/land managers in the GCBR is seen as both critical to the success of the reserve and as a challenge (S. du Toit, pers. comm. 2021). This challenge is partly due to the ideological tensions between actors, and partly because rural land managers are committed to being on their land and therefore meetings and workshops can be difficult to schedule (H. Muller, pers. comm. 2022). The GCBR has therefore embarked on extension work through individuals embedded in their landscapes. Extension officers are local farmers who do part-time work for the reserve to facilitate trust building, monitoring and learning in the GCBR context (S. Du Toit, pers. comm. 2021). This approach allows GCBR to support sustainable lifestyles and learning in non-adversarial ways, while finding ways to promote environmental stewardship.

Chapter 3: Methods

The researcher used grounded theory (Charmaz 2006, p. 5) to guide the study process. Grounded theory allows for exploratory qualitative research in contexts that may not be well understood by the researcher at the outset of the study. Strauss and Corbin (1998) describe this theory as being grounded in data which comes from the participants. Maree (2019, p. 87) says that data collection, analysis and theory "stand in reciprocal relationship with each other" in a grounded theory study. This facilitates reflection and ongoing data analysis depending on how the study unfolds, including building the literature review in response to the data analysis (Charmaz 2006, p.6).

Worldviews and values were considered by the researcher to be integral to land management, and it was expected that worldviews and values relating to the participants' land management decision making would become apparent as the interviews unfolded. This study did not set out to specifically identify the participants' values, but rather to include them implicitly in the perspective of their land management and decisions. This was, in part, because the co-researcher warned that "personal" questions might cause discomfort for the participants. Rather, it was decided to encourage broad ranging conversation to permit participants to say as much or as little as they wished to.

The co-researcher for the study works part-time as the GCBR extension officer for the Albertinia-Herbertsdale region of the GCBR. She facilitates information sharing, assists land owners who wish to join the GCBR as members, and supports land owners who wish to develop biodiversity management plans for their land. She is also a farmer who lives and manages land in the region. Her role in this study involved facilitating contact (through the GCBR membership database and her local knowledge) with potential study participants. She also provided the researcher with contextual information and gave guidance on how to approach the study in a locally appropriate and respectful way.

The co-researcher's role was to: advise on matters pertaining to local context during the research design process; to assist with purposive sampling based on her extensive knowledge of the GCBR organisation, the GCBR landscape, the land management practices conducted in the study area, and the people conducting these activities; to make first contact with potential interview candidates and establish whether they were prepared to participate; to attend the interviews as a familiar face and to help build trust between participants and researcher; to participate in one interview as an interviewee; to attend the workshop as a participant in her role as local land manager and interviewee; to reflect with the researcher following each interview and after the workshop; and to assist the researcher to contextualise her findings.

Reflexivity, the continuous practices used by researchers to evaluate how their context and perspective influence the research process (Olmos-Vega, Stalmeijer, Varpio *et al.*, 2022), was a central aspect of the project design. Reflexivity was included in all the stages of this project, in multi-faceted ways.

This study combined one-on-one interviews and a workshop to understand land user decision making in the Gouritz Cluster Biosphere Reserve, focusing on the Albertinia-Herbertsdale area. At the time of designing the study, it was not known whether the workshop would be possible due to potential lack of interest and availability of participants (see page 19). However, during the interviews, the participants expressed an interest in attending a follow up futures thinking workshop. The co-researcher suggested August 2023 as the most suitable time for the workshop, to try to align with the majority of farming schedules and thus attempt to optimise the participants' potential availability.

Although grounded theory aims to involve all participants in all aspects of the research, it was not possible to include the participants in the data coding and thematic analysis of the interviews due to their busy schedules and time constraints on the study. In keeping with the reflexive research design, and to confirm that the interview findings accorded with the workshop participants' experiences, the researcher presented the interview findings at the workshop for workshop participants to reflect on and question, however. Not all the interview participants were free to attend the workshop, and not all of them wanted to. However, all interview participants were given a hard copy of the interview summary booklet for their comment (none of them gave comment). Due to the same time constraints, workshop participants were not involved in the thematic analysis of the workshop. However, all study participants were notified of the studies completion, and invited to ask for a digital copy. Only two did so, and no further comment was received.

In designing this study, the three principles of ethical research as defined in the Belmont Report (1979) were used. These are: respect for persons, beneficence and justice. This study sought to embrace the

first of these principles by acknowledging the participants' autonomy, and not seeking to use participants with diminished autonomy. The second principle was considered by maintaining confidentiality of both interview and workshop participants. Ethics approval was obtained for the interviews in October 2022 (approval number 2022-5908-7183, see Appendix 1) from the Rhodes University Human Research Ethics Committee. The study adhered to the principles of confidentiality for participants in the interviews. Since the workshop built on the analysis of the interviews, a separate ethics application was submitted for the workshop, and was obtained in July 2023 (approval number 2023-6999-7773, see Appendix 2). Confidentiality for the participants in the workshop could not be guaranteed because of the nature of group processes, but confidentiality was addressed with the participants in the introduction on the day, and data from the workshop has been anonymised in the study.

3.1 Positionality statement

The researcher lives and works in a small rural town in the Eastern Cape Province, and descends from a family who have been engaged in livestock farming operations for three generations. While not involved in farming herself, she has a reasonable understanding of the South African farming context, and can relate to rural work and life at a personal level. This assisted in building rapport with many of the participants, despite differences of home language (in most cases) and cultural differences arising from her (culturally) English family background. Many of the study participants descend from (culturally) Afrikaans families. The researcher also used lessons learned in her work in adult education to listen reflexively, confirm her understanding of participants' views, and clarify unfamiliar concepts.

While the researcher made every effort to conduct the interviews, workshop and data analysis in a neutral way, her own worldviews and values influence her perceptions of the process and data. These have been corrected for by including the co-researcher in discussion of the study design and process, providing feedback to the study participants for verification, ongoing personal reflection and review of literature, as well as close academic supervision.

3.2 Interviews - data collection

In this phase, semi-structured interviews (Mathers, Fox & Hunn, 1998) were used to answer the research questions. To answer the research questions, the interviews explored participants' knowledge, values, adaptation strategies, perceived risks, learning pathways and decision making criteria for land management, as well as how they see their possible futures. The interview questionnaire (see Appendix 3) consisted of 81 questions which triangulated these topics.

The researcher attempted to link concepts in sequence of interview questions that would make the interviews more conversational and less potentially stilted. Rather than grouping the interview questions according to the research question sequence, the interview questions were designed primarily with conversational flow in mind. The subsequent data coding was intended to be the point at which the data was drawn together into categories to answer the research questions.

Each section of the interview was headed with a main question to set the direction, and subsequent questions to clarify or elicit more information if it was required and had not already been mentioned in response to the main question. This was because the researcher anticipated that participants would have differing conversational styles, and in some cases the more loquacious participants would be likely to answer several questions at once, while more briefly spoken people might answer questions more pointedly. Closed questions were therefore avoided as much as possible. Table 2 (below) gives an example of the way the researcher linked the interview questions, coding categories and research questions.

Table 2. Example of linked interview questions, coding category and research questions

Interview question	Coding category/ies	Research question/s
How did you get into farming?	3. Reasons for becoming a farmer or land owner/manager	Why do participants manage land?
Why are you a farmer now?	4. Reasons for being a farmer or land owner/manager in the present. What meaning does land management have for them?	Why do participants manage land?
Do you want to keep farming into the future?	22. What does a positive future for themselves and their land look like?	What future scenarios do they envisage for themselves and their land?
What training do you have? This could be any formal or informal training that has prepared you for your work	5. Training, both formal and informal for current activities	Why do participants manage land? How and from whom do land managers learn?

The participants were selected based on their farming/land management practices as well as their location within the Albertinia - Herbertsdale region. The final selection was based on willingness to participate as well as their availability for an interview during the time period between September and December 2022. A sample of farmers from the categories of land use practices common in the area (as identified by the co-researcher) was sought from the GCBR membership database. These land use

practices include: dairy farmers, flower farmers, citrus farmers, wine farmers, aloe farmers, grain farmers, sheep farmers (usually also grain farmers, H. Muller pers. comm. 2022, Maree and Vromans 2010), lifestyle farmers (people who own land but do not use it for any commercial purpose), nut farmers, nature reserve owners and game farmers.

For this study, the intended sample size for the one-one-one interviews was a minimum of two participants per land use type and a maximum of four, to permit the researcher to develop a richness of detail from the eighty one interview questions across a variety of land use types representative of the study area, but possible within the limits of time available for the study (Taherdoost, 2016).

Potential participants were stratified by land use type on their farms, and then purposively sampled according to guidance from the GCBR extension officer from the contact lists available. In some cases, there is only one farmer producing a certain crop (such as the vineyard and winery) or only one of the land owners of the only two macadamia farms responded.

The sample was limited to voluntary respondents and thus did not include potentially antagonistic farmers. The sample also did not include those land owners who are not on the GCBR membership list. An attempt was made to correct for this by snowball sampling (Taherdoost, 2016). Two interview participants were not GCBR members. They were selected by snowball sampling. Note: most of the participants have more than one land use on their property. The activities that are conducted on the majority of the properties appear in figure 11 below. The detailed information is available in Appendix 4. The activities are: mixed livestock and cultivation (n=6 participants), dairy (n=3), sheep (n=3), agroforestry (n=2), wildlife/tourism (n=1), flowers (n=1), nuts (n=1), wine (n=1), lifestyle (n=1), and conservation/tourism (n=1).

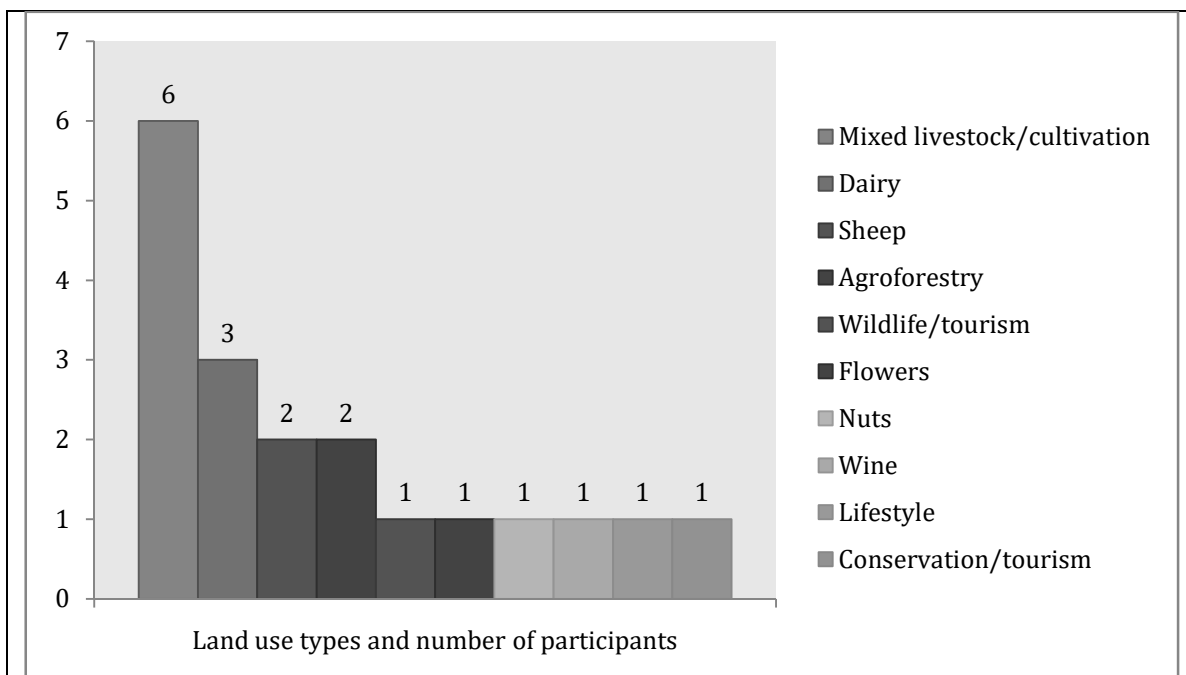


Figure 11. Land use on land owned/managed by interview participants

Participants in the survey were initially contacted by telephone or by email, using the contact information held on the GCBR membership database (see Appendix 9). The interviews were mostly (n=18) conducted in person, or electronically over Zoom (n=1) or telephonically (n=1). Mrs Halcyone Muller, the GCBR extension officer for the region, was included as a co-researcher and attended most of the interviews (n=17) but did not conduct the interview or participate. Written consent was obtained before the interviews began (see Appendix 10).

Each interview was recorded using the sound recorder application on the researcher's cellular telephone (a Huawei Y4) and subsequently transferred to her laptop and stored in her Google Drive as per the ethics application. The data from one interview was irretrievably lost due to data corruption when transferring the voice recording from the researcher's cell phone to her laptop. This was the voice recording of the telephonic interview. This interview was then excluded from the sample.

Interview questions 28, 29 and 30 regarding ecosystem services were abandoned after the fifth interview. "Ecosystem services" was a term unfamiliar to many of the participants, and explaining what it means was time consuming and distracting for the interviewer and the participants. The interviewer did not have a prepared, ethics approved guideline in order to explain ecosystem services. It was thus not possible to ensure that the explanation was consistent across all participants.

The interview questions were posed in English, and the participants were free to respond in their language of choice. Some (n=6) engaged in English, some in Afrikaans (n=3), but most (n=11) in a combination of the two languages. The interviews were recorded, and the recordings were transcribed by the researcher. The researcher is English speaking, but has a strong command of Afrikaans. The Afrikaans responses were translated into English during transcription. Where doubt regarding the nuances of the participants' responses occurred, the researcher confirmed her translation with her co-researcher who is both a home-language Afrikaans speaker and familiar with the context. There were six female and thirteen male interview participants. All but one of the participants own (outright or through legal arrangements such as trusts) the land they are managing.

3.3 Interviews - data analysis

Thematic analysis was used to interpret the primary data from the interviews (Kiger & Varpio, 2020). An inductive and latent approach to thematic analysis was initially taken in order to explore not only the themes that are explicitly mentioned but also the possible underlying themes (Udemy, 2023, Kiger & Varpio, 2020). However, due to the very large data sample obtained (more than 40 hours of interviews) and the amount of time that this approach would require, the researcher abandoned the

search for latent themes and focused on inductive thematic analysis of the interview transcripts (Udemy, 2023), using the research questions as a guide. NVivo software was used for the coding process.

The initial 29 coding categories (see table 3 below) used for the deductive analysis were derived from the 81 interview questions and the 6 research questions (see Appendix 5). The interview questions and responses that broadly spoke to each of the research questions were grouped (see table 3 below). These grouped answers were then coded using the 29 coding categories in table 2. 717 codes were allocated this way. During the data analysis, these 29 broad categories were used to guide the data coding, and further themes and subthemes were developed iteratively (Udemy, 2023, Braun & Clarke, 2020). The data analysis from the interviews formed the basis for developing the feedback booklet (see Appendix 6), which was given to the participants in the second part of the study to assist with data verification, following Balvanera *et al.*(2017). The booklet also informed the futures thinking exercise conducted at the workshop.

Table 3. Research questions and initial interview data coding categories

Research question	Coding category
Why do participants manage land?	3. Reasons for becoming a farmer or land owner/manager 4. Reasons for being a farmer or land owner/manager in the present. What meaning does land management have for them? 15. What aspects of their life and land management do they want to increase in the future? 16. What aspects of their life and land management do they want to reduce in the future? 22. What does a positive future for themselves and their land look like?
What are participants' perceptions regarding social-ecological risks	13. What risks do they perceive to their land management? 14. Strategies to deal with risks they have identified
What are their adaptation strategies for their perceived risks?	13. What risks do they perceive to their land management? 14. Strategies to deal with risks they have identified
How and from whom do land owners/managers learn?	5. Training, both formal and informal for current activities 25. What information sources do they use when making decisions about land management? 26. How do they prefer to learn new techniques and new information

	about their land management?
How do land owners/managers make decisions?	<ol style="list-style-type: none"> 1. Previous land uses of the property/properties owned or managed by the participant 2. Current commercial operation on property/properties owned or managed by the participant 5. Training, both formal and informal for current activities 6. Is the participant the owner of the land they manage? If not, what is the arrangement? 7. Changes in farming practices during the time the participant has managed the land 8. Reasons for land use or land management changes mentioned 9. Changes in environment the participant has observed during this time 10. Perceived reasons for environmental changes observed 12. Which sustainable land management practices does the participant use? 20. Which institutions are key to their land management? 23. How do they use monitoring in their land management? What and how do they monitor? 24. Decision making - what decisions do they make in their land management and how do they make these decisions?
What future do participants envisage for themselves and their land?	<ol style="list-style-type: none"> 15. What aspects of their life and land management do they want to increase in the future? 16. What aspects of their life and land management do they want to reduce in the future? 17. What are the crucial issues to support these desired changes? 21. Which institutions do they think will be important for their land management in the future? 22. What does a positive future for themselves and their land look like?

When analysing the participants' reasons for managing land (and values), the data coded in categories 3, 4, 15, 16 and 22 was used. When analysing the participants' perceptions of social-ecological risks, the data coded in categories 13 and 14 were used. Category 14 was included because some participants retrospectively identified risks when discussing mitigation and adaptation strategies.

Section 13 and 14 also provided the data for analysis of the participants' risk adaptation strategies. When learning was assessed, the responses in coding categories 5, 25 and 26 were used. Decision making was analysed drawing from categories 1, 2, 5, 6, 7, 8, 9, 10, 12, 20, 23 and 24. Future scenarios were analysed drawing from categories 15, 16, 17, 21 and 22. The researcher decided which questions to ask to answer the research questions when designing the survey, but also used the responses from the participants as a guide to which questions' responses were meaningful in terms of the analysis. Not all participants answered the questions in a linear way, sometimes circling back to earlier questions in conversation. This was taken into account when coding.

3.4 Workshop

The workshop was conceived of in two parts. Firstly, a feedback session in which to share findings from the interviews, and secondly an introduction to the concept of futures thinking and working through a futures thinking exercise as a group (see Appendix 13).

It was also hoped that by giving the land owners and land managers a space in which to share their perspectives and explore their visions of the future, they would have an opportunity to reflect. It was hoped that this might encourage increased environmental awareness, and create opportunities for more ecologically sensitive practices going forward (Jiren, Hanspach, Schultner *et al.* 2020, Bengston 2019).

At the very least, it was hoped that by engaging in a respectful, meaningful interview and by hosting a workshop, a space would be created where participants were specifically listened to and encouraged to share their knowledge, given recognition for it and where trust could be built for future engagements with the GCBR (Ruiz-Mallen, Corbera, Calvo-Boyero *et al.*, 2015). Lessons learned in the process may be valuable for other biosphere reserves, and other projects wishing to find collaborative pathways towards sustainable stewardship.

All the interview participants were invited to participate in the workshop. The invitations were sent to interview participants via the communication channel they specified in their interviews (see Appendices 11 and 12). Of the twenty interviewees, nine elected to participate in the workshop.

3.5 Formulation of interview data for use during workshop

In preparation for the feedback session and futures thinking exercise in the workshop, the researcher compiled an experimental Three Horizons Framework from the coded interview data. The Three Horizons Framework (Sharpe, 2019) is the futures thinking tool that was chosen for use during the

workshop (see workshop section) . This was organised using the answers to questions 43 -56. The codes were printed out onto slips of paper, and organised into the categories as described in table 2 (see figure 12 below).



Figure 12. Data arranged according to initial coding categories (see Appendix 5)

These paper slips were then used to fill the Three Horizons Framework (figure 13 below) as a model of how the researcher understood the data at that stage (Charmaz 2006, Udemey 2023). This process was also used to estimate the amount of time that the process would take during the workshop.

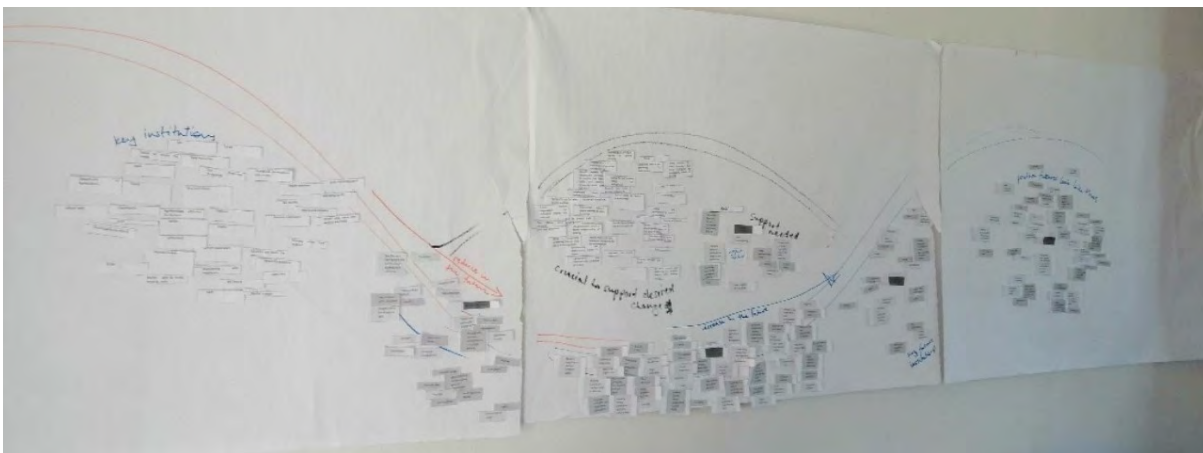


Figure 13. Three Horizons Framework constructed by the researcher using answers to interview questions 43 - 56 (see Appendix 3)

3.6 Workshop process

Each workshop participant was given a synopsis booklet of the interviews (see Appendix 6), and asked to complete the workshop consent form (see Appendix 7). The workshop began with brief introductions and an icebreaker where participants were asked to show where they live on a paper map of the study area.

Just less than half (n=9) of the interview participants attended the workshop. The breakdown of land uses on land owned by the workshop participants were as follows: three dairy farms, one lifestyle farm, one declared conservation area which is also used for tourism and accommodation, one agroforest and three mixed livestock/cultivation farms, one of which is leased by the participant to someone else for commercial production. Two of the farms are not used for agricultural production. One is intended to be used as such, but the agroforest is still being installed. The remaining six farms are commercial farms. Four women and five men attended the workshop. The yellow circle on the map in figure 14 below shows the participants' geographical location.

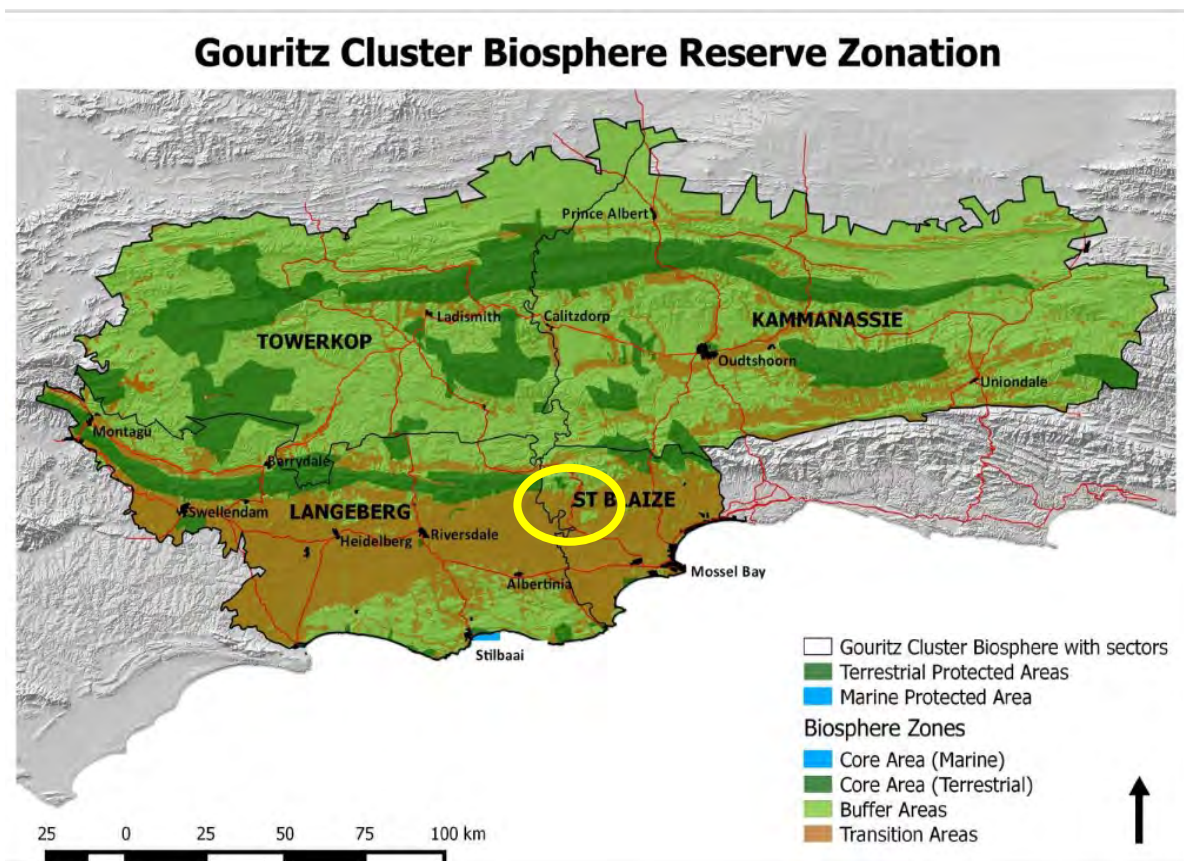


Figure 14. Map showing location of workshop participants (GCBR, 2024)

The first working part of the workshop consisted of a feedback session, in which a summary of themes and information derived from the interviews was shared for the participants to confirm and to reflect on. The researcher presented the themes verbally and visually, and read (aloud) through the

responses that participants had given. Any responses that potentially breached confidentiality were adapted, and where this was not possible, they were left out of the feedback. This was only required in one case, where the response was of a personal nature and considering the group, anyone would immediately recognise whose response it was. The themes were also shared in the synopsis booklet (see Appendix 6). The themes and responses were then put up on the wall so that participants could read and reflect on them during the course of the day (figure 15 below).

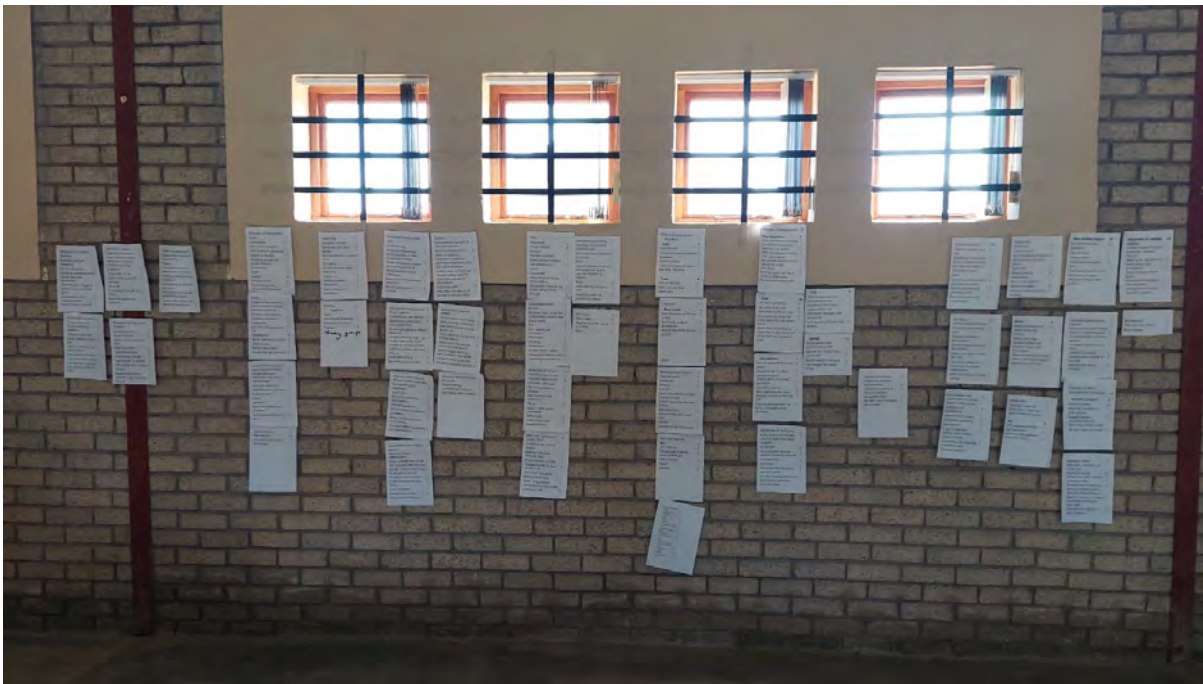


Figure 15. Photograph showing display of codes and themes

During the researcher's presentation, the participants made no corrections to the data that was presented. One participant asked how the researcher had categorised their activities on their land, and although the participant did not feel that the categorisation was completely accurate, they said it was "good enough" for the purposes of the study. There was one additional point made regarding ways that land owners learn, specifically that land owners in one district have formed a community of practice where they share information relevant to their product and context.

Although all the participants live in the same district, only one participant knew everybody else. The social learning and trust building involved in sharing information and engaging in debate around topics of mutual interest and concern was judged to be valuable in itself, in terms of building relationships between participants for the future. Some participants (n=4) had experience of workshops, but more than half (n=5) of the participants did not. This meant that for the participants who were unfamiliar with workshop-type group processes, there was a learning curve about what was expected and what was needed in terms of participation. Initially, one group was slow to participate because there were

three people who had not engaged in group work of this type before, and it took time for the participants to adapt to the group conversations and become fully engaged. Once the discussions developed, all the participants participated energetically.

Both groups were given envelopes slips containing of pieces of paper showing the coded data and categories of data from the interview questions and responses. These were used to seed discussion about each horizon within the Three Horizons Framework. One group elected to cluster the slips into related concepts that they felt were important, and discarded very few. The other group discarded a number of slips and concentrated on the items they decided were most important. From this process, key themes were identified (Lamarque, Artaux, Barnaud *et al.*, 2013).

The second part of the workshop introduced the concept of futures thinking. The researcher's supervisor made a short presentation of the history and uses of futures thinking, and the researcher then introduced the futures thinking tool for the group process.

Scenario planning is a widely used futures thinking method (Jiren, Hanspach, Schultner *et al.* 2020, Ruiz-Mallen, Corbera, Calvo-Boyero *et al.* 2015) and was initially considered as an option for the futures thinking workshop. However, following the consultation between the researcher and interview participants about the desirability of a group process, the co-researcher expressed concern that a multi-day process would be difficult for land managers to attend. In order to increase the accessibility of the process to participants, a shorter futures thinking technique (the Three Horizons Framework) was chosen (Sharpe, 2019).

The Three Horizons Framework (Sharpe, 2019) was used for the futures thinking exercise because it is intuitive and can be used in processes of a few hours duration (Sharpe, 2019). Thinking about the future is a "natural function of the mind" (Sharpe, 2019) but it can be difficult for people to articulate and share these thoughts. Culture, social convention, criticism and reluctance to articulate inherent uncertainty can inhibit discussions about possible futures (Sharpe, 2019). The Three Horizons Framework somewhat eases these sticking points because there is a structured process in which to discuss possibilities and the facilitator can create a safe space in which the participants can explore uncertainty.

Developing the Three Horizons Framework begins with the present, designated as Horizon 1. This includes the status quo of the system being discussed, and elements of the current system that that are deteriorating or that participants want to reduce, as well as those elements the participants wish to preserve or to see increase into the future (pockets of the future in the present) (Sharpe, 2019).

The next step is the development of the desired future, designated as Horizon 3. Here, participants create their desired future state. This state could include completely new ways of doing things.

Horizon 3 develops from the aspects of Horizon 1 which participants feel are worth preserving, those that they feel are going to grow to be important in the future, and those that are a better fit for their projected future.

The processes involved in transitioning from the present to the intended future are the last element of the process, designated Horizon 2. These are the mechanisms, changes, barriers and transitional arrangements leading to the future, as the participants see them. A diagram of these horizons appears in figure 16 below.

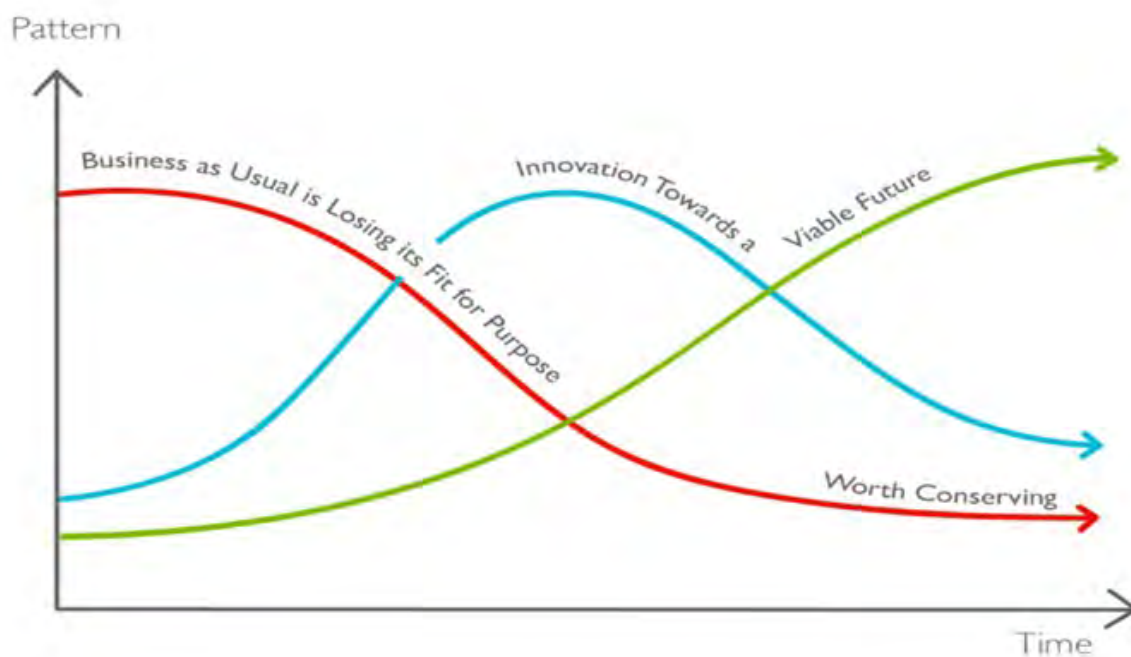


Figure 16. Outline of Three Horizons Framework (H3Uni.org, 2024)

The researcher then introduced the Three Horizons Framework and explained the exercise, and then divided the participants into two groups. Group 1 consisted of two dairy farmers, one mixed livestock/agriculture farmer, one land owner who leases their land to a cattle farmer and one land owner who has declared their land a protected area and uses it for tourism and accommodation. Group 2 consisted of one dairy farmer, one agroforester, one lifestyle farmer and one mixed livestock/agriculture farmer. The Three Horizons Framework enables diverse stakeholders to collectively make sense of complex topics (Sharpe, Hodgson, Leicester *et al.*, 2016).

For the Three Horizons Framework exercise, the researcher's supervisor facilitated one group and the researcher facilitated the other group. Each group was given pens, sticky notes, and flip chart paper and asked to create their own Three Horizons Framework diagram. Each group was given printed slips of paper showing the coded responses from the interviews in the themes relating to the future. These slips were used to seed the discussions during the exercise. The workshop participants used data from

the interviews as a starting point for discussion about their preferred futures, and identified the pathways and processes that could lead them towards a desired future.

Although the researcher outlined the Three Horizons Framework process using the H3Uni Facilitator's Guide (2019), as the groups worked through the steps they diverted from the original process from time to time. There was brisk and participative discussion about many topics, ranging from new technology in water conservation to possible political secession of the province. Although these were frequently digressions from the structured Three Horizons process, the facilitators allowed some time and space for the conversations to develop because the social learning and relationship development elements of the workshop were considered to be as important as building the frameworks.

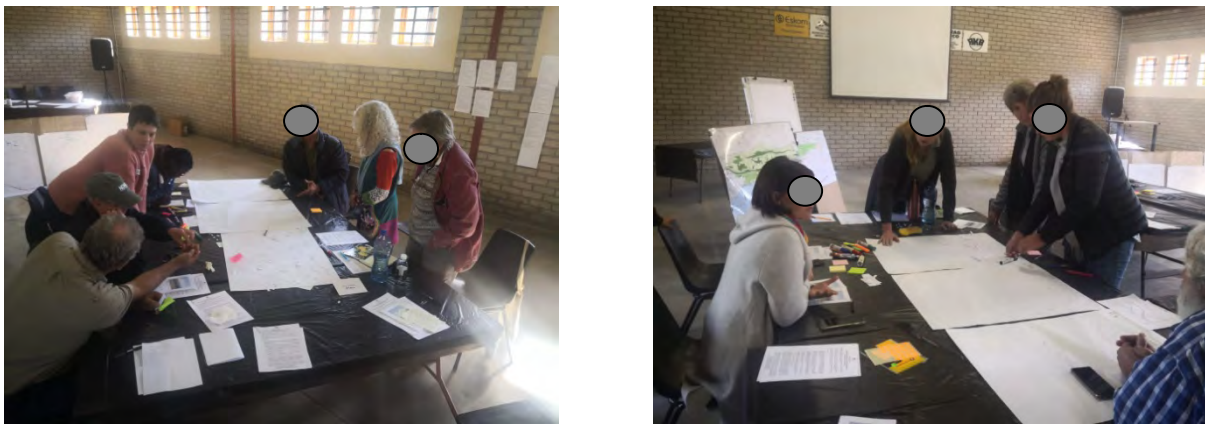


Figure 17. Group activity layout

After the lunch break, two of the participants from one group had to leave for an appointment. Both groups had built the first and third horizons by this time, and after lunch the two groups were combined to discuss the second horizon as one group.

It became clear that the participants were fatigued after the lunch break. Therefore, the facilitators dispensed with the workshop feedback forms (see Appendix 8) and held a verbal feedback and reflection session at the close of the workshop. During the reflection session, each participant was asked to reflect on and share something that they had learned, and/or to share an observation about the workshop process and what they thought about it. The facilitators held a separate reflection session after the workshop.

The GCBR employs a group of Groen Sebenza interns who assisted with setting up the venue and catering arrangements on the day of the workshop. These four people were invited to sit in on the workshop session after completing a consent form, and were asked to keep notes about the process to assist the researcher in capturing data. As the workshop progressed, they began to take an active part in discussions and participate in the development of the 3 Horizons Framework. The researcher made

a judgement call to allow this emergent development to continue and not to stop their participation, because the land owners were still engaging actively with the process and did not seem to be inhibited by the interns' engagement. The interns' participation meant that their notes were incomplete, and in the end the researcher did not draw on their records of the process.

The posters on which the two groups built their first and third horizons and the one on which the combined group built the second horizon were photographed *in situ* on the day of the workshop, and the posters were kept intact by the researcher until the data analysis was complete. The outcomes of the participants' reflection session were recorded by the researcher and co-researcher, and the researcher recorded the outcomes of the facilitators' reflection. Figure 18 and 19 (below) illustrate the way the groups laid out their frameworks.

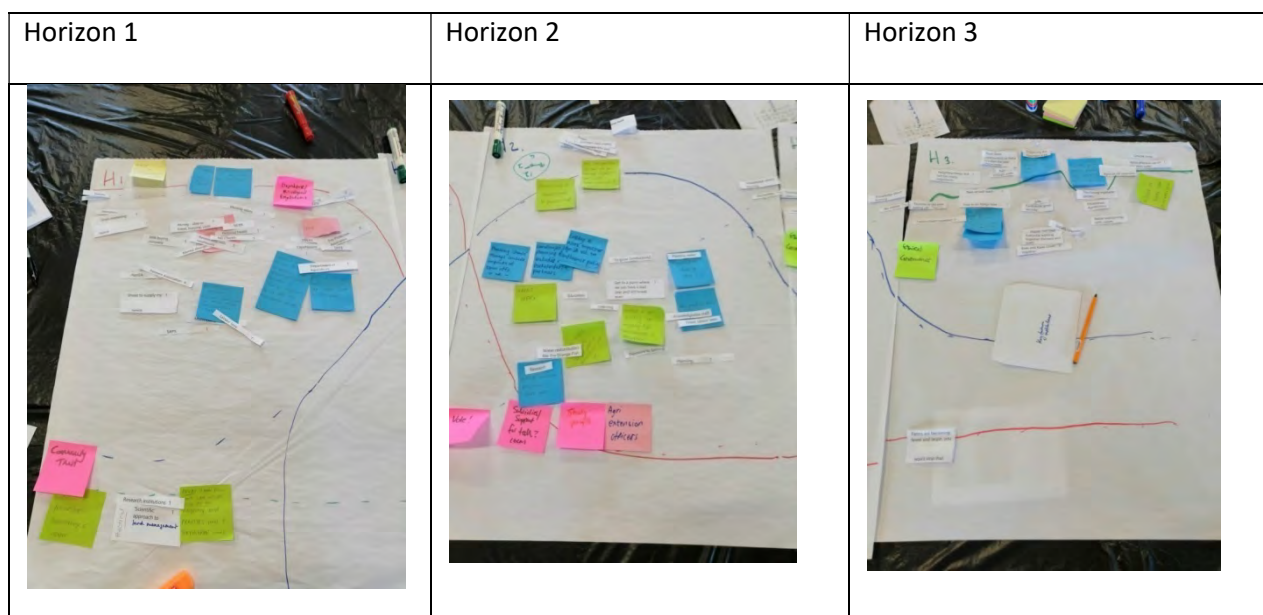


Figure 18. Photograph of group 1's Three Horizons Framework

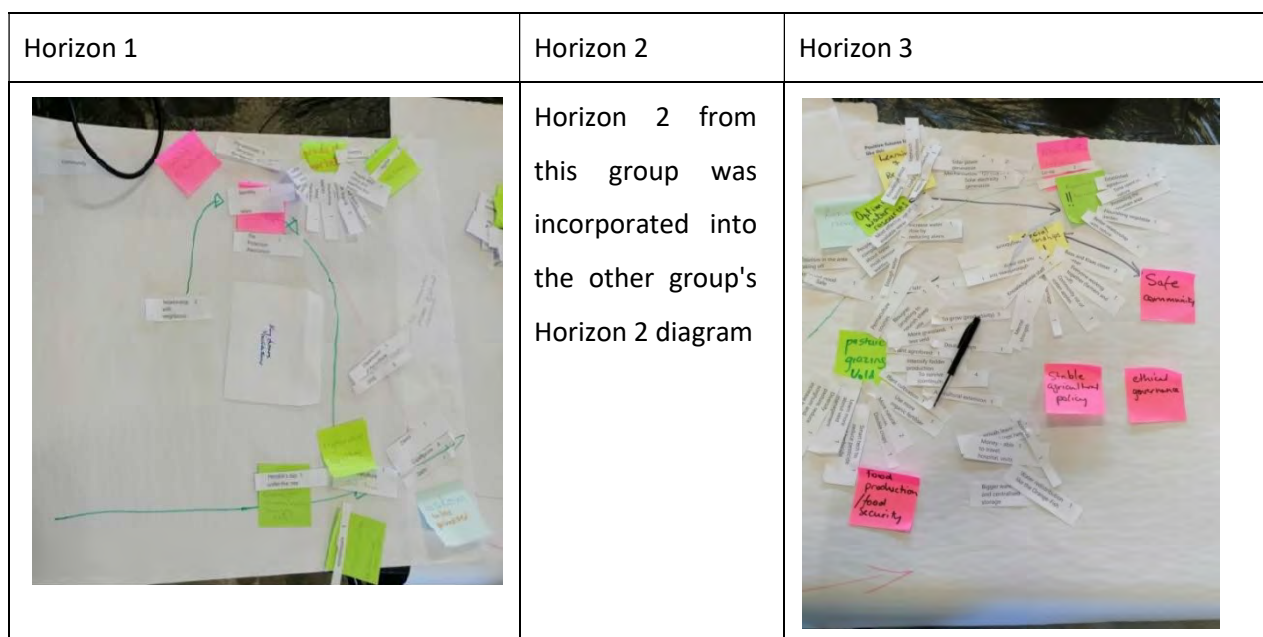


Figure 19. Photograph of group 2's Three Horizons Framework

3.7 Data interpretation

Interpreting qualitative data can be slow (Udemy, 2023, Maree, 2019). Synthesising a large data sample can require multiple iterations (Braun & Clarke 2020, Maree 2019, p. 141.). However, triangulating topics from multiple perspectives can help to give a deeper understanding of the system, especially if the system being studied is complex (Maree 2019, p. 142). Therefore, triangulation has been used in this study to understand the complex adaptive system that the participants inhabit. In interpreting qualitative data, Maree (2019, p.142) says "...we are describing and analysing...an emerging reality".

Discussing how to use triangulation to validate qualitative data, Maree (2019, p. 143) outlines the importance of transparency in the research procedure. He adds that this allows the reader to follow the decisions and interpretations that have been made in order to agree or disagree with the research findings. If the researcher is transparent, the researcher's biases and assumptions can be factored into their interpretation of the data.

This interpretation of the study was guided by its design, which included open-ended questions on a range of topics, dynamic literature review, feedback to the study participants (by providing a booklet and during the presentation of the interview data findings during the workshop), data confirmation by the workshop participants, the workshop process and reflexive thematic data analysis. Open-ended questions encourage answers that are not 'yes' or 'no'. They allow the interviewee to say as much or as little as they wish to (Roberts, 2020). Dynamic literature reviews are multi-stage, iterative and non-linear (El Hussein, Kennedy and Oliver, 2017), to allow the literature to support data findings (Thronberg & Dunne in Bryant & Charmaz, 2019 p.207) in grounded theory studies. Feedback to and from study participants can help correct data interpretation errors, build relationships, and make research more useful in complex SES, and participatory processes can help build consensus on complex topics (Balvanera, Daw, Gardner *et al.*, 2017). Thematic analysis is a flexible qualitative data analysis method which can be applied to a wide range of sample sizes. It involves identifying patterns across a data set, as well as interpretation of these patterns (Kiger &Varpio, 2020).

Some unexpected topics and themes emerged that were not initially included in the research design. These included religion or faith and the lack of contact crime. This element of surprise is to be expected when engaging in research in complex adaptive systems (Biggs *et al.* 2022, p.5).

Without the assistance of the co-researcher, this study would have been far more difficult, slower, or perhaps impossible. Their dual role of local farmer and biosphere reserve extension officer was central

to the researcher developing an understanding of the local context in the time available for this study. Further, the established relationships of trust between the co-researcher and the land management community facilitated the depth of discussion considerably. For example, at the beginning of one interview, the participant asked the co-researcher: "Can I talk to her (the researcher)?" When the co-researcher nodded, the participant signed the declaration form, and answered every question posed with absolutely no 'political correctness' or hesitation whatsoever. The co-researcher also provided valuable insight into the design and timing of both the interviews and the workshop, which facilitated participation.

Chapter 4: Results

4.1 Interviews

More than three quarters of the participants (n=15) were managing their land for commercial purposes. Two participants were in the process of developing a commercial enterprise on their land, and one participant was leasing their land to a commercial farmer. One participant was using their land for accommodation and nature tourism, and one participant was not carrying out any operation whatsoever. The interview participants have been allocated numbers designated P1-20. These are provided in parentheses alongside all quotes.

4.1.1 Why do participants manage land?

This section explored factors that originally motivated participants to get involved with land management (table 4). Further, it explores the reasons that they continue to manage land (table 5) and the meaning land management has for them.

Table 4. Participants' reasons for getting involved in land management

Reasons for becoming a farmer, buying land or starting in land management career	Examples	Number of responses (out of total n=19)	Quotes
Family reasons	Older brother did not want to farm Only sibling who wanted to at	8	<i>"We've got to get it right, not for us but because... we are stewards. (We) will die but the land will still be there and I want to be judged</i>

	parent's retirement Support aging parent It was always the plan Farm manager resigned Father didn't want to sell farm		<i>kindly by people in a hundred years that we did the best we could" (P1)</i>
It was always my dream or aspiration	Always wanted to Privacy Away from the city	5	<i>"Land management is incredibly attractive to me because you have influence, not so much control, but you have influence over an area..." (P1)</i>
Business reasons	Liked the business	1	<i>"You can make more money farming than in other business" (P7)</i>
Location is convenient		1	<i>"It's not too far from a big town" (P16)</i>
Came to retire		1	<i>"I ran a business before but retired early, and we moved here. I never want to leave" (P12)</i>

The most frequently mentioned reason (n=8) for starting in land management was that the decision had to do with family. Not all the participants came from families who have historically owned the land they manage now; however, of those who did manage inherited land, not all mentioned family reasons for embarking on a land management career. Several participants (n=5) from land management families embarked on a different career initially, and began land management when changes in circumstance made it necessary for them to take over the land management operations (in order for the land to remain in their family), or when something changed their perspective on the prospect of managing land as a career.

Some participants (n=5) bought land because they wanted to settle somewhere and had always liked the idea of land management or found it an aspirational lifestyle(n=4) or wanted privacy (n=1). One

participant was managing land on behalf of someone else and did not wish to own land themselves, although land management was always their dream. Other reasons for embarking on land management were that the business was more profitable than other business options (n=1), the area is convenient for a pleasant lifestyle (n=1) and because the participant wanted to retire from their previous profession (n=1). These were the historical reasons participants gave for starting in land management. Table 5 (below) lists the reasons that the participants continue to manage land in the present.

Table 5. Participants' reasons for continuing to manage land

Reasons for continuing to manage land now	Examples	Number of responses (of total n=19)	Quotes
Personal fulfilment/ Satisfaction/ Pride/ Joy	You can create a product Sense of satisfaction and personal fulfilment when watching things grow Building something for next generation	14	<i>"This is something I build for myself, so if I take care and do things right, then I can get the benefit directly, for the business and satisfaction and I feel good. And there is a bit of me that wants to prove that I can". (P3)</i> <i>"I will never retire. Because we built it up ourselves its very rewarding to reap what you sow. We are only starting (to do that) now, we know what to do when and how to do it". (P12)</i>
Lifestyle	Peace Community of likeminded people	9	<i>"It is wonderful for the soul" (P16)</i> <i>"Raising children on the farm is lekker" (P8)</i>

	Enjoy working with the animals/plants		<i>"It's a lifestyle as well as a living" (P6)</i>
Commitment	Made this commitment Acceptance of chosen path I have bills to pay	8	<i>"Ek gaan nou boer tot ek in my moer geboer is" (I'm going to farm until I can farm no longer). (P2)</i> <i>"You must be an economist and a vet and a business person and fit and determined to be a farmer. And in the bad years - when 70 percent of farmers are going further into debt - you must be steady in those times. You must stay in it for the future". (P15)</i>
Independence	I can be my own boss Within constraints I am independent	5	<i>"I don't have to work with moeilike (difficult) people." (P2)</i> <i>"I can make my own decisions" (P4)</i>
Love	Love what I do	2	<i>"I do it because I love it (farming)" (P8)</i>

Personal fulfilment, satisfaction, pride and joy was the category of reasons that was most commonly mentioned when participants explained their reasons for continuing to manage land (n=14). This included the satisfaction of *"building something for myself"*(P3), which was mentioned by nearly a quarter of participants (n=4). Productivity was also linked to satisfaction (n=4). The participants linked productivity both with financial success and continuity for future generations, but also with service to the community and farmers' place in the world: *"People must eat, there will always be demand for food. There will always be a place for farmers because two weeks ago the 8 billionth child was born.*

The only continent in the world which has positive growth is Africa... and Africa will need the food" (P18). Triumph over doubt and difficult circumstances was referred to directly (n=2) and indirectly as part of what makes land management satisfactory. One participant mentioned faith specifically when elaborating on what meaning farming had for him: *"I think we need to have faith because without it you can't farm. And that helps things go better with you. Farming is unpredictable. You have to stay nederig (humble)"*(P5).

Elements of the lifestyle that land management permits were mentioned by nearly half of the participants (n=9) as part of the reason they continue to manage land. Lifestyle reasons included the community they are part of, the way the participants' children will experience the world, the value their lifestyle has for the participants' souls, experiencing peace, and enjoyment of working with animals and plants.

Commitment was the third most frequently mentioned reason (n=8). Participants mentioned being committed to the career they have chosen (n=4), to their families (n=3) and to their land (n=1). Independence was mentioned by a quarter of the participants (n=5) as a reason for managing land. The corporate environment was mentioned as being unsatisfactory (n=1) as well as preference for being able to make decisions for themselves (n=2). Love was mentioned by two participants as a reason for managing land.

Stewardship of land was mentioned in different ways. The participants with a higher degree (n=4, one fifth of the participants) in agriculture prioritised efficient, cheaper production practices in their farming, but the concept of maximising efficiency of natural resource use and the intersection between cost effectiveness and *"what is good for the land"* (P17) came up again and again in the context of long term continuity of the productive capacity of their land. This often intersected with future generations of land managers and making sure that their children and grandchildren inherit the land in the best possible condition. All the participants demonstrated awareness of their dependence on natural resources such as water and systems such as weather. The participants with more diverse educational backgrounds had a more *"we appreciate nature for its own sake"* (P19) attitude, even when they are financially dependent on the productivity of their commercial operation. Only one person mentioned stewardship explicitly, and this was the participant currently managing a private reserve.

More than half the participants (n=10) mentioned future generations when discussing why they are managing land in the present. All of the participants who grew up in families who managed land mentioned the next generation as part of their reason for continuing to do so. Some participants mentioned their own children and grandchildren, but some mentioned children other than their own direct descendants - *"even if my own children don't want to farm, someone's children (in the family)*

will" (P18). Almost all (n=18) of the participants were the owners of their land, or the land was owned by a trust which they are part of administering. These participants were therefore in a position to make decisions regarding the inheritance of their land or transferring ownership to future generations in some formal way.

Managing land was associated with being part of their identity as well as being a profession and a lifestyle by many of the participants. One participant (P18) said *"it's just a job, I have bills to pay"*, but when he spoke about the drought he said *"if there isn't water in the river, I don't think there is going to be a future"*. He did not say if the drought continues, we will have to sell up and change jobs. Another participant said *"it is a lifestyle as well as a living"* (P6) - they spoke of their work and their life as one system rather than being distinct. This found an echo in the ways people spoke about why they continue to manage land despite significant challenges and setbacks, their commitment to seeing their choice through and following their chosen path, and the joy they feel when they triumph over doubt and adversity.

Although this study did not set out to investigate the role religion plays in land management, the theme of faith emerged consistently with a quarter of the participants (n=5). The role the church plays in linking the people together at communal services, bazaars and other events was mentioned by several participants as being important to sustaining their activities both now and in the future. Several participants mentioned that faith and prayer play a role in strengthening their resolve during times of doubt or difficulty. One person (P5) said *"farming is unpredictable...without faith you can't farm"*. Shared values about community support and helping people in difficult personal and environmental circumstances were also mentioned in relation to religion and faith. The care packages to farmer's wives provided by the church were mentioned twice as having been an important source of encouragement and moral support in severe drought. Another participant mentioned church services which help them understand and address key national dilemmas about leadership, war or other large scale issues which have impact on their land management.

4.1.2 What are their perceptions regarding social-ecological risks?

This section explored the risks to the participants lives and livelihoods that concern them (table 6 below). These risks also help point to the systems that the participants connect with and within which they operate.

Table 6. Social-Ecological risks perceived by the participants

Risk	Examples	Number of responses (total n=19)	Quotes
Rising costs and	Fuel	18	<i>"Everything is getting</i>

inflation	Labour Electricity Fertiliser Seed Tax Interest rates General rising costs and inflation		<i>expensive" (P4)</i>
Local, district and national government failures	Unrealistic taxes Political instability Load shedding Crime (theft, murder of tourists) COVID 19 regulations Travel restrictions	12	<i>"Those tourists who were murdered in Kruger, that affects us" (P1)</i>
Environmental degradation	Crop sprays Alien invasive plants Erosion Over extraction of water Agricultural intensification near protected area Overgrowth of fynbos Population growth Bush encroachment	10	<i>"There is tension between what is good for the land (burning fynbos) and what is good for neighbourly relations (in terms of fire management and liability)" (P20). "People complaining about (lack of) water must remove aliens." (P19)</i>
Disruptions	Load shedding Crime (theft, murder of tourists) COVID 19 pandemic Travel restrictions	10	<i>"We had to change our business model, (during COVID 19) people couldn't travel" (P1)</i>

	Family drama		
Fire	Wildfire Liability Arson	9	
Laws and policies	Environmental laws Labour laws Water laws Tax laws Bad policy (e.g. foot and mouth shutdown) Travel restrictions Contradictory legislation	7	<p><i>"If they could scrap environmental affairs I'd be happy. I understand that they don't want you to destroy the land, but they must realise you love your land more than they do, so you aren't going to do something stupid to damage your land."</i> (P6)</p> <p><i>"They pressure you from all sides. One guy (from the Fire Protection Association) says you must have a fire break this wide, and then someone else (from the Dept. of Forestry, Fisheries and the Environment) comes and says you must have one, but not here. So now what do you do?"</i> (P6)</p>

Market volatility	Unpredictable prices Pricing product correctly Exchange rates Fluctuating market sentiment	6	<i>"In the European Union they say aloe cause cancer, so (now) we can only sell to the United States." (P2)</i> <i>"Right now, everyone wants cute baby lions." (P1)</i>
Drought		5	<i>"If it doesn't rain, if there isn't water in the river, then I don't think there is going to be a future" (P18)</i> <i>"When it rains, we don't need irrigation. When it doesn't, you must pump(water) to survive" (P3)</i>
Animal and crop diseases		4	
Human/wildlife conflict	Baboons Escaped animals Predators	3	<i>"Our biggest problem is actually with domestic dogs." (P14)</i>
Flooding	Clear cutting wattle	3	
Labour	Poor quality Unreliability Time taken managing staff	3	
Weather	Wind	2	<i>"For grain, the weather conditions are all or nothing." (P15)</i>
Profit-driven decision	Big farmers' influence	2	

making	Unsustainable production for capacity of land, especially in drought		
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Rising costs were the most frequently mentioned risk (n=18). Failures of government at all levels were the second most frequently mentioned risk (n=12). Environmental degradation and unplanned/unanticipated operational disruptions were mentioned equally frequently (n=10). Fire (n=9) was mentioned by nearly half the participants as a concerning risk. Problematic laws and policies were concerning to a third of participants (n=7). This was followed in descending order of frequency by market volatility (n=6), drought (n=5) animal and crop diseases (n=4), human/wildlife conflict (n=3), flooding (n=3), labour (n=3), weather (n=2) and profit driven decision making (n=2). Regarding this last item, one participant mentioned intensification of commercial agriculture alongside a protected area as a risk, and one participant mentioned the need to intensify production to increase profit as risky to their farm's sustainability.

Many of the participants who identified laws as risky (n=6) referred to the implications of contradictory, poorly enforced and impractical laws, and laws that are time consuming in terms of compliance. One participant, discussing compliance with environmental laws, said: *"They pressure you from all sides. One guy (from the Fire Protection Association) says you must have a fire break this wide, and then someone else (from the Department of Forestry, Fisheries and the Environment) comes and says you must have one, but not here. So now what do you do?"* (P18). The perception of environmental law enforcement as being negative was repeated when the participant said: *"If they could scrap environmental affairs I'd be happy. I understand that they don't want you to destroy the land, but they must realise you love your land more than they do, so you aren't going to do something stupid to damage your land."* On the other hand, one participant said *"I want them (CapeNature) to do their (enforcement) job, because people take chances. But they must make it easy for us who are trying to do right"* (P7).

Although arson (n=1) and theft were mentioned (n=2), no participants mentioned contact crime, and two people specifically said that they feel very safe, in contrast to rural communities in other areas.

Climate change was mentioned either specifically or obliquely by more than half (n=11) of the participants, but not as a specific risk. Participants mentioned that they can't see a direct link between what they can do and how they can contribute to fixing it. A number of people (n=3) said they try not to think or worry about things if they can't do anything about them. Another participant said *"I don't want to know too much about climate change because it might mean I have to do more work"* (P2)- this in the context of being overwhelmed with the busyness of daily life. Several participants (n=4)

mentioned being concerned about climate change, and three have interrogated rainfall and weather data to try to verify whether the predictions they have seen or heard are correct. Several others (n=4) mentioned techniques for managing alien invasive plants in the context of increasing climate uncertainty.

4.1.3 What are their adaptation strategies for their perceived risks?

This section explored the ways participants are adapting to or mitigating the risks they perceive. Risks and strategies are presented together in table 7 (below).

Table 7. Adaptation strategies to perceived Social Ecological risks

Risk	Strategy to deal with perceived risk	Examples	Number of responses (total n=19)	Quotes
Fire	Avoidance	Don't burn	1	
	Preparedness	Firebreaks Controlled burning Belonging to FPA Insurance Fire-fighting equipment Monitoring wind	10	
	Co-operation	Working with neighbours Whatsapp communication groups	2	
Costs	Adapt to make more efficient use	Efficient tractor use	6	<i>"You must control costs on</i>

	of existing resources	<p>Maximise use of staff time</p> <p>Buy fuel before price increases</p> <p>Use ruraflex electricity low tariff times</p> <p>Consider return on investment and change expenditure accordingly</p> <p>Collaborative strategies with importers</p>		<p><i>poor return on investment. But not irrigation, because that has a good return." (P8)</i></p>
	Invest in new technology	<p>Install/investigate solar electricity</p> <p>Use combined processing machine not tractor</p>	3	<p><i>"And (the new planter machine) it's cheaper... because you aren't working (the soil) as much. Just the diesel costs alone make it work. We now use a planter that places the seed in a row and adds manure. I</i></p>

				<i>noticed that we used 10 litres per hectare of diesel in the old system, now we use about 5."</i> (P15)
	Reduce resource use	Use as few staff as possible Reduce animals per camp Farm within farm's capacity to provide fodder	3	
	Increase income	Generate more income and hire more people	1	
Drought	Adapt	Change land use and/or change water use	1	<i>"(Using the new combined planter machine) you keep the plant material on the land and you don't compact your land. I don't like to see people baling, you create your own drought."</i>

				(P15)
	Find additional resources	Drill borehole	1	
	Reduce	Use less water	1	
Laws	Comply	Stay within law as much as possible	3	
	Avoid	Avoid law enforcement as much as possible	2	<i>"When the department of labour visits, the boss is never on the farm."</i> (P4)
	Participate for change	Petitions about poor policies such as foot and mouth shutdown	1	
Human-wildlife conflict	Barriers	Fencing Electric fencing Kraaling	3	
Crime	Prevention	Invest in local community Community collaboration (farm watch, municipal crime prevention system)	3	

		Lock everything		
	Monitoring	Count stock	1	
COVID 19 pandemic	Adapt	Retrain staff Focus on local tourist market	2	
Erosion and flooding	Soil protection	Contour ploughing Move animals to avoid overgrazing Avoid clear-cutting when removing wattle	4	<i>"Working for Water...left the wattle (in place after clear-cutting) and the river came down and the banks were damaged."</i> (P12)
Stock and crop diseases	Prevention	Vaccination Spray crops	7	
	Avoidance	Keep animal numbers down to avoid the need to move them and expose them to ticks	1	
Market volatility	Diversify	Focus on different export destinations Diversify product Collaborate with	4	

		"anyone" to grow new markets		
	Optimise	Focus on one product with a constant demand	1	

There were only two specific mitigation strategies that more than one participant mentioned. The first was firebreaks (n=5) for fire management, and the second was belonging to the Fire Protection Association (n=2).

Some participants had avoidant strategies in terms of the laws they perceived to be risks, and some used compliance as a strategy for these risks. One participant (P15) expressed their attitude this way: *"You try to stay within the laws that involve you, tax and labour laws and things. Other than that - successful farmers will say you can't focus too much on those disruptive things, you must focus on your job and you will be the last one standing."* Several participants (n=4) mentioned that they adjust their compliance to laws according to how likely the enforcement of those laws seems to be (in their evaluation). The Department of Water and Sanitation was seen as the least effective in terms of monitoring and law enforcement.

Most of the participants mentioned ways to control costs by reducing resource use or making their resource use more efficient (n=7). However, one person saw expansion and hiring more staff as the pathway to managing costs.

Half of the strategies mentioned for managing the risk of theft were concerned with investing in the community (n=2), and half with security measures (n=2). One farmer had stopped farming sheep entirely due to stock theft, although since they no longer farm sheep this was not mentioned in the risk and mitigation section.

Although they did not explicitly mention education and exposure as a risk mitigation strategy, one participant linked the impracticality of law making with lack of understanding of the complexities of farming on the part of people in centralised urban areas and positions of influence. The mitigation strategy this participant suggested was: *"We need to work with children who are interested in farming. We need to get children onto farms to see what farming is about. They need to experience farming. People in SA need to learn how things work"* (P5).

Risk strategies usually involve more than one risk per strategy, e.g. reducing animal numbers reduces need to move them and therefore vaccinations and therefore costs. It was apparent from the

conversation in each interview that although participants might not see an action as specifically intended to mitigate risk, many participants were in any case using strategies mentioned by others. For example, only one participant in the study is not a member of the Fire Protection Association, although only one participant mentioned the association as part of their risk mitigation strategy for fire.

4.1.4 How and from whom do participants learn?

This section explored explicit learning preferences (table 8 below). Further, sources of new information for decision support were explored (table 8 below).

Table 8. Ways of learning

Category	Learning activity	Example	Number of responses (total n=19)
Expert focused individual learning	Courses (aspirational)	Would like to go, no time (P2, P5, P8) Would like to go, too expensive (P5, P2)	3
	Reading	Scientific articles (P1, P3) Magazines (P2, P4) Books (P16)	5
	The internet	Google (P2, P12) YouTube videos (P5, P15)	4
	Talks	Farmers Association (P18)	1
	Training from experts	Permaculture course (P10, P20)	2
	Social learning	Discussion with other people	Talking to people (P3, P7, P11, P13, P17, P19)
Farmers' days		Grain day (P6) Hendrik's day under the tree (P15)	4
See what other people are doing		Visit other farms (P10, P3) Drive by other properties (P18, P13)	4

	Delegation	Give problem to staff (P1)	1
Experimentation and learning while doing	Hands on	Doing (P7, P14, P20) Making mistakes (P1, P19)	5
	Experimenting	Experiment on a small scale (P11, P16, P18, P19) Failing safely(P1)	5
Personal reflection	Reflection	Thinking about what happened (P1)	1

All the participants spoke of having a need to learn. The content, methods and sources varied somewhat between participants, but every participant linked learning with the success of their land management efforts.

Expert focused individual learning was mentioned by 15 participants. This aligned with the variety of land management practices and products in the study, and with the independent nature and busy schedules of the participants. Most participants mentioned learning new concepts and information this way. The value of expert knowledge was implied, although most of the participants spoke of the importance of praxis and contextual adaptation of expert knowledge to make it useful to them (see the sections below on social learning and experimentation).

Only one participant mentioned formal training from experts as their preferred method of learning. Several others (n=3) expressed an interest in formal training courses, but either time or cost or both were implied as prohibitive. Another participant mentioned that they had completely changed their farming operations on the advice of an expert who had been a close personal friend of the participant's father and a friend of the family. Several participants mentioned hearing influential talks from experts, specifically economists, at Farmers Association meetings, but none of those participants mentioned these talks when asked about how they prefer to learn - only one participant mentioned that they prefer talks. Reading was mentioned by a quarter of the participants (n=5): *"...it's just how my brain works, because I can learn at my own pace... And its independent, that's a big driver in my life. I like being independent. I treasure independence and I value... the ability to operate to my own priorities, (and) my own thinkings"* (P1).

Social learning was mentioned by 15 participants. Discussion with other people was the most frequently mentioned (n=6) way participants prefer to learn. Trust in the person they are learning from and that person's experience generally and with the topic in question were mentioned as ways people decide who to talk to. Farmers days with outings (n=4) and going to look at other people's

operations (n=4) were also frequently mentioned. *"If you see what someone does and they say it's working for them, I'm not scared to change things. I might try a small area, but if I see something working I feel like I can't believe I'm not doing that already. (On) the farmers day and the grain day you go through people's farms, and the rain isn't the same and soil isn't the same but you see what they do and how they do it. ...you go to the good farmers and you learn a lot and its very helpful."* He (P18) also mentioned that these visits can be de-motivating as well as positive sometimes: *"We went on a dairy (outing) as well but I normally don't want to see other people's dairy (operations), especially the big ones (because) I feel like: what am I doing? I'm playing here (on my small dairy farm), I should just quit."*

Experimentation and learning while doing were mentioned by 10 participants. One (P15) said: *"We like to test things too, like this...(new business enterprise) thing with GCBR. And some people who wanted to test fungus things, we like that."* Failing safely (n=1), and experimenting on a small scale (n=4) were mentioned as preferred learning pathways by a quarter of the participants. One participant installed and removed a large orchard on the basis that it had been a mistake despite having been a promising enterprise. Another participant mentioned making mistakes as the *only* way they learn.

One participant (P1) specifically mentioned learning from their staff: *"...and then (I learn) through the team because they are smarter than me and then we can learn collectively."* Learning from staff was also mentioned by other participants incidentally during the interviews. Personal reflection was specifically mentioned by one participant as a way they like to learn. Reflection was not mentioned specifically by the other participants, but was implied in their stories about decision making. The internet (n=4) was mentioned both as a way of learning and a source of information (see table 9 below).

Table 9. Sources of information

Sources of information	Examples	Number of responses (total n=19)
Other land owners/managers	Someone I trust Neighbours People with more experience Successful farmers Other people (unspecified)	19
Digital media	Google/"the internet"	14

	Google scholar YouTube Facebook groups Newsletters (Dairy Mail, Graanboer)	
Product information services	Product reps Product advisory services Product catalogues	11
Magazines	Farmer's Weekly Unspecified	3
Farmer's days	Farmers' Association outing	2
Radio	Unspecified	1
Other	Books Consultants Experts in the field Science GCBR	5

Every participant (n=19) mentioned using someone else's knowledge and experience as a source of information. These included neighbours (n=4), people with more experience with a technique, product or system (n=5), and people who the participants trust (n=7). One participant mentioned using a family book as their source of information and one person also mentioned his own experience as a source of information (for himself).

Digital media were mentioned by 14 participants. Google/the internet was the most common (n=7), followed by Facebook groups with similar and/or specialist interests (n=3), newsletters (n=2), and YouTube (n=1) and Google Scholar (n=1).

More than half (n=11) of the participants mentioned that they use product representatives (n=9), pamphlets (n=1) and product advisory services (n=1) as a source of information. Although most (n=15) of the participants mentioned belonging to the Farmers' Association, only two mentioned the meetings as a source of information specifically. One participant mentioned radio as an information source. One

participant mentioned getting information from the GCBR. Experts in specific fields (n=1), consultants (n=1), science (n=1) and books (n=1) were also mentioned.

There were some tensions in the way most of the participants regard "expert knowledge", and many participants mentioned that experts may not be able to offer advice or information that is useful in their specific context. Nevertheless, most of the participants expressed a desire for more research to be conducted by experts of all kinds, and most commonly they want more practical research in their region.

There was also a recurring suspicion among some participants that experts would criticise the pragmatic application of knowledge by land managers and a frustration at the lack of recognition that local knowledge enjoys. During discussion of the value of different kinds of knowledge, specifically that one of the possible outcomes of this study was to uncover and make more available some of the local knowledge that participants hold, many participants were intrigued. More than half of the participants did not previously know that practical knowledge based on being and doing was recognised academically. One participant said *"in that case, I hope many more people like you come here to learn with us"* (P5).

Conservationists are also regarded by some participants as potentially suspect sources of knowledge, and several participants articulated a perceived conflict of interest between environmentalists in general and land managers. This related both to environmental laws and the perceived lack of understanding on the part of conservationists of the multiple spheres land managers inhabit and must transcend in order to make a living. One participant asked the researcher *"are you for the farmer or against the farmer?"* (P5). On the other hand, several participants felt that more knowledge about how to integrate conservation and agriculture was essential, and expressed a strong wish to know more.

4.1.5 How do participants make land management decisions?

This section explored considerations involved in decision making (table 10) and how participants make decisions (table 11). Further, it explored what the participants monitor on their land (table 12) and in their operations, as well as environmental changes they have observed (table 13). These link to their decisions as part of the context, and also helps uncover which environmental indicators they include in their decision making. The participants also shared changes that they have made in their land management practices over time (table 14), which is another reflection of their decisions.

Table 10. Decision making considerations

Decision making	Examples	Number of responses	Quotes
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considerations		(total n=19)	
Environmental factors	Weather Grazing/pasture availability Soil fertility Water availability	13	
Prioritisation	Urgent decisions(disease, breakdowns) Important decisions (herd genetics, infrastructure) Necessary decisions	11	<i>"If there is a broken pump and a sick cow, you treat the cow first because tomorrow it will be dead." (P4)</i>
Timing	Moving animals Irrigation Planting Marketing products	6	
Disruptions	Emergencies Load-shedding Interruptions	5	<i>"You wake up in the morning with a plan but by breakfast time the plan is out of the window." (P2)</i>
Staff	Staff skills Staff availability Supervision requirements	4	
Markets	Predictions Volatility Timing	4	

Consequences	Biodiversity impact Tourism impact Lowest negative consequences	3	
Laws	Relevant laws	2	" - you don't need an EIA to plant a tree, but they do the same job as a gabion." (P10)
Availability	Seed Money	2	"We wanted to plant a (grass and herb) mix but when we went to the co-op it was out of stock". (P3)
Experts	New or more specialist decisions	2	
Costs		1	
Suitability	Crops	1	

The most frequently mentioned decision making considerations were environmental factors (n=13). The weather (n=6), grazing availability (n=4), water availability (n=2) and soil fertility (1). This found an echo in nearly a third (n=6) of the participants mentioning timing their activities in accordance with suitable weather as an important decision making consideration.

More than half (n=11) the participants spoke of prioritisation being an important consideration. Often participants must prioritise in urgency (n=3) or because they are compelled to by circumstance (n=3), but six participants mentioned that they include long term, important factors like herd genetics in their decisions (n=6).

Markets were a factor in decisions for a fifth of the participants (n=4). Factors such as disruptions (n=5) and staff (n=4), were also mentioned. Less frequently mentioned considerations were laws (n=2), availability of money and seed at the time when they are needed (n=2), expert input (n=2) and costs (n=1). The suitability of crops was mentioned once.

Access to credit and the implications of borrowing on decision making came up regularly, although participants did not refer to these directly as a factor in their decisions. The implications of paying loans off was clear during the conversations about planting cash crops and decisions regarding whether and when to develop infrastructure, purchase new machinery or change systems. Access to credit to purchase new land was another recurring point. For several participants, the carbon insetting programs that Nestle offers their milk producers - an arrangement of low interest loans and debt write-offs for installing solar electricity and using organic fertiliser, and equipment - was a potential turning point for changing their systems.

The Co-Op (Farmers' Co-Operative) was regularly mentioned in these conversations. One person (of the two participants who live in a membership co-op area) spoke about the way Co-Op structures vary as having an influence on whether land owners can continue during bad years, and that the membership co-ops provide a mediation and buffering service with the banks in bad years, keeping people on their farms. *"You are a member of the Co-Op here, it's not a company. I think that's better because company people are focused on money making, but a membership Co-Op 's concern is primarily to keep farmers on their land. Sometimes in a bad year there is 700 million (Rand) outstanding in debt, but then a good year comes and they are paid off. In those bad years the Co-op mediates with the banks about whether to liquidate or not"* (P15). Table 11 (below) outlines decision making methods.

Table 11. Decision making methods

Decision making method	Examples	Number of responses (total n=19)	Quotes
Gut feel based on past experience or experiment		2	
Second nature/instinct		2	<i>"You are asking things (about how I make decisions) that are second nature, you do things you don't even know you are thinking about them... a lot of the things you are asking about are not</i>

			<p><i>conscious decisions."</i> (P6)</p> <p><i>"We all make decisions... Not making a decision is a decision. Decisions happen organically and instinctively and we make a million every day."</i> (P1)</p>
Use decision making tools	<p>T4Deck tool</p> <p>Strategic Adaptive Management</p> <p>Team decisions</p> <p>Information gathering</p>	1	<p><i>..there is value in having a (decision making tool) to fall back on when there is a challenge or stress or pressure, to aid making the best decision possible.</i></p> <p><i>...that last step of the decision is to ask did it work? ...you have to keep checking how close did you get (to where you want to be)." (P1)</i></p>
Told a story about a specific decision		4	

Discussing how participants make decisions proved to be a challenging question. Some (n=4) participants told stories about specific decisions. Two participants said they make decisions on "gut feel" based on past experiments and experience. Another (P6) said: "*You are asking things (about how I make decisions) that are second nature, you do things you don't even know you are thinking about them... a lot of the things you are asking about are not conscious decisions.*" This was echoed by

another participant (P1) who said: *"We all make decisions... Not making a decision is a decision. Decisions happen organically and instinctively and we make a million every day."* The only person who mentioned using thinking tools has had exposure to strategic adaptive management processes, has had management training and does a job that requires extensive reporting. This participant uses *"a range of (decision making) tools to produce a range of results"*.

Monitoring as a source of information for decision making, as well as learning and adapting, was explored with the participants. Table 12 (below) outlines what the participants monitor routinely on their land.

Table 12. What do participants monitor?

What do you monitor?	Example	Number of responses (total n=19)	Reasons
Livestock and Economic Wildlife	Health Behaviour Numbers	11	Adjust management
Weather conditions	Temperature Wind Fire risk Rainfall	7	Adjust management Operations (planting, spraying, irrigation, burning) Planning
Veld condition	Plant growth Vegetation composition Soil (moisture, carbon, minerals)	6	Adjust management Fire risk
Production	Milk production Biomass yield per hectare Quantities harvested	5	Income predictions Animal health Adjust management

	and sold		Sustainable harvesting
Crop health	Diseases and disease vectors Cell development	3	Adjust management
Costs	Electricity use Diesel use	2	Cash flow Efficiency
Cash flow		2	
Too many things to specify		2	
Water availability	Tanks River level	2	
Alien plants	Wattle	1	Adjust management
Fencing		1	Animal safety
Requirements by professional bodies	Hygiene Record keeping Animal welfare	1	Income Adjust management

All (n=11) of the participants with animal based or mixed production systems which include animals mentioned that they monitor the animals, with the exception of the participant who leases their land to someone else. The weather was the second most frequently mentioned factor, and within this category four participants mentioned that they monitor rainfall as part of their decision making. Temperature, wind and fire risk indices were mentioned once each. Six participants said that they monitor the veld condition in non-planted areas. A quarter of participants (n=5) routinely monitor their production. Of the eight participants working with crops, three mentioned monitoring their crop health. Costs (n=2), cash flow (n=2) and water availability (n=2) were mentioned by surprisingly few participants. Alien plants and fencing were mentioned in the context of managing a nature reserve. The requirements of professional bodies were mentioned by a dairy farmer. Two participants said that they routinely monitor too many things to specify.

The most commonly mentioned method of monitoring was direct observation by the participant. One participant (P8) said: *"You must go and look. The best fertiliser you can get is the farmers footprints on*

the land." Two participants obtained regular soil reports from experts as part of a carbon insetting scheme. One participant regularly compiled an extensive annual monitoring report for CapeNature. The factors that the participants monitored were primarily used in decisions to adjust their land management. Day to day operational decisions, managing risk, income, cash flow, efficiency, operational planning, and sustainable harvesting were also mentioned. One participant (P3) observed *"we could calculate our water use from our pumps, but there is no point. The Department of Water and Sanitation (DWAS) came and we all registered, and we never saw them again"*.

Table 13 (below) lists the environmental changes participants have observed. These changes have occurred during the time that they have been managing the land they currently manage.

Table 13. Environmental changes participants have observed during their time managing land

Environmental changes observed	Example	Number of responses (total n=19)	Quotes
Climate and weather	Big drought Wind is worse Less frequent, more concentrated rain Less rain Less rain per rainfall event Rainfall patterns changing (more summer rainfall?)	13	<i>"Everyone says it's global warming that's changing the rain patterns, I don't know. I always thought that our rainfall totals come in the year but you can't say when they will come..." (P15)</i> <i>"The changes that water (rain) brings are more or less grazing, better or worse water quality, more or less production." (P3)</i> <i>"I don't know if farming practices had a lot to do with</i>

			<p><i>(climate change), I'm not sure what causes drought." (P15)</i></p> <p><i>"As jy die reënval syfers gaan kyk, ek dink ons is in 'n twintig jaar droësiklus." (If you look at the rainfall records, I think we are in a twenty year dry cycle) (P2)</i></p> <p><i>"There is nothing that makes me happier than rain or for me water. That's all I want.' (P18)</i></p>
Rivers	<p>Less water availability</p> <p>Poor water quality</p> <p>Change in water use approach (no longer time based)</p> <p>Some years good, some bad</p>	10	<p><i>There is a beurt sloop (water channel) that became defunct... (The users) hadn't done maintenance for a while... it became overgrown and they decided that they would clear... with a machine... (This) ruined the sloop physically because... (without proper supervision) the machine broke through the concrete</i></p>

			<i>so the water leaked out. It hasn't functioned for more than 10 years...Now everybody does their own thing out of the river." (P17)</i>
Invasive Alien Plants	<p>Aliens increasing</p> <p>Aliens removed</p> <p>Better downstream river flow since clearing</p> <p>Less river overflows since clearing wattle</p>	9	
Ecology	<p>Appearance of small game since COVID 19</p> <p>Appearance of brown hyena since COVID 19</p> <p>Spiders on organic land</p> <p>Less overgrazing</p> <p>Slower veld recovery</p> <p>A lot of birds</p> <p>Changing plant composition (more grass)</p>	7	<p><i>"In the natural veld areas we aren't doing anything active to the veld. To spend money on the veld is to waste money." (P6)</i></p> <p><i>"They (GCBR)... want to improve the environment. It's an enviable thing to have, it doesn't cost me money to do all these things to make our world a better place. They protect nature. If you don't protect it, you only have it once." (P15)</i></p>

Development	Intensified land use Clearing Property development	7	<i>"At Jakkalsvlei, there was a tiny hanepoot vineyard... and (they) built it up into a highly successful vineyard and an... industrial scale operation." (P17)</i> <i>"...the citrus farm...are in a pickle because there isn't enough (water)..." (P17)</i>
More laws	Less controlled burns due to liability concerns Labour and environmental laws	2	
Soil	Soil composition improving Soil has more life	2	<i>"That's why we do all this (regenerative agriculture), grond wat gesond is sorg vir jou. Ons boer met grond, nie met canola of koring."(Healthy soil cares for/makes provision for you. We farm soil, not canola or wheat). (P15)</i>
Electricity	Less available Less dependable	1	<i>"When I started farming there was no Eskom (electricity),</i>

			<i>and when I finish farming there will be no Eskom" (P4)</i>
Better agricultural systems	No till No flood irrigation	1	
Community		1	

The most frequently mentioned environmental changes were climate and weather, mentioned by two thirds of the participants (n=13), although none of the participants spoke specifically of the climate changing but rather of drought. Of these, one person mentioned that the wind has intensified, and everyone else spoke about changes in rainfall. Six people said that rainfall has been decreasing, one said there is less rain per rainfall event, one said the rainfall events are less frequent but more concentrated, and three people said the rainfall patterns are changing. Some participants attribute this to drought, although they mention climate change also: "... *ek dink ons is in 'n droësiklus, (dit is) nie die effek van klimaat change [sic] (nie)*" (I think we are in a dry cycle, it's not the effect of climate change) (P2).

Half of the participants (n=10) mentioned changes in the river systems. Most participants (n=7) said that there was less water in the rivers than when they started. Poorer water quality (n=1), variation in different years (n=1) and a change in the way water use is managed (switching from a time based sloop supply to pumps, n=1) were also mentioned.

Nearly half (n=9) of the participants mentioned changes relating to invasive alien plants. Four participants have removed wattle. One mentioned that the river has overflowed less since wattle was cleared. One person observed better downstream river flow since alien clearing. Three participants said they have seen that alien plants are increasing.

Changes in ecology were mentioned by just over a third of the participants (n=7). These included the appearance of brown hyena (n=1) and small game (n=1) since the COVID 19 pandemic, Veld condition was mentioned, including slower veld recovery after grazing (n=2) and less overgrazing (n=1), changing vegetation composition in the veld (n=1). Switching to organic land management was observed to support spiders (n=1) and more birds (n=1).

Seven participants mentioned development as part of the changes they have observed. This included intensified land use (n=3), bush clearing (n=1) and property development and building (n=3). One participant mentioned the deterioration of Eskom's electricity supply.

Two participants mentioned a proliferation of laws. Two mentioned improved soil health in planted lands and pasture, and one mentioned the uptake of "better" agricultural systems. One participant mentioned change in the community, as generation succeeds generation. Broader social and economic change was implied but not specifically mentioned. For example, one participant (P2) said: *"I often wonder whether we are in the right place, because things are tough here. But people are coming here from other places. But we live in a beautiful place and it's not too far from the town. But it's difficult farming here, stuck in between the koppies. When my father farmed here there were many more farmers, but things have changed and now small farmers can't make a living."* Table 14 (below) explores changes participants have made in their land management.

Table 14. Changes participants have made to their land management operations

Changes in their land management	Examples	Number of responses (total n=19)	Quotes
Changed products	<ul style="list-style-type: none"> Removed vineyards to plant pasture Removed sheep to graze cattle Removed fields to plant orchard Removed orchard to plant pasture Switched from mixed farming to flowers 	5	<i>"(After the protests) I will never again produce a crop that must be picked by hand." (P2)</i>
New activities	<ul style="list-style-type: none"> Agroforest Planted orchard Built house and accommodation Built winery Ploughed new lands Planted vineyard Clearing aliens 	10	

Terminated activities	<p>Stopped farming vegetables because market closed</p> <p>Stopped farming sheep due to stock theft</p> <p>Stopped planting cash crops</p>	4	
Adaptation of practices	<p>Use more organic fertiliser</p> <p>More strategic, less reactive</p> <p>Regulate camps to avoid overgrazing</p> <p>Changed from flood to sprinkler/pivot irrigation</p> <p>Burn veld less</p> <p>Diversify pasture crop species</p> <p>Improved record keeping for sustainability</p> <p>Leave plant material on the land</p> <p>Use less water</p> <p>No till planting</p> <p>Use better bulls</p> <p>Smart tech planter</p> <p>Managing wattle</p>	25	<p><i>"Die droogte het ons meer effektief laat boer. In die Gouritz rivier (area) is daar baie meer vloed besproeing, want daar is meer water. In die moeilikste omstandigede moet jy meer op pas"</i> (The dry conditions have caused us to farm more effectively. There is much more flood irrigation in the Gouritz river area because there is more available water. In difficult circumstances you have to take more care). (P2)</p>

	differently with follow ups		
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All of the participants who produce commercial products have changed their land management practices, some of them many times. Half of the participants (n=10) have started new activities in addition to what they were doing before. One quarter (n=5) of the participants have changed their products. One fifth (n=4) have terminated an activity.

Not all of the participants gave reasons for these changes. In many cases, multiple factors influenced the participants' decisions to change. One participant (P15) said "... *it's cheaper (regenerative agriculture practices) I think because you aren't working as much. Just the diesel costs alone make it work. We now use a planter that places the seed in a row and adds manure. I noticed that we used 10 litres per hectare of diesel in the old system, now we use about 5. And you keep the plant material on the land, you don't compact your land. I don't like to see people baling, you create your own drought.*"

Some changes were inadvertent: "*There is a beurt sloot (water supply channel) that became defunct because of mismanagement... They hadn't done maintenance for a while and it became overgrown and they decided that they would clear the sloot with a machine, (although) the servitude arrangement is for hand labour. They drove a machine through without agreeing amongst themselves and there was a caterpillar cutting through the fence line. So aside from a big fight (about that) they ruined the sloot physically, because they didn't supervise and the machine broke through the concrete so the water leaked out. It hasn't functioned for more than 10 years so everyone is now pumping like there is no tomorrow. That stopped the adherence to the time allocation. Now everybody does their own thing out of the river*" (P17). Although this was only mentioned by one participant, there were participants who mentioned that the change to sprinklers had led to using less water, and this is seen as an improvement. There is an element of finding the silver lining in this narrative, which is consistent with the satisfaction of triumphing over doubt in the earlier section.

Some changes were specifically intended to improve productivity: "*That's why we do all this (regenerative agriculture practices), grond wat gesond is sorg vir jou. Ons boer met grond, nie met canola of koring.*" (P15)(see translation in table 12).

4.1.6 What future do participants envisage for themselves and their land?

This section explored which elements of their current land management and lifestyle are elements participants want to preserve, as well as those elements they would like to change, and what a positive future would look like for them. Table 15 (below) lists the elements participants wish to increase in the future (assuming that this is possible).

Table 15. Aspects of living or land management that participants wish to increase in future

Increase in the future	Examples	Number of responses (total n=19)
Production	<p>Better infrastructure (communications, roads, electricity)</p> <p>More grass, less veld</p> <p>Solar electricity</p> <p>Better herd quality</p> <p>More land</p> <p>Diversify pasture</p> <p>Intensify fodder production</p> <p>Double cropping</p> <p>Plant cultivation</p> <p>Plant propagation</p> <p>Farm manager</p> <p>Smart tech</p>	19
Free time	<p>Travel</p> <p>Time in nature</p> <p>Relaxation</p> <p>Gardening</p>	7
Environmental stewardship	<p>Environmentally "respectful" farming</p> <p>Awareness of dependence on nature</p> <p>Better veld management techniques</p> <p>Caring for land better</p>	6
New income sources	<p>Tourism</p> <p>Cash crops</p> <p>Sales to new markets</p>	5

Social development	Community (racial) integration Authenticity in business Fire Protection Association more effective	5
Landscape connections	More natural veld spaces Habitat corridors	4
Water availability	Remove aliens More rainfall More water in river	4
Permaculture	Gravity fed irrigation Agroforestry Courses	3
Regenerative agriculture	Organic fertiliser	3
Planning	Think about what we are doing	1

Increasing production in the future was mentioned 19 times. Not all the participants wished to increase production, but of those who were themselves commercial farmers (n=15) all but two wished to do so (n=13), and some mentioned several things they wished to increase. All of the items mentioned aimed to improve or extend their existing activities.

Free time was something that more than a third (n=7) of the participants said they would like more of. Nearly one third (n=6) of the participants felt that better environmental stewardship would be desirable. New income sources and social development were each mentioned by a quarter of the participants (n=5). One fifth (n=4) of the participants mentioned they would like to increase landscape connections for wildlife and plants. Increasing water availability was mentioned by four participants, interestingly the increases in production mentioned were mainly independent of water. Increasing Permaculture (n=3) and regenerative agriculture (n=3) practices were mentioned in relation to increased production, and also improved environmental stewardship. One participant expressed a desire for more planning activities. Table 16 (below) explores those elements of the participants' land management and lifestyle that they wish to reduce (assuming this is possible).

Table 16. Aspects of living or land management that participants wish to reduce in future

Reduce in the future	Examples	Number of responses (total n=19)
Environmental degradation	Invasive alien plants Extractive development Overuse of water Burning veld for grazing Erosion from roads Traffic Cash crops	17
Costs	Fuel Fertiliser Chemicals "Stuff" Eskom power Interest rates	9
"Hassles"	Emails Admin Babysitting staff Labour problems Undesirable tasks Responsibility	6
Plant species unpalatable to domestic stock	Renosterveld Thorn trees Unwanted bossies	5
Drought		2

Predators		1
Land price increases		1

Environmental degradation was mentioned by nearly all (n=17) of the participants as something they wanted to reduce. More than half of the responses in this category (n=10) related to invasive alien plants.

Reducing costs was important to nearly half of the participants (n=9). The cost of chemicals (n=3) and the cost of electricity from Eskom (n=2) were mentioned by more than one participant.

Linked to the desire for more free time, nearly one third of participants (n=6) wanted to reduce the "hassles" in their lives. Time spent on administration, problems with staff, and on the aspects of their operation that were not enjoyable were mentioned. Two participants said they would like fewer droughts in future, but this was said with a resignation that suggests they didn't think that it is likely.

One quarter (n=5) of the participants and eighty percent (five out of six) of the mixed livestock/cultivation farmers wanted their veld composition to include more grass and fewer plant species unpalatable to domestic stock. One of these six farmers said they would like fewer predators (it is notable that this farmer does not shoot or trap predators and some of the others do).

One participant said they would like the land price to increase less dramatically, to make buying land more affordable. This participant linked "*Gauteng karre*" (P4) - wealthy people from other places - to land price increases. They mentioned that wealthy incoming people seldom take the time to find out how local systems work before they implement changes. They went on to say that these rapid, large scale changes are often detrimental to "the land" and lead to failure to produce, and then the land is sold again at a high price.

Participants were then asked what a positive future for themselves and their land would look like. No limitations were imposed other than those the participants chose for themselves. Table 17 (below) outlines what they shared.

Table 17. Elements of a positive future

Positive futures will include:	Examples	Number of responses (total n=19)
Knowledge about land management	Agricultural extension Education Exposure to farming (for children)	8

	<p>Knowledgeable staff</p> <p>Learning</p> <p>Research</p> <p>Collecting useful data</p>	
Community	<p>Integration</p> <p>Continued good security</p> <p>Community support</p>	8
Water	<p>Rain</p> <p>River flows year round</p> <p>Enough water</p> <p>Most effective use of available water</p> <p>Planting water (Permaculture concept of using perennial plants to retain water on the land rather than removing it annually in cash crops)</p> <p>Protecting the mountain catchment areas</p> <p>Water redistribution scheme</p> <p>No wattles</p>	8
Survival/continuity/ sustainability	<p>Financial security</p> <p>Better relationship with nature</p>	7
Growth	<p>Enlarge operations</p> <p>Double crops</p>	4
Productivity	<p>Flourishing vegetable garden</p> <p>Established agroforestry</p>	2
Tourism development		2
Laws	Fewer labour laws	1

Knowledge about land management was mentioned by more than a third of the participants (n=8) as key to a positive future. This category included giving children exposure to farming in order to develop

future farmers and better governance (n=1), education systems and institutions (n=1), agricultural extension(n=1), knowledgeable staff (n=1), lifelong learning (n=1), research (n=1), and data collection (n=1).

More than one third(n=8) of participants mentioned the importance of their community in a positive future. Racial integration (n=2), continuation of collaborative security efforts (n=4) and ongoing mutual support (n=2) were seen as key to their community.

Water was an essential element of a positive future for more than one third of participants (n=8). Controlling aliens, adapting and maximising the efficiency of water use, catchment protection, river flows and rain were mentioned as important in this category. One participant said that a positive future would be *"like now, but green"*.

More than a third (n=7) of the participants mentioned "continuing as we are" as constituting a positive future. Financial stability (n=4) and a better relationship with nature (n=3) were the two elements that participants felt would be important to enable them to continue as they are.

One fifth of the participants (n=4) see growth as a key element of a positive future for them. It is worth noting that all four of these participants were already commercially successful. One participant (P15) spoke of the effects of capitalism saying: *"farms are becoming fewer and larger, you won't stop that"*, and their target is: *"if we can get to a point where we can have a bad year and still break even"*.

Two participants would like their nascent activities to develop to full production, and two wanted to see tourism in the area developing. One participant felt that a positive future would include simplified and fewer labour laws.

4.2 Workshop results

The Three Horizons Framework exercise uncovers the elements of the future that the participants feel are worth preserving, and links to system resilience. Resilience is the ability to adapt in order to retain important elements of the current system while system transformation usually involves creating significant change (Sharpe, Hodgson, Leicester *et al.*, 2016). The Three Horizons Framework enables participants to articulate and discuss the transformative pathways they think will bring about the system changes they want. This process of articulation supports making decisions in the present which (to the best of current knowledge) lead to achieving desired future outcomes, despite the uncertain nature of the future (Sharpe *et al.*, 2016). The workshop provided participants with an opportunity to engage in a collective visioning of a desired future state. Figure 20 below shows a diagram of the combined groups' Three Horizons Framework for land management in their region.

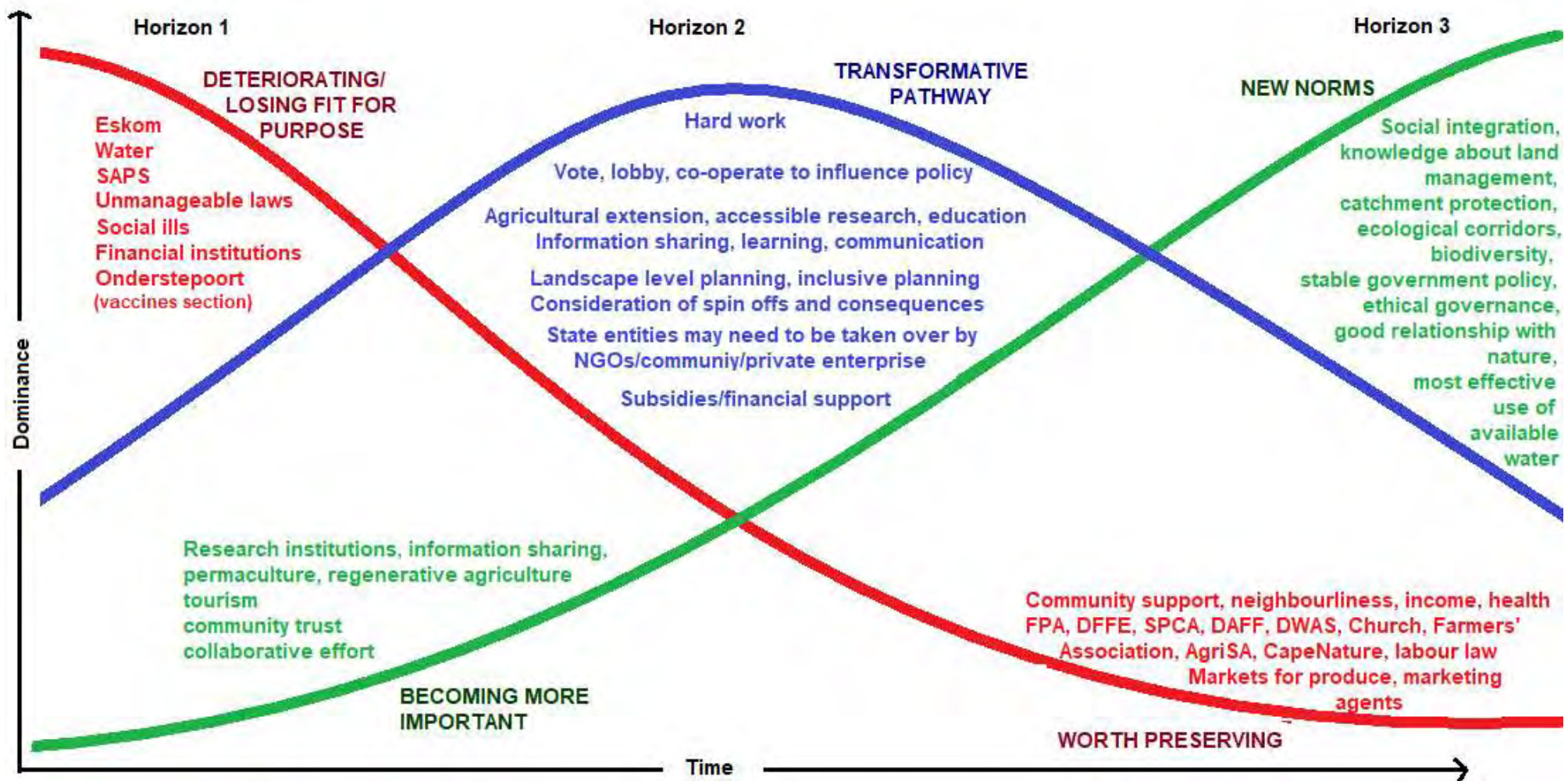


Figure 20. Diagram of combined Three Horizons Framework

Horizon 1

The elements of the present that participants saw to be deteriorating and/or losing their fit for purpose, or where there was need for significant change included Eskom, the South African Police Service (SAPS), banks and systems of credit, insurance and security companies (whose services are not fit for purpose in rural contexts), unrealistic laws and law making bodies without adequate understanding of agriculture and complex rural contexts, drug addiction in the community, crime, unreliable staff, water supply and management, and the vaccines section of Onderstepoort veterinary college.

Both groups referred to electricity generation problems with Eskom. Both groups located electricity on the "losing its fit for purpose" line, as well as being "worth conserving". One group referred to Eskom's history of being "*the best, but no longer*" (P4). One group saw self-generated electricity as the aspect of electricity worth conserving and Eskom as unsalvageable unless privatised.

Both groups mentioned laws and government departments relating to those laws on their red lines. however, one group red lined DFFE (the national Department of Forestry, Fisheries and the Environment) and DAF (the national Department of Agriculture) because there was "*no communication between national and provincial governments*" (P20) in regard to their legislation. The other group mentioned the lack of clarity regarding laws that conflict, such as Environmental Impact Assessment (EIA) and Fire Protection legislation about firebreaks. The cost and time involved in compliance with EIA legislation was redlined by this group, rather than the DFFE itself.

The elements of the present that the groups saw as necessary and/or felt were worth preserving included the mutual support that the community gives, neighbourliness and helping each other, income, personal health, the Fire Protection Association (FPA), the church, Agri South Africa (AgriSA) the Farmers' Association, The Society for Prevention of Cruelty to Animals (SPCA), markets for produce and marketing agents, the DFFE, the DAF, the DWAS, Cape Nature and labour law.

Horizon 3

New activities that have become the norm in a positive future included a socially integrated community, a community knowledgeable about land management, water catchment protection, all users making the most effective use of available water, established ecological corridors, sustained biodiversity, stable government policies, and a good relationship with nature.

The elements of the present that the group felt would grow to be more important were research institutions and praxis with land managers, information sharing, Permaculture, regenerative agriculture, tourism, community trust and collaborative effort.

Horizon 2

Discussion of this section was slightly abbreviated because the group was fatigued. The groups were combined for this section. There was some disparity in the pathways that group members thought would lead to their preferred futures, because the preferred futures had slightly different tangents, and because the members of the groups had different land management practices. However, as the discussion progressed it became clearer that although there were slight differences in which elements of the future they wanted to prioritise, the overall trajectories were very similar.

Hard work was the overarching aspect of Horizon 2 that participants felt would be needed to develop the future that they envision. Activities they felt would build better policy included voting, assisting community members to vote who have not done so, lobbying councillors and organisations for change, and co-operating in efforts to influence policy.

In order to build more knowledgeable land management communities, agricultural extension was seen as desirable. Communication, sharing information, encouraging learning, supporting education and making research accessible were also seen as important.

Planning activities were mentioned as relevant to building cohesive action for change. Specifically, including marginalised members (such as poor, black and coloured people, and land tenants) was mentioned. Planning at landscape level rather than on one or two properties was also seen as important for change, as was considering spin offs of activities, and what the unintended consequences could be.

Some participants felt that dysfunctional state enterprises would need to be taken over by Non-Governmental Organisations or private enterprise, as has happened with the Post Office. Subsidies, tax breaks and/or some form of financial support for farming other than bank loans were also felt to be important to enable change.

Table 18. Elements of the Three Horizons Framework developed by participants

Horizon	Location	Examples
1	Deteriorating, losing fit for purpose, or need for significant change	<p>Eskom</p> <p>Laws/lawmaking bodies</p> <p>Capitalism</p> <p>Insurance and security companies (not nuanced for rural contexts)</p> <p>Post office</p> <p>Staff issues (addiction, unreliability, criminal elements)</p> <p>Co-op</p> <p>Bank</p> <p>Onderstepoort vaccines section</p> <p>Water (availability, quality, rain and groundwater)</p> <p>SAPS</p> <p>CapeNature</p>
	Elements of current reality that we want to continue,/are working, and we think will/should continue to work	<p>Community</p> <p>Salary/income/money</p> <p>Markets/marketing agents</p> <p>Relationship with neighbours</p> <p>Fire protection association</p> <p>AgriSA</p> <p>GCBR</p> <p>Personal Health</p> <p>Church</p> <p>Mental strength</p> <p>Shops</p> <p>SPCA</p> <p>DWAS</p> <p>DAF</p> <p>CapeNature</p> <p>SAPS</p> <p>Municipality</p> <p>Farmers' Association</p> <p>Labour laws</p>

	<p>Growing, becoming more important or relevant, especially for the future that we want</p>	<p>Collaboration (community, inter-agency, inter-organisation) Community trust Improving mutual care Research institutions 'Scientific' approach to land management Farmers' days Information about novel systems Permaculture Regenerative agriculture Develop tourism in the area AfriForum (not unanimous)</p>
		<p>AgriWesKaap</p>
<p>2</p>	<p>Pathways and processes needed to move from current reality to desired future</p>	<p>Improved governance</p> <p>Vote Assist community members to register to vote Lobby Work together with AgriSA and other bodies to influence policy More practical laws DWAS more consistent DFFE and CapeNature more practical and applicable Fewer labour laws Many state entities will have to be taken over by the community, private enterprise and NGOs Subsidies and support for technology</p> <p>Financial stability</p> <p>Less debt More adaptable finance <i>"Get to a point where we can have a bad year and still break even"</i></p>

		<p>Sustainable production</p> <p>Agricultural extension</p> <p>Make research more practical and shareable</p> <p>Education</p> <p>Learning</p> <p>Study groups</p> <p>Distribution of information through Farmers' Association membership structures</p> <p>More knowledgeable staff</p> <hr/> <p>Planning</p> <p>Landscape level planning that includes all stakeholders and partners</p> <p>Planning that considers all impacts and spin offs, both positive and negative</p>
3	Desired future state	<p>Community</p> <p>Safe community</p> <p>Continued good security</p> <p>Neighbourliness but not too many neighbours</p> <p>Family closer together</p> <p>Socially integrated community</p> <p>A place for EVERYONE under the sun</p> <p>Community rid of bad elements</p> <hr/> <p>Knowledge about farming/land management</p> <p>Everyone working together (land owners and staff)</p> <p>Agricultural extension</p> <p>Learning and research</p> <p>Better relationship with nature</p> <p>Protecting biodiversity</p> <p>Protecting ecological corridors</p>

	<p>Water</p> <p>Protecting the mountain area</p> <p>Make the most effective use of available water</p> <p>No alien invasive plants</p> <p>Protecting water harvesting areas</p> <p>River flows continuously</p> <p>Enough water</p> <p>Optimise water resources</p>
	<p>Production</p> <p>Established agroforestry</p> <p>Flourishing vegetable garden</p> <p>Double crops</p> <p>Food production/food security</p> <p>Regenerative agriculture</p> <p>Pasture/grazing/veld (e.g. Permaculture courses, more organic fertiliser, diversify pasture species, increase fodder production)</p>
	<p>New activities</p> <p>Tourism in the area taking off</p> <p>Time spent in nature</p>
	<p>Laws</p> <p>Integrated, practical and applicable laws</p>
	<p>Governance</p> <p>Ethical government by state, and other governance-related institutions</p> <p>Stable agricultural policy</p>
	<p>Technology</p> <p>Solar electricity</p> <p>Mechanisation</p> <p>Other new technology supporting land management</p>

4.2.1 Reflection

Before the workshop closed, the researcher invited the participants to share their reflections about the day. By this time, there were six participants present of the original nine.

The participants mentioned that they had made helpful connections through meeting and engaging with new people during the workshop. These included meeting people who have different outlooks but who have similar land management problems, and discovering that they share similar goals. "*We need to share more information and talk more*" (P10) was how one participant summed this up.

One participant did not previously know that they would be welcome at the Farmers' Association, and the members of the Farmers' Association did not know that this participant was unaware that they could attend. The workshop had given them a chance to clarify this previously divisive mutual misconception.

The workshop was described as having given people time to think. The participants mentioned that having had to stop their daily activities and think, specifically to think together, was a valuable part of the day.

The need for changes in political systems and government institutions was highlighted during the reflection. While it was acknowledged that there is change needed in agriculture, government structures were mentioned as needing extensive change in order to support food security and conservation of natural resources and biodiversity.

4.3 Results overview

This study set out to explore what a positive future or futures could look like from the perspective of the participants. The researcher did not intend to evaluate these conceptions, but rather to encourage the participants to articulate them, to reflect on them individually and collectively, and to build a better understanding of what they are. Further, it is hoped that this understanding will go some way to helping the GCBR to support collaborative biosphere stewardship that aligns with the worldviews of the land managers in the region

There was criticism from both the interview and workshop participants about conflicting international trade regulations, perverse global trade incentives, market capture, inappropriate financial models, poorly considered government subsidies (or the lack thereof) and centralised political power structures which dis-incentivise or prevent comprehension of rural needs. Improving human relationships with nature and protection of catchments and biodiversity also emerged in the interviews and the workshop as important for the future. This aligns with the findings of de Bruin, van Vliet, Lehman *et al.* (2023) who conducted an expert review of scenario narratives on equitable ways to restore and conserve biodiversity while taking into account the need for agricultural production. They called an integrated global landscape with people living and working in landscapes while conserving biodiversity

around them "Sharing the Planet" (de Bruin *et al.*, 2023). Incorporating diverse values of nature to people is the thread joining the heterogeneous tenets of this approach. The Sharing the Planet scenario (de Bruin *et al.*, 2023) means that humans live in , with and from nature rather than being separated by fences from nature in protected areas, and requires that existing economic and political power structures undergo profound change.

Participants in both the interviews and the workshop linked community collaboration and social (including racial) integration to positive futures. They also outlined their desire to build community cohesion and reduce social ills such as crime and drug use. In fact, their community cross-connects to all the collective topics mentioned. The historical context of Dutch settlement and subsequent colonial activity has an influence on the worldviews and values of the study participants, who are mainly descendants of the original (white) Dutch and French settler families. It is worth noting that these values are not necessarily exclusive to the white community, however. In the context of diverse values and worldviews, it is essential that collaborative efforts for sustainability continually address imbalances of power, and strive for inclusiveness to build equity (Pascual *et al.* 2023, McDermott, Montana, Bennett *et al.* 2022). Although demanding to manage, inclusiveness generates better outcomes for sustainability (Therville, Mathevet, Bioret *et al.* 2018, Onaindia *et al.* 2013, Albert *et al.* 2012). Constructive dissent may even lead to innovation.

The broad value of stewardship (Pascual *et al.*, 2023) with the implicit consideration of future generations of land managers was mentioned consistent, even if the term "biodiversity stewardship" was not used to describe this. One participant said: *"We've got to get it (land management) right, not for us but because... we are stewards. (We) will die but the land will still be there and I want to be judged kindly by people in a hundred years that we did the best we could"* (P1). Future generations emerged as an important motivation for participants to manage land, some said they are *"building something for the next generation"* (P3), some that *"raising children on the farm is lekker"* (P8), and some that *"... in the bad years...you must be steady in those times. You must stay in it (land management) for the future"* (P15). Future generations of land managers also featured when participants discussed having changed their practices, as part of making sure that they 'hand the land over' in the best possible condition, because *"even if my own children don't want to farm, someone's children will (P18)"*.

When talking about decision making, most participants discussed factors that influence their decisions rather than how they make the decisions themselves. A number of interview participants also told stories about decisions they have made. This did not always clarify *how* they made the decision, but it suggests that a narrative approach could be one way of developing a better understanding of their decisions (Butina, 2015). Narrative approaches have been used to understand place-attachment in

changing landscapes (Goudriaan, Prince & Strzelecki 2023), and to help adapt to environmental risk (Herivaux, Vinatier, Sabir *et al.*, 2021).

The importance of nature in particular situations is termed specific values of nature (IPBES, 2022). Instrumental values of nature involve ways in which nature is a means to a desired end, such as soil health for crop production, or water supply for irrigation. The participants who are farming commercially all expressed instrumental values of nature in this regard. Intrinsic values of nature are independent of people as valuers (IPBES, 2022) but are valued in and of themselves. Several participants expressed views that the undisturbed fynbos on the high elevation areas has intrinsic value. One participant (P15) said *"if you don't protect it (nature), you only have it once"*. The meaning people derive from a sense of place, and the way interactions with nature link to human relationships are called relational values of nature (IPBES, 2022). These were mentioned when participants spoke of their parents and grandparents managing the same land they manage now, and their children growing up in the same place, knowing their place in the world. It also arose when participants spoke of feeling at peace when they are in their landscape, and that this *"is wonderful for the soul"* (P16).

Religion and faith emerged when discussing land management, relating to broad values, norms and beliefs (Özkaynak *et al.* 2023, IPBES 2022). Some participants mentioned the Dutch Reformed church as intrinsic to the cohesion of their community. One participant said that although theirs is a secular family, they are aware that the three institutions that contribute to building community cohesion are the church, the school and the Farmers' Association. Some participants referred to the spiritual support they receive from their faith (not the church specifically but their belief system), particularly during drought and hardship. One participant explicitly linked faith to managing uncertainty: *"Farming is unpredictable. Without faith you can't farm"* (P5).

Broadly, the participants described two main pathways of learning (pathway: the defined route through a learning experience which leads to a specific predefined outcome or qualification). All completed secondary school, and most (17 participants) then proceeded to a tertiary institution or for professional training (for example nursing and police colleges). These pathways involved full-time study and/or training. Subsequently, after starting out in their land management careers, most participants' learning pathways changed to those that could accommodate the demands of land management. In this context, spending large amounts of time learning continuously 'on campus' is difficult or impossible. The exceptions are the participants whose living is not dependent on managing land themselves. While managing land, preferred learning pathways parallel or intersect with the paths participants are travelling in the course of their work.

Learning was also mentioned in relation to providing education for children, and giving them experiential exposure to rural situations, with the intention of creating long term good governance for land management. The study participants also felt that children learning about land management was critical in order to feed future generations.

During the interviews and the workshop, learning was a consistent theme linked to success, progress, positive futures and sustainability. Participants also mentioned using a variety of decision support tools and techniques (see table 7, 8 and 9) including various forms of monitoring and trusted advisors and advisory services. These decision support systems also link to learning.

Trust was explicitly mentioned with regard to learning. Most participants spoke of whether they trust the source (in addition to or sometimes despite the content) of the information they get as part of their decision whether and to what extent it is potentially valid for them. This is consistent with what the researcher was told by members of the GCBR team when designing this study. Eastwood, Fischer, Hague *et al.* (2022) and O'Sullivan Leeuwis, de Vries *et al.* (2022) found that who delivered the messages about land management was as (and sometimes more) important as the content of the messages, and that trust was critical in uptake of new techniques, which is consistent with the findings of this study. Several interview participants directly or obliquely referred to lack of trust as an inhibiting factor not only in learning new things, but in developing relationships with individuals and organisations. Interpersonal relationships can have large scale landscape consequences (Eastwood *et al.*, 2022), and can reinforce positive and negative feedbacks (see the discussion on resilience in chapter 5, below).

Risk is a concept that is familiar to most people, and applies to many disciplines. This study used risk as a way to approach discussions of multiple aspects of land management decision making and change. Land management is also closely tied to the increasing social-ecological risks associated with climate change (Pörtner, Scholes, Agard *et al.*, 2021). When asked about risks, all of the participants were readily able to clearly articulate a number of items of concern, as well as what they have decided to do about these risks. Rising costs and inflation, market volatility, drought, environmental degradation, government failures, laws not fit for purpose, disaster risks, labour problems, animal and crop diseases and disease vectors, human-wildlife conflict, disruptions such as crime and load-shedding, and (purely) profit-driven decision making were mentioned. Some of the strategies participants used to improve production or conserve ecosystems are also implicitly risk reduction strategies and may not have been specifically mentioned as such in this section, or they may have inadvertently resulted in risk reduction, as have also been shown in other farming systems (McEwlee, Calvin, Campbell *et al.*, 2020).

The participants outlined a number of adaptation strategies that accomplish multiple outcomes (in addition to managing risk), and often that mitigate multiple risks simultaneously. For example, using community WhatsApp communication groups help mitigate fire risk and monitor fires, but also enhances co-ordinated responses to other emergencies such as flooding, and are used to communicate about other risks such as crime and escaped animals.

Some strategies mitigate a risk or risks, but potentially create other problems. One example is the transition from flood irrigation to electric pump driven sprinklers. Many participants said they had made the change because it was "better", referring to the reduction in soil erosion, expansion of potential cropland, increased ease of use, and the system being more flexible in response to changes of weather and plant growth needs. While flood irrigation, gravity fed systems and dam water storage was not dependent on Eskom for electricity, now that load shedding is a feature in land management, without power there are periods of no water supply. The rising cost of electricity now also plays a role in water use. As mentioned previously, there is now less mutual (time based) regulation of how much water is being used and *"everyone does their own thing out of the river"* (P17) while there is *"no effective law enforcement"* (P3) of Water Use Licenses from the Department of Water and Sanitation.

Climate change is implicitly seen as a risk, but not always one that can be immediately addressed at a personal, practical level. However, much of what the participants are already doing contributes, among other things, to climate change mitigation (McEwlee, Calvin, Campbell *et al.*, 2020). For example, efforts to increase soil organic carbon intersect with increased production, managing carbon dioxide in the atmosphere, water retention, new markets, cost reduction, and diversification of products. Particularly when applied at regional scales, these activities can have significant positive impacts.

The decision making pathways that participants mentioned are heterogeneous, and a number of participants did not mention any pathways at all. In this regard, this study has found insufficient data to develop a good understanding of the participants' land management decision making, but it does shed light on the decisions and their context.

Chapter 5: Discussion & Conclusion

5.1 Limitations of this study

Gender differences were not specifically analysed for the interview or workshop data. It was not certain at the outset who the participants in the study would be, and thus gender was not included into the research design.

The sample size for this study was small (19 participants). Although the study generated rich and detailed data, the sample size may limit generaliseability of the findings and may not capture the full diversity of perspectives and experiences of the study area.

This study was cross-sectional, and captured data at a fixed point in time. This limits assessment of long term effectiveness of the participants' strategies and adaptation measures.

The qualitative approach taken for this study may limit the ability to quantify the extent and impact of the trends and strategies mentioned.

This study was geographically limited, and findings may not be applicable to other regions with different contexts.

The participant selection may have introduced bias, which may skew the findings as they represent the views and practices of a particular group of participants.

5.2 Discussion

This exploratory study engaged with a remote rural population of land managers in the Albertinia-Herbertsdale area in the buffer and transition zones of the GCBR. The results showed that the landowners in this area were tenacious, dynamic, motivated, and practical people from a variety of professional backgrounds who were running primarily commercial land management operations in a highly biodiverse area and were making complex decisions about the management of their land into the future. The study participants' approaches to land management varied from strict conservation to maximising agricultural production and profit. Their adaptation strategies tended to be hands on, independent and practical, as well as action oriented. It emerged at the workshop that giving people time to think about abstract or large scale issues was appreciated, and was not routine.

All the participants knew that they are dependent on natural resources. They all valued their community and social networks. They had a strong appetite for learning, and combined an understanding of the historical context of their land management with an understanding that positive

futures will require dynamic and extensive changes at multiple scales. These findings are discussed below.

For the purposes of this discussion, sustainable land management, which is defined by the Food and Agriculture Organisation of the United Nations (2024, p 1) as “the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions”. The elements included in sustainable land management as well as the potential outcomes are outlined in figure 21, below.



Figure 21. Elements and outcomes of sustainable land management (Food and Agriculture Organisation of the United Nations, 2024)

5.2.1 Diverse specific and broad values inform decision-making, and provide leverage points for transformation towards sustainability

"Over millennia... people have developed myriad ways of understanding and relating to nature and its many values" (Pascual, Balvanera, Anderson *et al.*, 2023).Özkaynak, Ballesteros, Alonso *et al.* (2023) explain that values and worldviews "shape the way people interact with and value nature in a profound way". Despite not asking about values directly, but as expected, both broad and specific values strongly featured in participants' motivations for why they farm, and how they make decisions.

One element of the division between land managers and officials articulated in Table 5 arises from the historically eco-centric worldviews espoused by many conservation practitioners and institutions (IPBES, 2022). This results in tensions when engaging with primarily anthropocentric land managers (IPBES, 2022). Although conflicting worldviews and values can result in disputes about governance (Özkaynak *et al.*, 2023), thoughtfully including worldviews in collaborative governance can build consensus and result in better outcomes.

IPBES (2019) defines broad values as " general moral guiding principles and life goals". In this study, the participants expressed views that align with the broad values of justice, freedom, prosperity, health and responsibility (IPBES, 2022). Some participants wish to live in harmony with nature, and some to build a better relationship with nature in the future (see table 17).

It has been suggested that there are links between the work ethic engendered by protestant (particularly puritan Calvinist) Christianity and the rise of capitalism as an economic system (Weber, 1905). Frey (2001) interprets secular values arising from Puritanism, including intolerance for corruption, respect for property rights, and the need for individual achievement to be correlated with economic growth. These values are consistent with the broad values expressed by the participants across many topics. However, some of the participants in both the interviews and the workshop expressed concern that capitalism and limitless growth were not sustainable for the land. All participants agreed that systems of governance (particularly those linked to government institutions) need to change for sustainable land management to be possible.

Ruge (2017) points out that tireless work and re-investment (which he explains as using gains, surplus or profit to expand and improve current endeavours) are both tenets of Calvinism. He explains these tenets as a visible way to "confidently and constantly fulfil one's vocational duty to God". Ruge postulates that the link between work and Godliness lies in the German word *beruf*, which can variously be translated as one's vocation, profession, or calling. This found an echo in the reasons some participants gave for managing land, for example the participant who said "*it's a lifestyle as well as a living*", and how they see their personal challenges as tied to their occupation - "*if it doesn't rain,...I don't think there will be a future (for me)*" (P18).

Hard work was identified in the futures workshop as one of requirements and enabling pathways to the future that they collectively want, along with sound governance (among others). The concept of re-investment mentioned by Ruge(2017) was reflected in the discussions about Permaculture and regenerative agriculture as well as land management in general. Nutrient cycling, soil conservation practices, removing invasive alien plants, using organic fertiliser generated on the same property, encouraging water retention with swales, all in order to improve the land and/or its productivity were mentioned in the context of 'doing right' by the land and re-investing in it (and often also reducing costs).

This suggests that although many participants did not explicitly value or sometimes even recognise ecosystem services as defined by scientists, they are re-investing in some of them, which is consistent with their values. As one participant put it, "*grond wat gesond is, sorg vir jou. Ons boer met grond*" (healthy soil cares/provides for you. We farm soil)(P15).

Framing collaborative effort towards a sustainable future that takes these fundamental values into account, and that aligns with the spiritual requirements of land managers' belief systems, is likely to lead more effectively to environmental stewardship than those that do not (IPBES, 2022). Faith based organisations can make a positive contribution to environmental stewardship (Hitzhusen & Tucker, 2013), such as religious communities deliberately choosing to live more simply and in balance with nature, land restoration projects on land owned by religious communities, and religious rituals that promote conservation of ecosystem services (Hitzhusen & Tucker, 2013). Faith based organisations also form part of the multi-level institutions involved in processes of adaptive governance.

The participants' values play a role in their decision making. Some of these decisions include moving back to the family farm and continuing the operations there, choosing to continue to manage land in the face of drought and other difficulty, improving herd genetics, and buying land in mountain areas to conserve fynbos habitats. Values assessment approaches (Özkaynak *et al.*, 2023) can help to bridge gaps in worldviews and facilitate dialogues about sustainability, even in situations of dispute or conflict. These approaches may be useful in developing community cohesion, which was identified at the workshop as a key element of a sustainable future (discussed in the section on futures, below).

Environmental monitoring is routine for the participants (see table 11), and is intrinsic to their decisions (see table 8 and 12). Participants made decisions in response to environmental changes, but also to changes in many other systems (see figure 2 on land use change). Their decisions also aimed to mitigate risk and build resilience (discussed below). Taken together, the results speak to the participants being aware of change in ecological, social, political and economic systems and habitually adapting to these changes (see the discussion on risk, below).

5.2.2 Learning is valued and relational

Systems of knowledge (IPBES 2022) feature in values of nature (Pascual, Balvanera, Anderson *et al.*, 2023), and learning is one of the elements of adaptive governance (Schultz, Folke, Österblom *et al.*, 2015). All the participants mentioned learning, knowledge, information and research as important for land management and for positive futures, both in the interviews and the workshop. This study explored how and from whom land managers prefer to learn to help the GCBR to support learning for sustainability and biosphere stewardship (UNESCO, 2024). Further, this study hoped to surface the participants' knowledge that has been gained from practical experience and experiment. The study did not delve more deeply into over-arching knowledge systems. These systems should be taken into account however (Pascual *et al.*, 2023).

Expert led (books, videos, talks, and courses) individual learning permits the participants to learn about specific topics of interest in small chunks of time, and allows for interruptions. Social learning provides

concentrated multidimensional learning while potentially developing and sustaining relationships, and activities such as farmers' days provide a recreational break from daily activity. Experimentation and learning while doing allows reflexive learning in context.

Linked to social learning, some of the participants have formed formal and informal networks which fit the outline given by Wenger-Trayner (2015) of communities of practice. Wenger-Trayner (2015) explain that communities of practice share three elements: the domain, the community and the practice. The domain is the "competence that distinguishes members from other people" - in this case, land management within the GCBR. The community comprises "members who engage in joint activities and discussions, help each other, and share information" (Wenger-Trayner, 2015, p 1). Finally, the participants share a practice: "they develop a shared repertoire of resources: experiences, stories, tools, ways of addressing recurring problems" (Wenger-Trayner, 2015, p 1). These networks also cross-link different geographical regions, land management systems where elements of the community of practice are relevant to other systems.

The inter-relationships of trust with perceived success, and of these with power and influence, are especially important if social integration is to become a reality. Attempts to promote increased collaboration between landscape actors without taking these factors into account is likely to entrench existing divisions and potentially further polarise the community, with adverse outcomes for social-ecological systems (Eastwood *et al.*, 2022) and landscape governance (Schultz, Folke, Österblom *et al.*, 2015).

5.2.3 Perceptions of social-ecological risks drive adaptation strategies, and collaboration

McEwlee, Calvin, Campbell *et al.* (2020) studied 40 land management related activities to investigate their potential positive or negative effects on the complex intersecting problems of climate change, biodiversity loss and land degradation. They found that the following interventions had positive synergy with the Sustainable Development Goals and Nature's Contributions to People: improved cropland management, improved grazing land management, improved livestock management, agroforestry, integrated water management, increased soil organic carbon content, reduced soil erosion, salinization and compaction, fire management, reduced landslides and hazards, reduced pollution, reduced post-harvest losses, improved energy use in food systems, and disaster risk management (reproduced from McEwlee, Calvin, Campbell *et al.*, 2020). They found that some risk sharing measures like commercial crop insurance, bio-energy, bio-energy with carbon capture and storage and afforestation were associated with negative impacts on Nature's Contributions to People and the Sustainable Development Goals (McEwlee, Calvin, Campbell *et al.*, 2020).

It is interesting to note that the interventions mentioned by McEwlee, Calvin, Campbell *et al.* (2020) as being synergistic with better outcomes for climate, land and biodiversity conservation (with the exception of those aimed at reducing soil salinization, landslides and post harvest losses), were all mentioned by the participants. None of the participants mentioned bio-energy, and the only participant who is conducting afforestation is doing so on a very small scale (alone and by hand) with indigenous trees in a mountain kloof. This study did not discover any risk sharing measures such as crop insurance, but contextually inappropriate insurance was mentioned in the workshop as part of the status quo that is deteriorating.

Many of the participants' actions to respond and adapt to risk also support building resilience. Biggs *et al.* (2012) define resilience as the capacity of a social ecological system "to sustain a desired set of ecosystem services in the face of disturbance and ongoing evolution and change", and proposed a set of seven principles to help evaluate how resilient systems are. Biggs *et al.* (2012) contend that maintaining diversity and redundancy support resilience, by providing a range of options when there is disturbance. The study participants mentioned several ways in which they have diversified their incomes (by producing new products, or changing their land management completely, or adding additional new activities) to sustain their land management operation in the face of economic change. Some participants mentioned falling back on older infrastructure or methods (redundancy) when there is a disruption, such as using diesel generators during load-shedding. Some mentioned maintaining older land management systems on one part of their land, until the new systems were established and operational in other areas. Participants explained the importance of "everyone" in the land management community being more knowledgeable about land management, which will increase knowledge redundancy.

Connectivity (Principle 2, Biggs *et al.* 2012) is well established in economic, social, legal, commercial and learning spheres in the study area. Connectivity refers to the linking relationships between parts of a social ecological system, and is important for resilience because the connections between points of the system enable recovery after a shock or disturbance, but over-connected systems can also exacerbate shocks (Biggs *et al.*, 2012). Some of the participants spoke of the importance of ecological connectivity when discussing risk, including describing water flows, up and downstream water use and pollution (which also relate to slow feedbacks, discussed below), fire paths, wind, and disease vectors, but some participants did not mention them at all. This may be a result of how the question was framed, rather than a lack of understanding of the connectivity of these components or their importance for resilience.

All of the participants in this study spoke about the different time spans relating to their activities and decisions. Slow feedbacks (such as negative feedbacks causing desertification) have frequently been

poorly understood and/or underestimated and have led to severe ecosystem deterioration in a wide range of circumstances (Biggs *et al.*, 2012). There was some explicit mention made of the risks posed by some slow ecological feedbacks, specifically drought and desertification. Poor government policy and impractical and contradictory laws (which are also slow feedbacks) were mentioned frequently. There was also discussion about how fast changes can affect slower processes. It takes months for a wheat crop to come to fruition and years for a vineyard to achieve full production, or to improve the bloodline of a dairy herd, while disease can wipe out several dozen calves in one night, botrytis can blight an entire orchard in a few hours, and a car accident can disrupt a family farming operation in a few seconds.

The participants referred in various ways to systems of governance when discussing risk. These included "the Government" broadly, and specifically national and provincial departments including Water and Sanitation, Environmental Affairs, Labour, Agriculture, as well as political structures, ideologies and parties. With regard to crime, the South African Police Service (SAPS) were mentioned as important, as well as collaborative security arrangements between land owners, the Mossel Bay municipality, SAPS and private security companies. They also mentioned other collaborative groups involved in governance including AfriForum, AgriSA and AgriWesKaap, and civic groups such as Farmers Associations. While participants felt that the collaboration between actors for improved security was contributing to mitigating risk, and that the civic and Agri-type organisations were also making a positive contribution, most felt that "the government" was not.

Polycentricity - self organised, co-ordinated efforts between organisations at multiple levels (within and outside the government) which are involved in elements of governance (Morrison, Bodin, Cumming *et al.*, 2022) - can contribute to resilience (Biggs, Clifford-Holmes, Freitag *et al.*, 2017, Biggs *et al.*, 2012). Morrison, Bodin, Cummings *et al.* (2022) explain that it is usual for the dynamics of these governance systems to change because they are actor-driven, and thus they reflect changes in interconnected systems. They highlight that co-ordination between actors and between decision making venues (for example government departments, panels, farmers' associations) is key to polycentric governance. Thus, co-ordination should be given attention in order to help actors navigate polycentric governance. While not explicitly stating this link, the way participants framed their transformative pathway (Horizon 2) indicates that they recognise the important of co-ordinating their efforts with those of other actors and institutions. Linked to this, participation (Biggs *et al.*, 2012) was also identified as a key transformative pathway to the desired future at the workshop.

Writing about environmental governance, and specifically water management arrangements, Margerum and Robinson (2015) outline how collaborative partnerships can be used for sustainable water management. Partnerships are complex, and developing and maintaining them requires effort and

investment. Margerum and Robinson (2015) posit that one approach to integrated management involves a process of information analysis, goal setting and consensus building, followed by an implementation phases, which may be managed in different ways.

Their work highlights that the initial phases of this process can confront power imbalances, competing interests, and can be even more challenging when the context means there are likely to be few joint gains and more trade-offs. These early phases require intense effort and are time consuming, because generating a collective strategy may require significant changes.

Following the consensus building phase, one approach to the implementation phase of the collective strategy involves partners each carrying out their agreed tasks with little overlap, and general autonomy. This may involve fewer time demands than the consensus building phase, but is usually effective only if conditions are stable. Another approach to implementing collaborative arrangements involves co-ordinated activities between partners, which require networks to permit information, resources and capacity to flow or be exchanged between partners in an adaptive and responsive way. this is more demanding in terms of time and effort from all partners.

In terms of governance, there are a multitude of institutions involved in sustainable water management (or environmental management of any kind). Management of natural resources for sustainable use is subject to laws and policies which devolve to all levels of government for implementation. Margerum and Robinson (2015) highlight that co-operative strategies among government departments are rare, and in the South African context state functionaries are often under-resourced, and work silos are a common barrier to effective collaboration, even when all involved are aware of the need for collaborative activity.

Co-ordinated approaches to implementation require leadership from people who know how to build trust and who can build bridges between organisations and collaborative efforts within them, however the collaboration should not depend too much on a few individuals. Therefore, developing knowledge and skills for trust building and skills for building social capital form an essential and ongoing part of collaborative implementation strategies. Further, robust networks that are clearly organised and structured to support the flow of information are needed, and the investment of time and resources are essential to effective collaborative efforts.

Because hard work is considered to be a virtue in the participants' value system, because they view re-investment in a positive light, because they already have networks of communication, because their community is a key element in their lives and livelihoods, and because the importance of trust is already well understood, what might be challenging to implement in terms of collaborative activity might seem quite natural for the land managers in this study area. What might be more challenging is

how to integrate the voices of those who do not share their values (discussed below), or whose interests are conflicting.

5.2.4 Participants strive for a sustainable, equitable future

"All decisions are about the future" (Boulding 1973, in Bengston 2019). Bengston (2019) discusses the notion that the human brain makes imagining a future that is different from the present "repugnant". In addition, he explains that our conceptions of the future tend to be based on the past and present, as well as influential projections such as those outlined by Meadows and Randers(2013) in *Limits to Growth*(what Bengston calls legacy futures). These tendencies can create static, flawed and counterproductive conceptions of the future.

South Africa is one of the most unequal countries in the world (International Monetary Fund, 2020). Language, financial status, education, race, culture, religion, nationality, gender and other factors contributing to inequity and inequality continue to undermine efforts for community collaboration. Although literature admits that bringing diverse stakeholders together for environmental governance can be difficult, and that conflict in this context is common (Baird *et al.*, 2019), there is also convincing evidence that community cohesiveness and trust can be built, even in very difficult circumstances (Chavez-Miguel, G., Bonatti, Ácevedo-Osorio *et al.* 2022, Özkaynak *et al.* 2023), which can have positive outcomes for resilience (Ludin, Rohaizat and Arbon, 2018).

Özkaynak *et al.* (2023) suggest that values assessment approaches can help build bridges of understanding between people, even when they have historically been at odds, and IPBES (2022) highlight that conflicting worldviews and values should not be ignored or minimised. Co-operative approaches to governance should continually build shared vision and trust, and consider power relations (Biggs, Clifford-Holmes, Freitag *et al.*, 2017). This should be borne in mind when any community building process is undertaken, given South Africa's extremely divided history and ongoing inequality.

While some biosphere reserves are viewed with suspicion by land owners due to perceptions of conflicting values or interests (Zscheischler, Busse & Heitepriem, 2019), the GCBR, through its extension officer, has entrée to this landscape, as evidenced by the trust shown to her and the researcher during the study. The GCBR therefore has an opportunity to explore acting as a convenor organisation to facilitate or catalyse further discussions and/or action groups to take the collaborative planning called for in the workshop forward.

During the interviews, participants were primarily discussing their personal futures and the futures they hope for regarding the land that they personally own and/or manage. The workshop, since it was a group process, articulated more combined outcomes. The interviews highlighted productivity, free

time, environmental stewardship, new income sources, social development, landscape connections (ecological corridors), water availability, Permaculture, regenerative agriculture and planning as important in the present and the future (see table 14 and 16) as well as a number of polycentric governance institutions (see table 14, 15 and 16). The workshop added stable government policy and ethical landscape governance to this list, as well as income, community support, health, knowledge about land management, markets for produce and biodiversity.

In the interviews, the participants mentioned the desire to reduce environmental degradation in the future, as well as costs, hassles, plant species unpalatable to domestic stock, drought, predators, and land price increases (see table 15). These issues were considered to be relevant in the workshop, but the group identified electricity from Eskom, current management of water supplies and patterns of use, SAPS effectiveness in singlehandedly managing crime, financial systems and institutions, social ills, lack of vaccines and unmanageable laws as the elements of the present that are most in need of change.

Knowledge and learning were considered important for positive futures in the interviews and the workshop, as were the community, water, sustainability, tourism and better aligned and co-ordinated laws. The interviews highlighted growth as desirable, which was less of a priority in the workshop.

Some of these elements are potentially contradictory. For example, to prioritise growth might impact biodiversity, water supply and use, and cause environmental degradation if it involves ploughing new lands in marginal areas or pristine habitats, monoculture, inappropriate irrigation and increasing the use of pesticides. However, if growth involves intercropping, drip irrigation (where appropriate), appropriate use of organic fertiliser, integrated pest management, and using crop residues as mulch, growth could improve some of the ecosystem services in the region and contribute to biodiversity conservation. Reducing plant species unpalatable to domestic stock (which most participants articulated as Renosterveld, an endangered Fynbos subtype) could prove more of a problem for biodiversity, should participants choose to clear the areas of this vegetation that remain on their land. However, if biodiversity offsets, or some other arrangement of alternate use/value can be found, these areas could represent a way for participants to attract tourism and improve their relationships with nature, as they wish to (see figure 15 of workshop). Appropriate fora for discussion of these and other compromises and trade-offs is important if the land managers in this region are to realise their hopes for a sustainable future (Morrison, Bodin, Cumming *et al.*, 2022).

5.3 Conclusion

In the highly biodiverse Albertinia-Herbertsdale region of the GCBR where land has already been extensively transformed, land managers play an important and ongoing part in environmental stewardship. This study helps to understand their decision making and, it is hoped, to build trust in efforts to develop biosphere stewardship in the GCBR region. This study aimed to investigate the broader question of: "What influences land management decision making in the Albertinia - Herbertsdale area of the Gouritz Cluster Biosphere Reserve?", and set out to explore participants' motivation, perceived risk, adaptation strategies, learning pathways and decision making criteria for land management into the future in a changing Albertinia-Herbertsdale area.

This study aligns with the findings of a number of large international studies, which find that land management is closely tied to land managers' values, and that land use decision making is influenced by a variety of internal and external factors (Pascual, *et al.* 2023, IPBES 2022, Jaureguiberry, Titeux, Wiemers *et al.* 2022, Malek *et al.* 2019). More specifically, the study found that the motivation for managing land is tied to that participants' values, and that future generations, personal fulfilment, independence, peace and sustainable food production are important aspects of their land management. Their objectives are primarily to improve the productive capacity of their land while also building better landscape scale governance and a better relationship with nature. This study found that the participants are (independently) making a number of land use decisions which cumulatively improve nature's contributions to people, and build towards the Sustainable Development Goals (McEwlee, Calvin, Campbell *et al.*, 2020).

Literature has shown that biosphere reserves are important and useful fora to connect research and praxis, and that biosphere reserves can build collaboration and facilitate trust-building between stewardship role players (Barraclough, Reed, Coetzer *et al.* 2023, Barraclough, Schultz & Maren 2021, Hedden-Dunkhorst & Schmitt 2020). The GCBR is well positioned to adaptively support existing and future environmental stewardship in the Reserve area, and using stakeholder values to inform their approach will increase the effectiveness of their efforts. Although there are some differences in worldviews among participants, the study found that all the participants want to improve management of natural resources while sustaining or improving their production (on commercial land) and sustaining biodiversity. To achieve this, collaboration, hard work and better landscape scale governance emerged as key priorities.

The participants value learning, which is often relational. The participants expressed a desire for more local research and praxis. This appetite could help facilitate a range of future research activity in the study area. The GCBR provides a potential entry point to connect land managers and researchers, such

as this study, as well as being a long-term learning hub. Learning from the GCBR can contribute to other biosphere reserves, and beyond, as well as providing decision support to land managers in the GCBR region. The GCBR extension officer is a very important resource to help facilitate and contextualise research in the region. As a result of the workshop, there is an opportunity for actors such as the GCBR to facilitate collaborative activity and provide a space for land managers to meet, co-operate and learn together to build the sustainable future that they want.

The participants are aware of a variety of social-ecological risks, and use combinations of mitigation strategies, usually to manage several risks per strategy. These strategies tend to be hands-on and practical, as well as self-regulated due to the collapse or perceived inadequacy of government institutions. In terms of managing ecosystem services for resilience, this study found there is connectivity between actors, some maintenance of diversity and redundancy, and that participation is ongoing. Learning (from experts, experimentation, experience and through social learning) is used by all the participants and recognized as important to ensure a sustainable future. Learning - from experts, experimentation, experience, and through social learning, is a key element of land management decision making for the participants. Some slow feedbacks, such as the impacts of changes of law and groundwater supply, are recognised.

No studies of this nature have previously been conducted in the study area. Although this study set out to interview up to four participants from each land management activity type, the sample was initially limited to GCBR members, and despite snowball sampling only twenty participants were available for interviews during the time allocated. A larger sample size might introduce a wider variety of data. The results of this study are contextual to the participants' community and landscape, and would not be generalisable without careful consideration of the context. The data was also limited to what the participants elected to share, and thus might not constitute a complete reflection of their opinion and experience.

This study has provided contextual information about the land managers in the previously unstudied Herbertsdale-Albertinia region of the Gouritz Cluster Biosphere Reserve. It confirms what other scholars have found regarding the links between value systems and land use changes. This study shows the generally anthropocentric worldviews of the participants, and their awareness of the links between learning and success in their land management efforts. The study highlighted their independent, hard working approach to land management, and their shared values of justice, freedom, prosperity, health and responsibility. This study also uncovered that the participants wish to build a better relationship with nature, and are changing their land management practices in response to ecological and economic changes, as well as in response to their learning. The importance to the participants of future generations of land managers, and that future generations are considered in

decision making has also been shown. This study also illuminates the links between land managers in the study area and other complex systems of finance, trade, geopolitics and ecology at local and global scales.

The grounded theory approach allowed the researcher to develop the research process in a way that encouraged participation, even in the workshop which had previously thought might not be possible. The reflexive approach to this study led to a strong connection between the researcher and the community she was working in, resulting in rich data and helping to build trust between the researcher and participants as well and between the participants and the GCBR, and between themselves. The approach also set the tone for future respectful research engagement with this community.

In summary, this study found that land management decision makers in the GCBR inhabit a complex system, the nature of which influences their decisions. They use learning to adapt to change, are aware of and actively managing a variety of social-ecological risks. They hope for a future of better governance and improved management of natural resources, and are prepared to work hard together to achieve it.

Chapter 6: Practical recommendations

The funding for this study was provided by the GCBR, and the findings will inform change and support further stakeholder engagement in the GCBR region. The results of this study inform a number of practical recommendations for future research and praxis within the GCBR area. These recommendations were mainly intended be channelled through the GCBR to the relevant agents, for example extension officers, project co-ordinators and other actors. Wider use outside the GCBR may be considered in a context sensitive and appropriate way. Although the goals of this study did not explicitly include making recommendations, there were several requests to do so. These practical recommendations are made bearing in mind the limitations of this study, and should be implemented with the same adaptive and learning approach emphasized throughout this study.

Facilitation or support of communication and learning nodes. The study participants identified the school, the church, the Farmers' Association, the Fire Protection Association and the SPCA as some of the institutions that are important for their future. Shared civic activity has the potential to build community cohesion (Madsen and O'Mullan, 2014), and any of these or a combination could serve as pivots for improving community relationships. The GCBR is potentially in a position to facilitate engagement for sustainability, provided it can find ways to collaborate with or support existing civic activities, and/or develop a node for new activity such as a land management community of practice. Attention should be given to the potential for such a node or nodes to deliberately build equity.

Explore the largely understudied link between faith, spirituality, value systems and land management presents a potential space to explore transformative change from a different perspective, which could be a direction for further trans-disciplinary research.

Usage of other potentially appropriate research methodology. Future research might also include Cultural-Historical Activity Theory (CHAT) interpretation of either the researcher's data with permission from the participants, or of future surveys and processes. CHAT approaches human activity with the assumption that context, consciousness and activity are the same (Nickerson, 2023). This means that the actions people choose (or their decisions) reflect their understanding of the world, and that people can develop a deeper understanding of the world through their activity. This can apply to culture as well as work, and can form a pathway to transformative change (Nickerson, 2023).

Establish or support/participate in a community of practice. The alignment of participants' land management activities with the findings of McEwlee, Calvin, Campbell *et al.* (2020) suggests that the participants are highly aware of their social ecological system and are already taking steps towards better sustainability outcomes. Taken together with the participants' appetite for learning, knowledge and information sharing, a community of practice around sustainable land management could be

helpful in leveraging the future that participants want. Collaboration and learning are two pillars of governance that are central to adaptive co-management (Plummer *et al.*, 2020) which is one way of embracing complexity in land management and enhancing biosphere stewardship. The inter-relationships of trust with perceived success, and of these with power and influence, are another area for potential further research.

Further develop an interest in the role of knowledge systems. This will be essential going forward due to the inequities of formal education and knowledge in society, and should incorporate formal, experiential and indigenous knowledge. It is also important to take into account and sensitively attempt to align or address disparate values. The study did not delve more deeply into over-arching knowledge systems. These systems should be taken into account however (Pascual *et al.*, 2023), and could be a direction for further research. The starting point for this recommendation rests at executive or upper management level, who may follow a consultancy or partly academic route.

Continue and strengthen the role of the GCBR as an interdisciplinary research hub which builds long term research infrastructure and trust. Long term research infrastructure (including trust) is important for sustainability (Barraclough, Reed, Coetzer *et al.*, 2023). The GCBR forms an interdisciplinary research hub and as such should continue to actively seek to co-ordinate and promote learning within its domain. This study design was exploratory, and the researcher and co-researcher consulted extensively throughout the process to fine-tune the approach in order to respectfully engage the participants. This contributed to the responsiveness from the participants and should be borne in mind for future studies.

Develop strategies to navigate the well recognised tensions around water. Although existing activities have a soft focus on water, this can be developed into a more robust discussion. Water supply and use was a recurring theme. Several participants referred to the fluctuations in water supply as central to decision making in general, and that specifically rainfall has a direct link with all aspects of their land management. In the context of climate uncertainty, water will likely continue to be central to land management decision making. The participants all spoke of the need for more integrated and practical research on a variety of land management related topics. They also already have a considerable store of theoretical and non-academic knowledge. Knowledge co-production strategies have been used to mitigate disaster risks such as drought (Grainger, Murphy & Vicente-Serrano, 2021), and could be one way to for the GCBR to approach praxis to build resilience around water and other important ecosystem services. While the GCBRs existing strategy is understandable, there is sufficient goodwill to deepen engagement around water use.

Develop easy to share digital information content. There are other existing nodes that may be leveraged to build community and promote sustainable land management, such as the WhatsApp communication groups. The GCBR could produce material that is easy to share in these groups. Using these groups helps to build trust and create inclusion, and facilitates mutual assistance with transport, water, equipment, escaped animals, and other communal tasks or events. The groups are, however, dependent on cellular reception, which is not available to all land users due to the position of cellular towers. Many people have balanced this by installing Wi-Fi routers in their homes, but this still leaves large areas of land with no cellular communication cover. It also potentially excludes people who do not have smartphones, or who cannot afford data.

Digital media platforms such as YouTube and iNaturalist offer both a way to deliver practical research and information to land managers, and to co-produce it with them (Barraclough, Schultz, Coetzer, *et al.*, 2023). The participants all already use some form of digital communication, and with appropriate design and co-ordination they could make significant contributions to learning and landscape monitoring during their daily activities. The GCBR could facilitate the development and co-ordination of this type of engagement.

Widen the scope of co-operation with other land management agencies such as AgriWeskaap. This study did not specifically investigate the effectiveness or otherwise of the many institutions related to land management. Institutions play an important role in polycentric governance (Chu, Lam & Williams, 2023), and the study reflects some of the areas where rural institutions are both effective and lacking. Collaboration was highlighted as a pathway to the participants' desired future. In order for collaborative governance to be strengthened and sustainable outcomes achieved, attention to the way that land management actors and institutions relate and how these links can be developed should be a focus area for future research.

Hold more workshops. The futures thinking workshop in this study resulted from asking the interview participants whether they wanted to participate in a group process about potential futures. Although only half of the interview participants attended the workshop, several who were absent expressed the desire to do so but were not able to because of demands on their time relating to land management (spraying trees or vetting animals, for example). There were also requests from the study participants to include participants in the workshop who had not been part of the interview process, and these prospective participants could not be included because of the provisions of the ethical permission granted for the study. If desired, a further process could be held in future for more people. This could be designed to include a wider variety of land managers and other stakeholders, and/or could involve more incisive scenario planning. Such a process could be action oriented for individuals or for collective action or both.

Engage with sustainable finance and trade agencies. Markets for their produce were an element of the current reality that study participants felt would continue to be important in the future. Sustainable finance and trade systems that contribute to equitable global food security are in line with the future participants wish for, as well as being important for biodiversity outcomes (McEwlee, Calvin, Campbell *et al.*, 2020). This requires more research (which could be collaborative with the study participants) into, *inter alia*, the circular and solidarity economies and other novel economic systems (Barraclough, Reed, Coetzer *et al.*, 2023). This could be a focus area for development in the GCBR, through its linkages with the global network of UNESCO biosphere reserves.

Recognise the value of lifestyle elements of the GCBR landscape. The importance of the lifestyle elements of participants' motivation should not be ignored. These include, peace, mutual aid, neighbourliness, personal health and community support, as well as their sense of place and belonging. Sustaining the participants' ability to live and work in the rural landscape presents opportunities to trial adventurous and experimental concepts including eco-welfare, eco-social peace and regenerative development (Barraclough, Reed, Coetzer *et al.*, 2023). These also potentially provide tourism opportunities in line with future aspirations expressed by the study participants.

Systematically include young people. Young people are at risk of being excluded from environmental stewardship activities, although they are key to a sustainable future (Barraclough, Schultz, & Maren, 2021). This study did not include anyone (empirically) below the age of 30. Actively engaging young people in the aforementioned activities should be a consistent focus for all land management actors in the GCBR. It is important to note that their participation should not be a mere formality, but given weight and acted upon.

Include gender in future research. This study did not consider differences between participants of different genders, and this is an important consideration.

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Appendices

Appendix 1



RHODES UNIVERSITY
Where leaders learn

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14 October 2022

ryana.johnson

Email: g225842@campus.ru.ac.za ryana.j@newleafnetwork.co.za

Review Reference: 2022-5908-7183

Dear ryana.johnson

Title: Potential futures of farming systems in the Albertina - Herbertsdale area of the Gouitz Cluster Biosphere Reserve

Researcher: ryana.johnson

Supervisor(s): Ms Ryana Johnson,

This letter confirms that the above research proposal has been reviewed and **APPROVED** by the Rhodes University Human Research Ethics Committee (RU-HREC). Your Approval number is 2022-5908-7183

Approval has been granted for 1 year. An annual progress report will be required in order to renew approval for an additional period. You will receive an email notifying you when the annual report is due.

Please ensure that the ethical standards committee is notified should any substantive change(s) be made, for whatever reason, during the research process. This includes changes in investigators. Please also ensure that a brief report is submitted to the ethics committee on the completion of the research. The purpose of this report is to indicate whether the research was conducted successfully, if any aspects could not be completed, or if any problems arose that the ethical standards committee should be aware of. If a thesis or dissertation arising from this research is submitted to the library's electronic theses and dissertations (ETD) repository, please notify the committee of the date of submission and/or any reference or cataloguing number allocated.

Sincerely,

Dr Janet Hayward

Chair: Rhodes University Human Research Ethics Committee, RU-HREC

cc: Ethics Coordinator

Appendix 2



RHODES UNIVERSITY
Where leaders learn

Rhodes University Human Research Ethics Committee

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7 July 2023

ryana.johnson

Email: g22j5842@campus.ru.ac.za ryanaj@newleafnetwork.co.za

Review Reference: 2023-6999-7773

Dear ryana.johnson

Title: Potential futures of agricultural systems in the Albertinia-Herbertsdale ares of the Gouritz Cluster Biosphere Reserve - workshop

Researcher: ryana.johnson

Supervisor(s): Dr Sheunesu Rawanza,

This letter confirms that the above research proposal has been reviewed and **APPROVED** by the Rhodes University Human Research Ethics Committee (RU-HREC). Your Approval number is: 2023-6999-7773

Approval has been granted for 1 year. An annual progress report will be required in order to renew approval for an additional period. You will receive an email notifying you when the annual report is due.

Please ensure that the ethical standards committee is notified should any substantive change(s) be made, for whatever reason, during the research process. This includes changes in investigators. Please also ensure that a brief report is submitted to the ethics committee on the completion of the research. The purpose of this report is to indicate whether the research was conducted successfully, if any aspects could not be completed, or if any problems arose that the ethical standards committee should be aware of. If a thesis or dissertation arising from this research is submitted to the library's electronic theses and dissertations (ETD) repository, please notify the committee of the date of submission and/or any reference or cataloguing number allocated.

Sincerely,

Mrs Joyce Sewry

Acting Chair: Rhodes University Human Research Ethics Committee, RU-HREC

cc: Ethics Coordinator

Appendix 3

Interview questions

My name is Ryana Johnson. As I mentioned in my introductory email/telephone call, I am conducting a study about potential futures of farming systems in the Albertinia-Herbertsdale area of the Gouritz Cluster Biosphere Reserve. This study aims to uncover knowledge held by farmers in this area about land management, and to explore possible sustainable future options for farming in this region. This is very important for the future of the entire region. Thank you for agreeing to participate in the study.

This interview will consist of 81 questions and will take approximately 2 hours to complete. At this point I would like to confirm that you are comfortable with me using a voice recorder? The recording makes the interview slightly faster and allows me to make sure I don't miss anything when I write down the interviews. I will delete the voice recordings as soon as I have completed the writing up. Do you have any questions about the ethics form? (At this stage I will collect the signed form if I have not already received it by email). Do you have any other questions before we start? Please feel free to ask me any questions that occur to you at any time during the interview, and remember you do not have to answer any questions if you prefer not to.

Introductory questions

1. What is your name?
2. What would you prefer me to call you?
3. How would you prefer me to contact you? Email, phone, whatsapp, or some other way?
4. Can you tell me about the history of this farm? (Prompt - for example: did the farm belong to your family/land claim/bought it/ subdivided it, or other arrangement?)
5. What farming operations were carried out here before?
6. Do you farm here commercially?
7. What do you farm here?
8. How did you get into farming?
9. How long have you been a farmer?
10. Why are you a farmer now?
11. Do you want to keep farming into the future?

12. What meaning does farming have to you?
13. What training do you have as a farmer? This could be any formal or informal training that has prepared you for this work.
14. How long have you been farming in this region?
15. How long have you been farming on this farm?
16. Do you own this farm?
17. Do you own any other farms?
18. If yes, where is the other farm/are the other farms?
19. What do you farm there?
20. If they don't own the farm: What is your arrangement with the owner of this farm? (Leasing, managing, or other arrangement.)
21. Do you have this arrangement on any other farms?
22. Where is it/are they?
23. What do you farm on that farm/those farms?

Thank you for your answers so far. Would you like to take a break? May we continue?

Change

24. How have your farming practices changed since you started farming here?
25. Why have they changed in this way?
26. Have there been any changes in the environment during that time?
27. What are those changes?
28. Are ecosystem services on your farm improving or deteriorating? Ecosystem services are services provided by the natural environment for example water provision, pollination, parasite control, soil protection, or other measures.
29. Why do you think this is happening?
30. What is being done to achieve/stop this?
31. Are you using any sustainable land management practices? (Depending on their produce this could include drip irrigation, rotational or intercropping, no till or low till practices, organic fertiliser, natural pest control, or other practices).
32. If so, which ones?
33. Why those?
34. If not, why?
35. What proportion of your farm is under this management system?

- 54. What could a positive future look like for your farm?
- 55. What could a positive future look like for this area (beyond your farm)?

Thank you for your answers so far. Would you like to take a break? May we continue?

Environmental indicators and feedbacks

- 56. What do you monitor on your farm? (E.g. Rainfall, fuel prices, soil quality, yields)
- 57. Why do you monitor this?
- 58. How do you monitor this? (E.g. do you use measurements?)
- 59. Of these indicators that you monitor, please will you rank them according to how important they are to your decision making? Please rank each risk from 1 to 5, where 1 is the least important and 5 is of most important.

What	Why	How	Importance ranked out of 5
------	-----	-----	-------------------------------

Decision Making

- 60. What are the main decisions that you have to make in your day-to-day operations?
- 61. How do you make those decisions?
- 62. What barriers do you experience when making decisions? Barriers are anything that makes it more difficult for you to make a decision.
- 63. What information is important for your decision making about your farming activities?
- 64. What information that you don't currently have would be useful to you for decision making?
- 65. In making your decisions, where do you get most of your information from?
- 66. What are your sources of inspiration for decisions?
- 67. How do you learn new skills, information and techniques in your farming?
- 68. How do you choose when to use new skills/techniques and when to use existing ones?
- 69. How do you prefer to learn new skills, information and techniques? (E.g. other farmers, at farming days, consulting government departments, watching videos, consulting experts.)

70. Why?

71. Can we talk about a specific decision you made for a minute? How did you learn about climate change (or any other risk you have identified)?

72. How did you decide what to do?

73. Who/what influenced your decisions?

Biosphere Reserve perception/awareness

74. What does the GCBR mean to you?

75. Would you like to know more about the GCBR?

76. How would you like to get this information if so?

Brief reflection

77. How do you feel about this interview?

78. Are there any other questions you think we should be asking?

79. Are there any issues we have not discussed that you feel are important about your decision making?

80. What are they if so?

Thank you for participating!

Appendix 4

Name
Changes in environment
Alien vegetation
Aliens would have increased if we didn't control them
Appearance of wattle
Better downstream river flow since aliens cleared
Less big river overflows since clearing the wattle
More aliens
Much less wattle and gum thanks to GCBRs help
We have cleared the wattle
Better systems (no till and switching away from flood irrigation)
Development
A lot of land sold off to people from Gauteng
Clearing lands in Fynbos
Development esp Jakkalsvlei
Intensified land use
More pipelines and pump irrigation to further from the river
Property development has led to increased human pressures
Less controlled burning because of liability concerns
Less electricity
More laws
Old people die and young ones get started
River
Less water availability
Less water in the river
Poor water quality (in river)
Some years are better ito water availability and others worse
Switch from bertsloot to pumping has led to everyone doing their own thing with water
Soil
Soil has more insect life since regen ag
Soil improving
Veld
Appearance of small game
More rooigras and less renosterbos in veld
Neighbour don't have spiders and we do
There are a lot of birds
Veld better managed, less overgrazed

Veld recovery is slower after grazing

Weather

Big drought

Rainfall

Less frequent, more concentrated rainfall

Less rain per rainfall event

Less rainfall

Rainfall patterns changing (possibly more summer rainfall)

The changes that water brings - more or less grazing, better or worse water quality, more or less milk production

Wind is worse

Changes in farming practices

Activities stopped

Removed sheep

Removed sheep due to stock theft

Removed vineyards to make grazing

Stopped farming vegetables because Mossel bay market closed

We don't plant cash crops

Adaptations of existing activities

As little inorganic fertiliser as possible (use own manure)

Better camp regulations to avoid erosion and overgrazing

Better management of admin

Burning veld less due to poor recovery

Changed from flood to sprinkler irrigation

Diversified pasture crop species

Emphasising animal health (dairy)

Improved record keeping for sustainability of flower species

Increased dair herd from 80 to 600

Installed spoelpunte

Leaving plant material on the land

Less reactive, more strategic

Managing wattle differently - insisting on follow ups

Moved to no-till

Planter that adds manure to sowing rows

Provide better fodder for sheep in irrigated lands and with food additives

Reduced number of sheep to increase grazing for dairy cattle

Switched from flood to pivot irrigation

Switched from flood irrigation to sprayers

Use less water

Use manure as well as inorganic fertiliser
Using better bulls
We don't burn firebreaks we cut them
New activities begun
Agroforestry
Avos and macadamias
Built house and accommodation
Built new winery
Clearing aliens
Created new ploughed lands
Piped water from the river
Planted citrus (later removed)
Planted macadamias
Planted vineyards
Switched from mixed farming to flowers
Crucial issues to support desired change
A cellular tower
Be more present and convincing in decision making with farming partner
Colaboration between private reserves to lobby for change
Education about nature through people like Halcy
Faith
Farming with nature
Finance
Money
Money available for more expensive but better techniques eg bossikapping instead of burning
Sustainable finance (not borrowing) for development
Government
Cape Nature more adaptable
Co-operation and communication between govt depts
DFFE more adaptable
Environmental law enforcement needs to happen
Govt to prevent grain dumping in SA
More toeganklikewetgewing (labour laws about dismissing staff)
The government needs a better understanding of farming
Information about farming in karoo areas
Improved trust among neighbours
Narrow the gap between laws and management
Narrow the gap between science and laws

Narrow the gap between science and management
People must look away - seeking of environmental law enforcement
People with know how
Personal strength and health
Private wildlife organisation co-ordinating efforts and advocacy
Rain
Research into better genetics, cultivars
Scientific defense for management practices, to counter the social media and emotive perspective about 'cute baby lions'
Soil
Support and knowledgeable labour to clear aliens in kloofs
Time
Training and enforcement for animal record keeping
Understanding implications of pesticide and fertiliser use
Understanding of future impacts of current practices
Current commercial operation
Aloes (natural)
Beef cattle
Canola
Dairy
Flowers
Heifers
Landowners (property model)
Leaed to neighbour fo cattle
macadamias
Non-commercial use
Oats
Pigs
Sale of wildlife (not currently operational)
Sheep
Slaughter cows
Tourism
Wheat
Wildife tourism
Wine
Decision making
2 heads are better than one
Availability of things like straw or sorghum at the time they are needed
Biodiversity impact

Costs
Decision prioritising most important elements
Decisions prioritising necessary tasks
Decisions prioritising urgent tasks
Cow sick vs pump broken, cow comes first because tomorrow it will be dead
Die natuur - environmental limitations
Do the long slow things first
Emergent problems disrupt plans
Gut feeling based on experience from past experiments
Herd improvement - bulls, culling
How to achieve and objective with the lowest negative consequences
Implications of loadshedding
Improvements to dairy
Information gathering
Interruptions
Is there enough food for the animals
Market information to predict prices and demand
Matching staff capabilities to necessary tasks
Moving from risky unstable markets and products to one more stable (dairy)
Range of tools produce range of results
Relevant laws
Soil fertility and what type of plant to plant
Staff availability and skills
Staff supervision
Strategic Adaptive Management
T4Deck tool
Tourism impact
Use consultants for new or more specialist decision making
Using legal means to achieve ends - trees not gabions, swales not dams
Water flow
Weather - wind conditions for spraying and feeding trees
Weather and its implications
What is the objective
When to market grain and where - information about markets is key for this
Where and when to move the cows
Where to irrigate
Whether, what and when to plant
Will the weather support development plans
Ecosystem services

Aliens a huge burden

ES deteriorating

No change

No change - although a small improvement in nutrient cycling because they use manure on their planted pasture

No changes - have not been here long enough to observe

Water quality good because of position high in catchments

Formal training

Agriculture

Agricultural Diploma

Agricultural school

Agriculture undergrad

Oakdale

Business management

Electrical technician

Engineering

Gibbs executive development

Grew up on the farm

International aid NGOs

Nature conservation Btech

Nursing

Permaculture course

Police officer

Psychology

Sport science

Teacher

GCBR

Appreciating nature

Branding on my wine box

Collaborating on the nursery

Communication tool

Doing good (not working the way WFW did with clearcutting and ensuing floods)

Doing wonderful work

Finding creative ways for working through key stakeholder to benefit the land

Grateful they are busy with pestenplaae

Joint venture is going to create a lot of business, we are very grateful

Making water available with biocontrol

Nobodys friend, in a good way (neutral)

Not pushing us to do anything specific and not asking us to do anything unmanageable

Protecting nature
Removing aliens
Sharing information
Something with the bees (wine bottle)
With the farmers not against the farmer
GCBR communication suggestions
Booklets
Come to the farmers association meetings
Do they have any money
Emails
Halcy must come and tell me
I read their newsletter if there is something relevant to us here
Internet
It's interesting to learn more reading the boekies
Short videos
Website
Whatsapp
Increase in the future
Animal record keeping for breeding and health purposes
Authenticity in business
Awareness of our dependence on nature
Blougras (anything to nourish sheep or cattle)
Buy more land
Community (racial) integration
Develop infrastructure to increase production
Develop tourism on the farm and in the area
Diversify pasture, reduce sorghum and increase herbs
Find someone to help manage farm
FPA more effective
Gravity fed irrigation
Higher rainfall for increased production
Increase area under their land management or influence
Install 3 more spoelpunte
Intensify fodder production (arid land cattle farmer)
Landscape connections - allowing wildlife like brown hyena to range
Learn more about veld management techniques
Make more money
More gardening
More grassland, less veld

More milk production
More natural veld spaces
Neighbours caring or land better
New sources of income from tourism and cash crops
People complaining about water must remove wattles
Permaculture courses
Planning
Plant agroforest
Plant cultivation
Regenerative agricultural practices
Relaxation
Respectful farming toward the environment
Rooigras
Sales to China
'Scientific' approach to land management
Smart tech to reduce pesticide and herbicide use
Solar electricity generation
Solar power generation
Son wants to double crop
Time spend on propagation and cultivation
Time spent in nature
Travel
Travelling
Use more organic fertiliser
water flow by reducing aliens
Water in the river
Key future institutions
AgriSA
AgriWesKaap
Collaborative security bodies
Co-op
DWS
Farmer friendly legislation
Farmers association - in absence of other governmental advocacy bodies
GBR for wattle and other things
Health good enough to remain
Milk buyer
People who want to buy sheep
Reciprocity of neighbours

Schools
Seed companies
The bank
The church - for community unity and solidarity
The government
Water
Key institutions
Advocacy and or representation
AfrioForum
AgriSA
AgriWesKaap - advocacy for farmers
GCBR
Regulators
CapeNature
Department of Agreiculture
DFFE
DWAS
Labour laws
Municipality (qualified)
SAPS
Sources of income
Business collabrators
Monthly salary from husband
Sales of product
Flower exporters
Grain marketing agent
Marketing agents
Milk buying company
Nut buyers
People who come and want to buy sheep
Seed marketers
Sources of information
Cape Flora
Hendrik's day under the tree
Research institutions
Worldwide permaculture community
Supply
Co-op
Eskom

Shops to supply my needs
SSK
Support
Bank
Farmers Association
Fire Protection Association
Mental strength
Money - able to travel, hospital, visits
NG Church
Personal health
Relationship with neighbours
Transnet
Land management change
Cleared a lot of kloofs with GCBR - increase in river flow
More scientific, less reactive
Scaling up experimental management
Learning
Delegation
Discussion with other people
Experimenting on a small scale
Fail safely
Farmers days and uitstalings
Go and see what others are doing
Hands on
Making mistakes
Reading
Magazines
Reflection
Talks
The internet
Training from experts
Would like to go on courses
Monitoring - what
Aliens
Animal behaviour to indicate predators
Animal health
Biomass yield per hectare (pasture)
Cost of electricity
Costs and cash flow

Count animals
Dairy gap audit
Diesel
Eskom use
Feesgetalle
Fencing
Fire risk
How much water is pumped into the storage tanks
I look at the animals twice a day when they kraal
I look at the wheat (disease, growth)
I move around the farm and I observe
Milk production
Plant diseases and disease vectors
Plant health and cell development
Quantities harvested and sold (flowers)
Rainfall
So many things that you do them automatically
Soil
Soil moisture
Temperature to decide where animals go
Veld condition
Water
Weather
Positive futures look like this
A boss
Community
Baas and Klaas closer together
Community rid of rotten apples
Everyone working together (farmers and staff)
Family closer together
Integrated
Neighbourliness, but not too many neighbours
Safe
Continued good security
Fewer labour laws
Husband
No Gauteng karre - people who think they know what they are doing but they know nothing
Productive

Bigger warehouse and centralised storage
Double crops
Established agroforestry
Farms are becoming fewer and larger, you won't stop that
Flourishing vegetable garden
Get to a point where we can have a bad year and still break even
If the river started here and I could irrigate everything
Mechanisation
Our wine available everywhere in SA - 2 million bottles
To grow (productivity)
Sustainability
Better relationship with nature
Continue as we are
Enough water
Knowledge
Agricultural extension
Education
Exposure to farming
Knowledge about farming
Knowledgeable staff
Learning
Research
Useful data collected
Like now but green
most effective use of available water
No wattles
Planting water
Protecting the mountain area
Rain
River flows continuously or there is a dam for year round water
To survive (continuity)
Water redistribution like the Orange-Fish
Tourism
Tourism in the area taking off
Previous land uses
Cattle
Ostriches
Vegetables
Wheat

Reaction to questionnaire
A bit long
All good, no problems and nothing personal
I don't know if I said what you wanted me to say
I learned a lot
I think you knew these things before you asked
Interesting
Its good if itsdone for the right reasons (not coming to take over on our farm)
It's good that people are interested in our situation
Made me think
Makes me feel optimistic and ehtusiastic
Not so bad
Questions are too broad
Very pleasant
We must be doin something right if someone is interested
Reasons for becoming 'farmer'
Always wanted to
Came to retire
Father didn't want to sell farm
Grew up on farm
I liked the business
It was always the plan
Near enough to big town
Older brother did not want to farm and I did
Only sibling who wanted to
Privacy
Support aging mother
Wanted to get away from the city
Was always the plan, then had second thoughts, then manager resigned and timing was forcd
Reasons for being a farmer
Acceptance and resignation to the chosen path
Animals don't mind if you come home late
Be my own boss
Building something up for family and next generation
Clearing bush, irrigating, planting, see something grow
Community of like minded people
Doens'thave to work with 'mooilike' people
Feeling of ownership

Guilt free farm where everyone is happy including animals

I love it

I have bills to pay

I like working with the animals

Its a job

It's a lifestyle as well as a living

Love for plants he is gowing

Made a commitment

Make more money than in business

Peace

Perceives less politics around retirement on the farm

Raising children on farm is 'lekker'

Rewarding to reap what you sow

Satisfaction of building something myself

Seeing the animals grow

Sense of satisfaction when plants are growing

To prove that I can

To raise (provide for) my children

Triumph over doubt

What I always wanted to do

Within constraints he is independent

Wonderful for the soul

You can create a product

You get to an age when you can't do anything else

Reasons for ES change

Alien removal - doesn't increase rain but makes rainfall more available

Increasing soil carbon due to reduced carbon

More cows and increased runoff from dairies polluting rivers

Pesticides

The municipalities (mismanagement implied)

The rivers run less

Reasons for land use change

Changes in exchange rates

Development in agriculture and technology available

Increasing cost of fuel

Labour risks and costs

More money available

More to lose

No till is cheaper and better for the soil

Scaling production up to farm's capacity without having to buy fodder in
Shortage of fuel
Reduce in the future
Alien plants
Babysitting staff
Burning veld, increase bossiekapping to provide grazing
Cash crops
Chemicals (e.g. for controlling grass in wheatlands)
Drought
Emails
Erosion due to roads
Eskom power
Extractive development
Fertiliser usage
Fuel use
Interest rates
Labour hassles
Less involved with restaurant
Non-farmers buying land and not farming it, pushing land prices up
Overuse of water
Predators
Renosterveld
Responsibility (hand over to son)
Stuff that costs money
Things that cattle and sheep can't eat
Thorn trees
Time spent on admin
Traffic
Unwanted bossies
Wattles
Risk
Alien plants
Animal disease
Baboons
Bevolgingsaanpas
Bigger farmers influence
Cost effectiveness
COVic
Crop sprays

Dairy disruption due to loadshedding
Disruptions in tourism e.g. Kruger killing, COVid
Drought
Environmental laws
Erosion
Exchange rates - when the rand weakens inflation rises
Family drama
Fire
New Code
Fire - liability and neighbours
Fire (arson)
Flooding
Government
Human wildlife conflict
Increasing cost of bottling
Increasing cost of fertiliser
Increasing cost of fuel
Insetkoste rising
Increasing Eskom costs
Increasing labour costs
Increasing seed costs
Increasing wages
Increasing feed costs
Inflation
International travel restrictions
Kikuyu - fynbos area
Labour - poor quality, unreliability
Labour laws
MArket forces and unpredictability
NOT a risk - personal or contact crime
Overextraction of water
Political stability (to attract tourists)
Politics
Predators including domestic dogs
Pricing product correctly
Product thought to cause cancer in EU
Production disruptions
Rising interest rates
Scale - unsustainably changing to increase profits

Scaling up and development of farming operations surrounding prtected area
Socio-economic disruptions to tourism
Taxes
Tensions between what the land needs and what is good for neighbourly relations
Theft
Time taken by managing staff
Unwanted plants (as distinct from aliens)
Water laws
Water supply
Weather conditions are all or nothing (grain)
WInd
Sources of information
Books
COnsultants
Dairy mail newsletter
Die Graanboer Newsletter
Experts in the field
Facebook groups with similar interests
Farmers days
Fertilisation - not sure of the source if this information
GCBR
Google
Google scholar
Grain farmers about (information about) the wheat
I ask the guy who sells the stuff
I read (what) to learn about the (farm) murders because they are not on TV
Industry wide networks
Landbouweekblad (too expensive at R40)
Magazines
My daughter
Neighbours
Other macadamia farmers
Other people
Oupa's book
People who are successful, communicative and who have a positive attitude
People with more experience who have tested things
Personal experience
Plant diseases
Product advisory services

Product reps
Radio
Science
Sean Barkly about vet medicines
Seed pamphlet at the Co-Op
Someone I trust
The internet
YouTube videos about technology
Strategies to deal with risk
Avoid burning
Avoid law enforcement where possible, or when unavoidable moetons maar optree
Avoid overgrazing rooigras to enable seed setting
Bakkie sakkie and water containers
Belonging to fire protection association
Buy fuel before price increases
Change land use according to resources available or change use of resources
Collaboration with 'anyone'
Collaborative strategies with flower importers
Community collaboration and engagement
Contour ploughing to reduce flood risk
Control electricity costs - use ruraflex times when tariffs are low as much as possible
Control of wildlife with more fencing
controlled burning
Controlling costs on poor return on investment, but not on irrigation (better ROI)
Co-operating with neighbours
Count stock
Diversifying products
Drill borehole
Efficient tractor use
Electric fencing for baboons
Firebreaks
Focus on different export destination
Generate bigger income and hire more people
Investigating solar irrigation pumps
Investing in local communities
Keeping people busy to get the maximum from their time
'Knuip' - reduce resource use in drought or scarcity
Kraaling animals at night
Legal arrangements with family

Lock everything
Monitoring the wind direction when there is a bushfire
More scientific approach to alien management
Move animals around to avoid overgrazing
New Code
Participate in petitions against poor policy e.g. foot and mouth shutdown
Reduce animal numbers per camp to reduce need for movement and cost of vaccinations
Retraining staff
Scale - farming within the capacity of the land to provide fodder
Scale - go big (don't have the means)
Soil protection from floods
Spray trees to control pests
Stay within the law as much as you can
Strict control of animals with fortified fences
Switch from international tourism to local tourism
Switch to solar electricity with assistance from Nestle
Use as few staff as possible
Use one processing machine instead of driving twice with the tractor
Using whatsapp communication groups
Vaccinating against disease
Support expected
Support not expected
Support needed
Cheaper electricity
Community functions, farmers meeting and social events, dances.
Donor funding or co-funding
Fertiliser subsidy
Government to support local rather than cheap BRICS dumping
Knowledge about locally appropriate methods (DAF)
Less loadshedding
Rebates
Reduction of taxes
Scrap environmental affairs
Testing of products, seeds, on farms in real conditions

Appendix 5

Initial coding categories used for first round of data coding (in order as they occur in the interview questionnaire)	
1. Previous land uses of the property/properties owned or managed by the participant	15. Increase in the future (aspects of life and land management)
2. Current commercial operation on the property/properties owned or managed by the participant	16. Reduce in the future (aspects of life and land management)
3. Reasons for becoming farmer or land owner/manager	17. Crucial issues to support desired changes
4. Reasons for being a farmer or land owner/manager now. What meaning does land management have for them?	18. Support needed to make these changes
5. Training for land management and other professional backgrounds	19. Support expected
6. Land ownership/other arrangements	20. Key institutions (for current land management)
7. Changes in farming practices	21. Key future institutions
8. Reasons for land use change	22. What does a positive future look like for themselves and their land?
9. Changes in environment observed by participant	23. Monitoring - what do they monitor and how?
10. Perceived reasons for environmental change	24. How do they make land management decisions?
11. Ecosystem services participant is aware of	25. Sources of information for decision making
12. Use of sustainable land management practices	26. How do they prefer to learn?
13. Perceived risks	27. What does the GCBR mean to them?
14. Strategies to deal with risks identified	28. GCBR communication suggestions
	29. Reaction to interview



Potential futures of agricultural systems in the Herbertsdale-Albertinia area of the GCBR

Summary for study participants

August 2023

Ryana Johnson

MSc student, Department of Environmental Science, Rhodes University

Co-researcher Halcyone Muller

Supervised by Professor Alta de Vos

Background

This study set out to investigate how land owners and land managers are working towards the future in the GCBR's Corridors Project area. This seemed important because in the context of climate change and increasing uncertainty, how people see the future and what they are doing to prepare for it is a way to understand how resilient or vulnerable they are and will be if exposed to increasing climate and other shocks, and what support they may need. For the GCBR, understanding land owners' values and priorities can help with aligning goals, and building a shared understanding of environmental stewardship.

In addition, although research has traditionally been conducted by academics, there is a growing understanding that people who are living and working in a given system or environment are holders of very important and often unique knowledge. Engaging with and linking their knowledge with more traditional research methods is essential for sustainability.

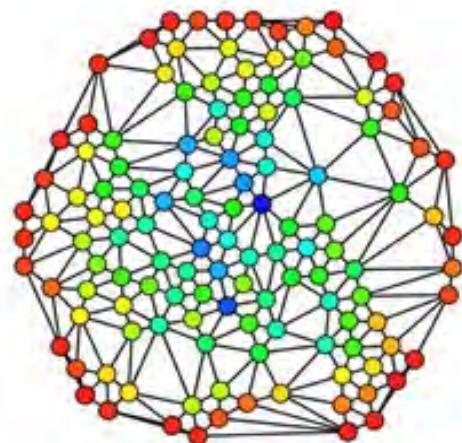
"We've got to get it (land management) right, not for us but because we are stewards. (We) will die but the land will still be there and I want to be judged kindly by people in a hundred years that we did the best we could".

Approach

We used the Social-Ecological systems approach for this study, which is based on the idea that humans and nature are not separate. "Social-Ecological systems are **complex adaptive systems** co-constituted by **intertwined** social and ecological agents and processes" (Biggs et al. 2021, in Press). If you approach humans and nature as intertwined, thinking about how each influences the other can be quite overwhelming. In order to make sense of how things are connected and interdependent, we used the complex adaptive systems worldview.



Intertwined



Complex Adaptive Systems

Study design

This study combined one-on-one interviews (to explore decision making, risk, learning, values, positive futures and land use history) with a workshop where the data from the interviews is shared with the participants, and the participants work through a futures thinking exercise.

19 participants shared their knowledge in one-on-one interviews. In total, the participants spent more than forty hours talking to the research team. Some participants are commercial farmers, some are small scale farmers and some are using their land for other purposes. All the participants were very responsive, although some of the questions were not easy to answer.

"You are asking things (about decision making) that are second nature, you do things you don't even know you are thinking about them..... But a lot of the things you are asking about are not conscious decisions".

The interviews were recorded and transcribed into text, then the text was analysed for themes. The 19 interviews generated more than seven hundred data points (codes). These were organised into 28 initial themes. Later, these themes were combined in different ways to cross-check data.

Themes from the interviews

Commitment

Participants are strongly committed to their land and their livelihoods, despite some significant challenges. These include climate and other system disruptions (such as load-shedding, wars and COVID 19) , inconsistent or absent law enforcement and economic pressure.

"I often wonder whether we are in the right place, because things are tough here. But people are coming here from other places. But we live in a beautiful place and it's not too far from the town. But it's difficult farming here, stuck in between the koppies. When my father farmed here there were many more farmers, but things have changed and now small farmers can't make a living".

"People must eat, there will always be demand for food. There will always be a place for farmers because two weeks ago the 8 billionth child was born. The only continent in

the world which has positive growth is Africa. Africa is 4.1 children per family and the rest of the world is under 2 and Africa will need the food".

"I will never retire. Because we built it up ourselves it's very rewarding to reap what you sow. We are only starting now, we know what to do and when and how to do it".

"You must be an economist and a vet and a business person and fit and determined to be a farmer. And in the bad years - when 70 percent of farmers are going further into debt - you must be steady in those times. You must stay in it for the future".

'Ek gaannouboer to ek in my moergeboer het".

Laws

Inconsistent, conflicting and unwieldy laws, and patchy law enforcement were a common theme.

"I understand that they (the Department of Environmental Affairs) don't want you to destroy the land, but they must realise you love your land more than they do, so you aren't going to do something stupid to damage your land".

"They pressure you on all sides. One guy says you must have a fire break this wide, and then someone else comes and says you must have one, but not here. So now what do you do?"

"You try to stay within the laws that involve you, tax and labour laws and things. Other than that - successful farmers will say you can't focus too much on those disruptive things, you must focus on your job and you will be the last one standing".

Learning

Participants have a strong preference for practical, experiential learning from their own and other people's experience, and have a taste for experiment.

"If you see what someone does and they say it's working for them, I'm not scared to change things. I might try a small area (at first), but if I see something working I feel like I can't believe I'm not doing that already. (At) the farmers days you go through peoples' farms and the rain isn't the same and soil isn't the same but you see what they do and

how they do it, and you go to the good farmers and you learn a lot and it's very helpful".

Change and adaptation

Most participants have changed their land management strategies, some several times. Deliberately making changes and adapting to externally driven change is a regular occurrence.

"We all make decisions, no one doesn't make decisions. Not making a decision is a decision. Decisions happen organically and instinctively and we make a million every day. But there is value in having a something to fall back on when there is a challenge or stress or pressure to aid making the best decision possible. So that last step of the decision is to ask did it work?we have a desired state and you have to articulate what is the desired state that you want. And then you have to look at the current state and then look at the distance between the two and what buttons and levers can you pull or push to get to your desired state. And that's theoretically where you make decisions, but then you have to keep checking how close did you get, and that's the last part of the decision, that's what is important for me about decisions, not the decision but the feedback. Course correction. To make one big decision like I said (can lead to a big failure). We want to fail often but fail safely so we don't make one big decision, we make lots of little decisions, and course correct, and find the way".

"And (no-till) it's cheaper I think because you aren't working as much. Just the diesel costs alone make it work. We now use a planter that places the seed in a row and adds kunsmis. I noticed that we used 10 litres per hectare of diesel in the old system, now we use about 5. And you keep the plant material on the land, you don't compact your land, I don't like to see people baling, you create your own drought".

Climate

Most participants mentioned the climate and weather conditions as playing a major role in their decisions both on a daily and long term basis.

"Die droogte het onsmeereffektief laat boer. In die Gouritzrivier is daar baie meervloedbesproeiing want daar is meer water. In die moeilikste omstandighede moet jy meer op pas".

Research

Almost all the participants mentioned that they would like more research conducted in their region.

Inter-generational land management

Many participants are part of inter-generational farming operations, and many intend that their land be passed on to future generations for their benefit. Several participants are currently in inter-generational land management partnerships.

Future generations

Several participants highlighted the need for engaging the interest of children and the importance of education to ensure a future for rural land management.

"We need to work with children who are interested... We need to get children onto farms to see what farming is about. They need to experience farming. People in SA need to learn how things work".

Inter-dependence with nature

Many participants explicitly mentioned their dependence on natural resources such as rain, water and soil, and the inter-relationship between benefits from nature and their happiness, the success of their activities and their over-all wellbeing.

"If it doesn't rain, if there isn't water in the river, I don't think there is going to be a future".

"There is nothing that makes me happier than rain or, for me, water. That is all I want".

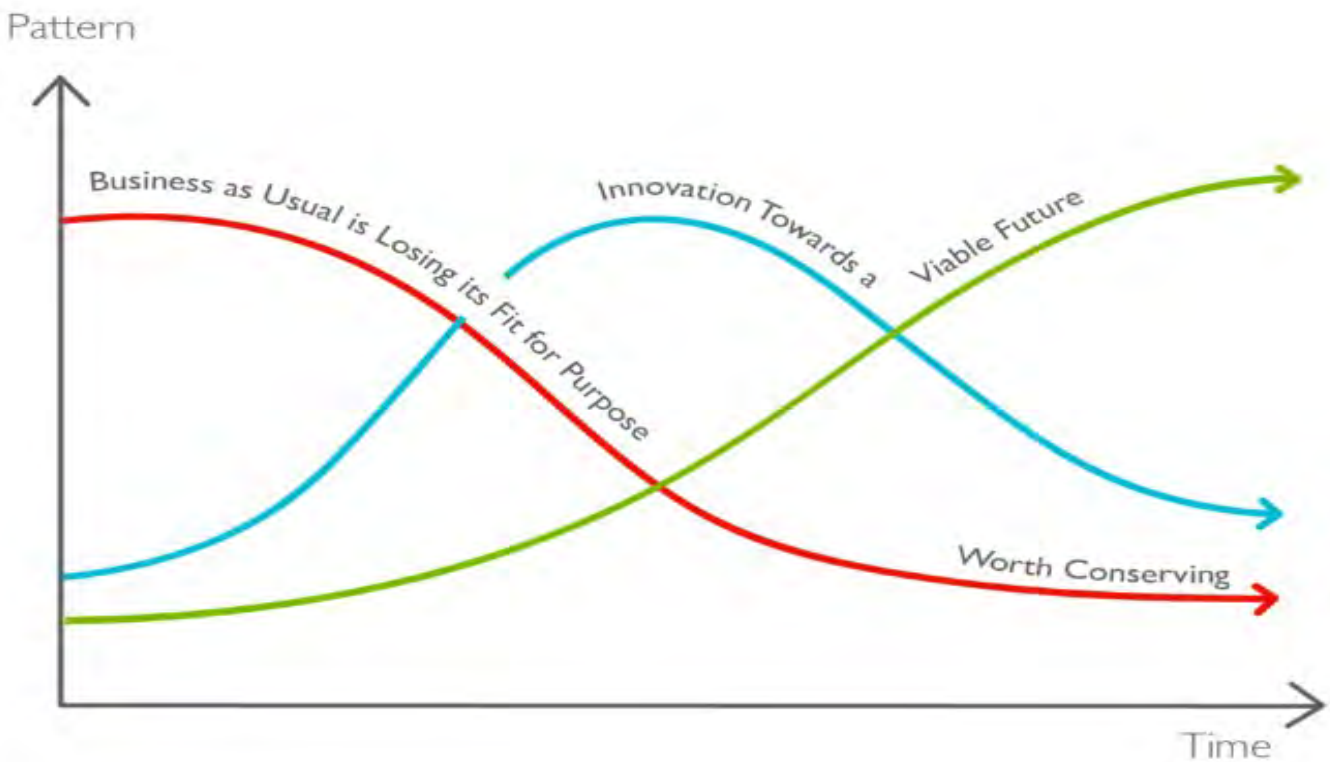
"They (GCBR) are working on the Gouritz area, they want to improve the environment. It's an enviable thing to have, it doesn't cost me money to do all these things to make

our world a better place. They protect nature. If you don't protect it, you only have it once".

"That's why we do all this (conservation agriculture), grond wat gesond is, sorgvirjou. Ons boer met grond..."

Feedback workshop 10 August 2023

The workshop allowed the research team to share the findings from the interviews, to verify the interview data and fill gaps that the participants identified. During the workshop, the participants fitted the data into a futures thinking framework called the Three Horizons framework. This allowed the participants to use the data to build a model of how they see the future, and consider possible ways to get there.



3 Horizons Framework outline

Source: H3Uni.org

The summary of this workshop will be available later in the year.

Appendix 7

PARTICIPANT INFORMED CONSENT DECLARATION

(To be signed by research participant/s)

Project Title: Potential futures of farming systems in the Albertinia-Herbertsdale area of the Gouritz Cluster Biosphere Reserve (GCBR).

Ryana Johnson from the Department of Environmental Science, Rhodes University has requested my permission to participate in the above-mentioned research project.

The nature and the purpose of the research project and of this informed consent declaration have been explained to me in a language that I understand.

I am aware that:

1. The purpose of the research project is to gather detailed information from farmers and land managers in the Albertinia-Herbertsdale areas of the GCBR as well as specialists in various fields. This will be used to explore possible futures of land management in the area.
2. Rhodes University has given ethical clearance to this research project (**number 2023-6999-7773**) and I have seen/may request to see the clearance certificate by contacting the Ethics Coordinator (ethics-committee@ru.ac.za).
3. By participating in this research project I will be contributing towards knowledge and understanding of decision making and possible futures for land management in the Albertinia-Herbertsdale area of the GCBR.
4. I will participate in the project by participating in a workshop with the researcher and a number of other workshop participants.
5. My participation is entirely voluntary and should I at any stage wish to withdraw from participating further, I may do so without any negative consequences.
6. I will not be compensated for participating in the research.
7. The following risks are associated with my participation: There is a physical risk of contracting COVID 19 during the workshop, however to mitigate the risk the researcher and any accompanying translators will adhere to COVID19 protocols laid out by the South African Government. There is a risk of loss of confidentiality, as there will be other participants in the workshop, but this will be mitigated by mutual agreement by participants to maintain trust during and after the workshop.
8. The Researcher intends to publish the research results in the form of a journal article. However, confidentiality and anonymity of records will be maintained and my name and identity will not be revealed to anyone who has not been involved in the conducting of the research, **unless I indicate to**

Appendix 8

Potential futures of agricultural systems in the AlbertiniaHerbertsdale area of the GCBR

Workshop Feedback Form

Thursday 10 August 2023

Thank you for participating in the workshop today. Please take a minute to answer these questions to help us learn from the day.

Was the workshop interesting? Yes No Somewhat
Please tell us why?.....

Was the workshop valuable? Yes No Somewhat
Please tell us why?.....

Was the workshop useful? Yes No Somewhat
Please tell us why?.....

Was anything missing? Yes No
If you answered no, what was missing?.....
.....

Was anything about the workshop different than you expected? Yes No
If you answered yes, what was different?.....
.....

What could have improved the workshop?

What did you enjoy about the workshop?.....

What didn't you enjoy?.....

What was the most surprising thing you learned today?.....

Do you have any other feedback?.....
.....
.....
.....
.....

Appendix 9



Gouritz Cluster Biosphere Reserve NPC

Reg.no: 2011/008876/08
PBO no: 930059846

Postnet Suite 027, Private Bag X423, Riversdale, 6670
2 Barry Street, Riversdale, 6670
Tel: 028 050 0577

www.gouritz.com

14 October 2022

To whom it may concern,

Letter of consent to participate in MSc research project (Gatekeepers Permission)

This letter serves to confirm that Gouritz Cluster Biosphere Reserve (GCBR) consents to working with Ryana Johnson, MSc student at the Department of Environmental Science of Rhodes University, to facilitate access to GCBR members relevant to her study.

Having participated and commented on the main survey instrument, GCBR will contact landowners and invite them to participate in the survey. Participation will, of course, not be compulsory.

The main objective of the proposed survey and participatory workshops/follow up survey to be run between October 2022 and December 2023 is to better understand the social-ecological system in the Albertinia-Herbertsdale region of the GCBR, to understand farmers' and land managers' decision making priorities in this area, and to explore their desired potential futures for themselves and their land in order to build trust and facilitate conservation and stewardship in the area.

Please do not hesitate to contact us should you require any further information.

Kind Regards

A handwritten signature in black ink, appearing to read "Luami Zondagh".

Luami Zondagh

Gouritz Cluster Biosphere Reserve: Learning and Evaluation Coordinator

Directors: K Coetzee (Chairman), CC Horsley (Vice Chairman), HS Visser, LH Jordaan, CF Cupido
Chief Executive: Dr SR Du Toit
Ambassador for Archaeology: Prof C Henshilwood

Appendix 10

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Project Title: Potential futures of farming systems in the Albertinia-Herbertsdale area of the Gouritz Cluster Biosphere Reserve (GCBR).

Ryana Johnson from the Department of Environmental Science, Rhodes University has requested my permission to participate in the above-mentioned research project.

The nature and the purpose of the research project and of this informed consent declaration have been explained to me in a language that I understand.

I am aware that:

15. The purpose of the research project is to gather detailed information from farmers and land managers in the Albertinia-Herbertsdale areas of the GCBR. This will be used to understand decision making priorities and possible futures of land management in the area.
16. Rhodes University has given ethical clearance to this research project **(2022-5908-7183)** and I have seen/may request to see the clearance certificate by contacting the Ethics Coordinator (ethics-committee@ru.ac.za).
17. By participating in this research project I will be contributing towards knowledge and understanding of decision making and possible futures for land management in the Albertinia-Herbertsdale area of the GCBR.
18. I will participate in the project by doing an interview with the researcher and attending a follow-up workshop OR doing a follow up interview .
19. My participation is entirely voluntary and should I at any stage wish to withdraw from participating further, I may do so without any negative consequences.
20. I will not be compensated for participating in the research, but my out-of-pocket expenses will be reimbursed.
21. The following risks are associated with my participation: There is a physical risk of contracting COVID 19 during in-person interviews, however to mitigate the risk the researcher and any accompanying translators will adhere to COVID19 protocols laid out by the South African Government. There is a risk of loss of confidentiality, as there will be other participants in the workshop.
22. The Researcher intends to publish the research results in the form of a journal article. However, confidentiality and anonymity of records will be maintained and my name and identity will not be revealed to anyone who has not been involved in the conducting of the research, **unless I indicate to**

Appendix 11

Potential futures of agricultural systems in the Herbertsdale - Albertinia area of the Gouritz Cluster Biosphere Reserve

Text of Whatsapp invitation message to participants in the interviews (interviews conducted under approval number 2022-5908-7183). Whatsapp was used because it was the medium of communication preferred by the participants.

Hello (name), this is Ryana Johnson.

Thank you once again for participating in the interview for my study. I am working on the data now and it is very interesting. We are going ahead with the second part of the study which is a workshop on 24 January 2023.

At the workshop, we will be using futures thinking tools to develop scenarios to examine potential futures for the region. I will be inviting a number of experts/specialists to join us on the day.

Please let me know if you will be able to join us at the workshop? And please also let me know if there are any experts/specialists that you would like us to invite? These could be local people with special knowledge, or professionals in any field that you think would be valuable in a discussion about future possibilities.

Kind regards,

Ryana

Appendix 12

Potential futures of agricultural systems in the Herbertsdale - Albertinia area of the Gouritz Cluster Biosphere Reserve

Text of email invitation message to participants in the interviews (interviews conducted under approval number 2022-5908-7183). Email was used because it was the medium of communication preferred by the participants.

Hello (name), this is Ryana Johnson.

Thank you once again for participating in the interview for my study. I am working on the data now and it is very interesting. We are going ahead with the second part of the study which is a workshop on 24 January 2023.

At the workshop, we will be using futures thinking tools to develop scenarios to examine potential futures for the region. I will be inviting a number of experts/specialists to join us on the day.

Please let me know if you will be able to join us at the workshop? And please also let me know if there are any experts/specialists that you would like us to invite? These could be local people with special knowledge, or professionals in any field that you think would be valuable in a discussion about future possibilities.

Kind regards,

Ryana

Appendix 13

Workshop outline Thursday 10 August 2023

The primary aim of the workshop is: to build visions of sustainable, hopeful futures of the Albertinia-Herbertsdale region farming community in the context of agriculture/food production.

When	What	Who
08h00 to 08h30	Registration and welcome	All
08h30 - 09h00	Brief introductions	All (Ryana)
09h00 - 09h10	Introduction of the workshop and activities for the day	
09h10 - 10h30	Feedback from the interviews Discussion	Ryana Johnson
10h30 - 11h00	Tea Further discussion (if needed)	Ryana Johnson
11h00 - 11h20	Futures thinking: what does it mean for us?	Dr Alta De Vos
11h20 - 11h45	What are we trying to do now? Broader vision for the landscape, pathways to get there and possible leverage points.	All
11h45 - 12h30	Presentation of Three Horizons Framework developed from information from the interviews	Ryana Johnson
<p>The Three Horizons Framework is a graphical approach developed to explore the change in importance of issues over time and connect the future to the present. Emerging change will challenge our current assumptions and, over time, today's decisions, policies, and products will become obsolete (Hichert, Biggs & Preiser, s.d).</p>		
Lunch		
13h15 - 15h00	Discussion and feedback about interview data and Three Horizons Framework. Is there something here that you want to change. Are there seeds that are not represented here? How would they change the pathways and leverage points?	All
	<ul style="list-style-type: none"> • Establish what current seeds we want to grow • What are the dominant trends now that we want to see less of in the futures • Where are the leverage points in the present to enable the desired future developments 	All
15h00	Tea on the go	
15h30 to 16h00	Brief reflection - key learning points and	Ryana Johnson / all

16h00 - 16h15

feedback forms
Thanks and close

Ryana Johnson

Appendix 14

Proposed Timeline

First phase: Desktop preparation, literature review, research proposal, ethics permission.

Estimated completion date: September 2022.

Second phase: Survey/questionnaire for farmers to explore trends, values, barriers, concerns and other influences on their land management (see attached questionnaire as a base example). This could be administered in person or modified for online participation if necessary and if online questionnaires are a technology participants feel comfortable with. The results of this survey will be synthesised to help contextualise and frame the Social-Ecological system involved in the Herbertsdale region of the GCBR project. The data will be analysed and will inform the next phase of the process (Plan A or Plan B).

Estimated completion date: February 2023.

Third phase: Series of 3 participatory workshops (involving directly affected stakeholders) to develop future scenarios (Plan A) OR development of scenarios by researcher and follow-up survey with participants to reflect thereon (Plan B).

Estimated completion date: August 2023

Final phase: Collation, data analysis and writing-up of findings, submission of article, submission of thesis, final reflection report and feedback report to GCBR.

Estimated completion date: February 2024.

Budget

First phase: Desktop preparation, literature review, research proposal, ethics permission (6 months).

Data/internet	R4000
Stationery/sundries	R2000
Travel	R7000
Telephone	R1800

Subtotal: R14 800

Second phase: Survey/questionnaire for farmers to explore trends, values, barriers, concerns and other influences on their land management (see attached questionnaire as a base example). This could be administered in person or modified for online participation if necessary and if online questionnaires are a technology participants feel comfortable with.

The results of this survey will be synthesised to help contextualise and frame the Social-Ecological system involved in the Herbertsdale region of the GCBR project.

Travel to Herbertsdale: 1148 km @ R5/km:	R5740
Accommodation: 6 nights @R500 per night:	R3000

Subtotal: R8740

Third phase: Series of 3 participatory workshops (involving directly affected stakeholders) to develop future scenarios.

Travel to Herbertsdale: 1148 km @ R5/km:	R5740
Accommodation: 3 nights @R500 per night:	R1500
Venue hire: 3 days @ R1000 per day	R3000
Catering @ R110 pp x 20 pax X 3 days	R6600

Subtotal: R19 840

Final phase: Collation and writing-up of findings, submission of article, submission of thesis, final reflection report and feedback report to GCBR (6 months).

Data/internet	R4000
Stationery/sundries	R2000
Travel	R7000
Telephone	R1800

Subtotal: R14 800