

MEDIA AND COMMUNICATION INFLUENCES ON
FARMERS' VIEWS OF WATER CONSERVATION IN THE
GARDEN ROUTE, SOUTH AFRICA

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**MEDIA AND COMMUNICATION INFLUENCES ON FARMERS’
VIEWS OF WATER CONSERVATION IN THE GARDEN
ROUTE, SOUTH AFRICA**

By

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Declaration

I, Dorothea Maria Buckle (209006387), hereby declare that the dissertation for Masters of Arts in Media Studies to be awarded is my own work and that it has not previously been submitted for assessment or completion of any postgraduate qualification to another University or for another qualification.

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Dorothea Buckle

Abstract

The Garden Route is situated between a mountain range and the ocean, both within close proximity. These geographic considerations make the farmers in the area vulnerable to extreme weather events, especially droughts and floods, which have been experienced in recent years. Agriculture in the area is predominantly focused on dairy and vegetables, which require intensive irrigation practices. It is this water demand that inspired adaptations to counteract the risks of extreme weather and dwindling water sources. These adaptations and behaviours were investigated to determine the underlying perceptions and influences.

The research aimed to understand the way environmental knowledge would disseminate through the use of the Diffusion of Innovation theory, whilst determining the ecological worldviews of the participants through the use of the New Ecological Paradigm (NEP) scale. Both of these theories proved effective in researching the ecological perceptions of and various influences on the participants, with a few minor drawbacks.

The data analysis investigated the research questions with a three-pronged approach. Interpersonal interviews and media content analysis of the local and agricultural media in the area was followed by analysing the two sets of findings, in order to find overlaps and relationships between the factors explored. The interviews were designed as semi-structured to allow for themes to emerge and were conducted mainly within the dairy and beef industries, consisting of 24 participants. The media content analysis incorporated a niche agricultural magazine (32 articles) as well as the local newspaper (74 articles). The articles were coded for themes to allow for comparison between the two, and to provide an overall understanding of the media coverage.

The use of the interviews and media content analysis concurrently, made it possible to determine the farmers' perceptions of water conservation and the possible influences on these. By exploring this, the research endeavours to understand the dynamics between the farmers' use of media and interpersonal networks and their water conservation practices.

The farmers' perceptions appeared to be predominantly shaped by agricultural media and interpersonal communities. The NEP scale responses exposed the clash between economic and environmental considerations. The farmers were acutely aware of their ecological impact and were employing various measures to counteract it. However, these were heavily dependent on their financial situation. This is in contrast to the NEP scale's measuring of NEP statements

contrasted with Dominant Social Paradigm (DSP) statements to determine ecological attitudes. These findings confirm previous research and demonstrate that modern farmers are more likely to adopt conservation practices than their traditional counterparts, if it helps achieve their economic, social and environmental goals.

The importance of the historical context of South Africa's water issues emerged, with the past and future proposed changes to water regulation and legislation affecting farmers' perceptions. The move from agriculturally privileged water legislation to equitable distribution is affecting the farmers negatively, causing distrust towards the government. The research was successful in achieving an understanding of the effect of the mass media and interpersonal communication influences on the farmers' perceptions of water conservation.

Keywords: Environmental communication; Interpersonal communication; Mass media; Diffusion of Innovation; Water conservation; Agricultural views; Farmers; New Ecological Paradigm; NEP Scale; Dominant Social Paradigm; Water legislation

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Dedication

For my mother, who has been my best friend and greatest supporter. I wish I could share this degree with you. You deserve thousands of Master's for raising me the way you did.

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List of Abbreviations

DSP: Dominant Social Paradigm

NEP: New Ecological Paradigm

NWA: National Water Act

IAP: Invasive Alien Plants

DWA: Department of Water Affairs

DEA: Department of Environmental Affairs

Definition of Key Terms

New Ecological Paradigm (NEP)

The New Ecological Paradigm is an assemblage of beliefs which indicate that there is a limit to our natural resources, that we are approaching this limit and that the environment needs to be managed sustainably (Catton and Dunlap 1978). The New Ecological Paradigm scale explores the current state of society's understanding of and relationship with nature. It tested the following paradigms: The reality of growth limits; Anti-anthropocentrism; Fragility of nature's balance; Rejection of exemptionalism; Possibility of eco-crisis. Example: It was conceptualized to understand the ways in which humans interact with nature (Adapted from: Dunlap and Van Liere 1978, Grendstad 1999). The NEP scale was formulated to investigate the transition from the Dominant Social Paradigm to a more ecologically-friendly worldview (Grendstad 1999).

Dominant Social Paradigm (DSP)

The Dominant Social Paradigm is a shorthand term for the constellation of common values, beliefs, and shared wisdom about the physical and social environments which constitute a society's overall worldview. It is conceptualized that the DSP is responsible for the rise in environmental problems, because the DSP was formed in a bygone era where natural resources were abundant. This paradigm is no longer acceptable with the ecological limits now faced by society (Adapted from: Dunlap and Van Liere 1984; Pirages 1977).

Environmental Communication

The deliberate exchange of environmental information, knowledge and wisdom. This includes the application of communication approaches, principles, strategies and techniques to environmental management and protection. Environmental communication includes environmental journalism, which aims to inform the public of environmental events and happenings. However, it has been argued that environmental communicators also have an ethical duty, not only to inform, but to educate the public. Environmental communicators should thus perform the role of environmental journalist and environmental educator. Environmental communication is also a budding academic field, which should be treated with caution. Therefore, environmental communication should be investigated as a complex concept and

explored against the backdrop of relevant cultural discourses (Adapted from: Flor 2004, Carbaugh and Cerulli 2013).

Chapter 1: Introduction and Background

Water, as a limited resource, will become even more scarce and the management thereof more problematic in the future. Agriculture is a demanding water use industry in South Africa (Lotter 2009). This has led to negative perceptions of agriculture by various publics. Government entities are predominantly in charge of policies on land use and development processes and subsequent decision making. This often leads to short-sightedness by role players of potential consequences, which are felt by the water-intensive economic sector and the public, and succeeded by activist backlash from local communities (Wilhelm-Rechmann *et al.* 2014).

The need for equitable redistribution of natural resources, including water, is becoming a global reality. The Integrated Water Resources Management framework allows for collaboration amongst a variety of stakeholder groups, including groups with diversity of views and stakes (du Toit *et al.* 2011). However, it becomes problematic when stakeholders do not understand or appreciate the importance of the ecological reserve, which is often the case (Pollard and du Toit 2008).

The relationships and influences between stakeholder groups within the selected catchment areas are important because of additional strain put on the natural resources, particularly through diverging views and competition (Pollard and du Toit 2008). A fundamental shift is required in the stakeholder engagement processes in South Africa, specifically in government instances. Values, attitudes and worldviews of the stakeholders should be taken into consideration to create an understanding of the various economic and socio-cultural values of the land to the community (Wilhelm-Rechmann *et al.* 2014). This project aims to engage with this restructuring and investigate the reasoning behind perceptions and consequent behaviours. South Africa, being a third world country in some regards, has been called upon to coordinate agricultural water management with the overall water management. This includes the increase of water storage during water surplus to aid in times of droughts and other water shortages (Bouwer 2000).

Agriculture, along with industry, forestry and households, are the area's main water users (Pauw 2009), but the droughts in the area are particularly insidious when it comes to the agricultural sector (Schachtschneider 2014). Social-ecological theory opens up a way of analysing ecological problems by including social conflicts and their possible influences.

Environmental communicators and scientists assume they have an impact on the water conservation awareness of farmers. Agriculture, specifically with regard to environmental change, faces many challenges and risks (Trautmann 2014). In the tension between environmental and economic considerations, environmental communicators assume public awareness will lead to the stewardship of aquatic ecosystems in catchments. Other influences, e.g. previous experiences, interpersonal communication channels, established beliefs, should be taken into account when researching the effects of mass media messages, especially because channels of influence could be diverse.

Previous experiences and perceptions influence the way we interpret messages. This phenomenon can be explained by the so-called ladder of inference which was initially proposed by Chris Argyris and recreated in Peter Senge's "The Fifth Discipline Field book." This theory proposes that individuals instinctively make subjective observations. This is based on the premise that all individuals have their own beliefs which they held to be true, and selectively see their experiences through this lens. This leads to conclusions which reinforce these same beliefs (Ross *et al.* 1994).

Communication does not exist in a vacuum either, but rather is informed by the cognitive perceptions behind certain actions and behaviours. This is attempted in order to determine how the various communication processes inform, or possibly does not inform, the farmers who are also the key focus of this study (Kilbourne 2006). This understanding of the influence of environmental communication on behaviour is crucial for environmental communicators and scientists who are interested in promoting ecosystem stewardship of catchments, which would form the 'building blocks' for ecological transformation. Researchers first have to understand what these perceptions are, and how they are shaped, to be able to analyse the different influences and their respective impact on the farmers' relationship to water as a resource.

Environmental communication then serves to fulfil more than one duty. It has theoretical implications as an academic field of inquiry, as well as practical implications in what it aims to achieve. Theoretically, even though environmental communication research has been increasing drastically, there is no 'gold standard' journal available for practitioners and scholars to turn to. A more "centralized point of publication" has been identified as an issue by the literature (Pleasant *et al.* 2002:197). The focus of environmental communication is pragmatic, in that its goals are not merely academic but are intended to trigger behaviour changes among

the public or specific targeted recipients (Ralston 2011). The academic engagement with this field thus explores the communication process and practical engagement, to base both content and medium upon scientific inquiry as a prerequisite to effecting academic endeavours.

This research will therefore assess which type of messages and influences could possibly have an effect on different types of audiences, alongside the overall environmental inclination and view of water to see how these perceptions influence uptake of information. The measurement of the success of environmental communication has been focused on its immediate effect on the behaviour of the public towards the physical environment, whilst ignoring that it could also have an effect on academic observation (Stephens 2014), as well as on public perceptions, and subsequently, behavioural change in the long run.

Ecological importance of water

Water is essential to all stakeholders, but the importance of allocating a minimum amount of water to be left in its natural state has been highlighted in South African Water Affairs policies in recent years. This is known as the ecological reserve, which serves the purpose of conserving the entire ecosystem. Environmentalist perspectives recognise the importance of the ecological reserve. Various studies investigated this notion and found it imperative that there be enough water flushing through the ecosystem to keep it healthy, instead of storing as much as possible before it runs into the ocean (Matthews *et al.* 2012; van Vuuren 2010, Wood 2010). For example, a study conducted on the Orange River concluded that it has been polluted, that its annual flow has been reduced by half, and that the decrease in freshwater input further has a negative effect on the ecology of the marine and coastal environment (Wood 2010).

This, combined with the fact that water demand is rising, suggests that competition for water amongst agriculture, industry and the ecological reserve is rife. Academic research into water-related issues has also seen a stark increase. This increasing trend is evident in the focus of journal articles and research reports, which have increased from 20 in 1977, to 380 in 2011, an increase of 1900% (Siebrits *et al.* 2014).

Water rights in South Africa

South Africa, it is alleged, has been too liberal with its water use in the past (Van Vuuren 2010). This has been linked to its water rights, which have in turn been linked to the country's political evolution. Changes in government and political ideologies filtered through into policies and legislation concerning water. Consequently, social and economic forces and other water management issues have been integral to the development of various water rights (Tewari 2009).

The history of water rights in South Africa is intricately connected to the country's political evolution. The National Party, in power from 1948 to 1994, encouraged economic development in geographical locations where a lot of their support base was located, specifically the rural areas. This brought with it a milestone in South African water rights, The Water Act of 1956. It focused on water regulations amongst the three most intense users: agriculture, mining and industry (Tewari 2009). Even though rights to the water were regulated by the State, some principles lent from riparian water rights were still prominent, which included favouring the white minority of commercial farmers (Francis 2005).

The National Government was the exclusive custodian of all the sources of fresh water in the country, but this was changed when the African National Congress came into power (Tewari 2009). For the first time, "equitable access was considered very important due to the discriminatory policies of the past," which fundamentally changed the distribution of water in the country, which meant that domestic use of water would be prioritized (Tewari 2009:703). However, as it was in the past, the white minority still seems to be privileged. It is believed that white suburbs, accounting for ten percent of the population, uses at least half of the domestic water sources (Winkler 2007). Even though water equality is not a reality in South Africa as yet, the slogan for the new classification of water resources paints a promising picture: Some, For All, Forever (MacKay 1998).

There has been a significant change in the focus of research on water, moving from the technical and engineering solutions to a focus on water resource management and multidisciplinary approaches which includes stakeholder engagement (Siebrits *et al.* 2014). It is suggested that the Constitution and National Water Act (NWA) spurred these changes. The NWA attempts to create solutions for sustainable and effective water management (De la Harpe and Ramsden 2006). However, the act is still misunderstood and many South Africans

are unsure of its application. They are also unsure of their rights and obligations set out by this act (Van der Merwe 1998).

The NWA was necessary because of increased competition for water in South Africa (Van der Merwe 1998; Van Wyk *et al.* 2006). Other purposes of the NWA include sustainable use of water sources to secure the basic water needs of present and future generations; upholding equitable access to water; addressing and redistributing results of past racial discrimination; encouraging efficient and sustainable use of water in the public interest; using water allocations to promote social and economic development; protecting the ecology; including aquatic and other ecosystem health; preventing degradation of freshwater sources, especially due to pollution; ensuring dams are upheld to a standard of acceptable dam safety and providing a blueprint for the management of droughts and floods (Van der Merwe 1998).

Agricultural privilege

South Africa's water policies have a long history of prioritizing agricultural needs. Surface water was divided into rivers, streams and springs, and was considered a commons in 1874. This brought water legislation which primarily focused on the development of extensive irrigation systems. It included flood diversion schemes and the development of using dams for water storage, primarily in the 1920s (Tewari 2009). Agricultural privilege was inexplicitly tied to riparian water rights, which were replaced by the prioritization of domestic use after 1998. Meanwhile, authorization is now required for the same uses as were previously afforded to the agricultural users.

During the period of 1956 to 1998 the Water Act 54 of 1956 was in place, which meant the use of water was intricately tied to the ownership of the land. Riparian-adjacent land owners were entitled to use water that flowed from or through their property, provided that they use it reasonably and that there was enough water for the downstream users and their needs (Pienaar and Van der Schyff 2007) . If the water supply was insufficient for all owners of the properties which it flowed through, quotas were instituted based on the proportion of the river/source that bordered the various properties. This was an improvement to the traditional riparian rights principles, which, before 1998, favoured the upstream land owners (Tewari 2009). Furthermore, the government had a subsidy system in place for white-owned irrigated agriculture (Francis 2005). Agriculture was one of the most important focuses of water

distribution and policy, before domestic use was prioritized (De la Harpe and Ramsden 2006). With the advent of the National Water Act in 1998, water became an outright public resource, conceding no individual ownership, only a right to its usage. Water is now prioritized for protection, use, development, conservation, management and control of water resources so as to meet the basic human rights of the entire population (Pienaar and van der Schyff 2007).

The NWA aimed to rectify past water governance mistakes. The most influential of the water rights alterations, in terms of agriculture, was the shift to democratic rule. This was a tremendous change from the white commercial sector being the favoured receiver of water rights under the National Party's rule. Because of the previous advantage lent to the farmers, the change in legislation became a contentious issue when the privileged position of agriculture was reassessed. It is stated in NWA of 1998, that the previous act was drawn up when there were fewer people and there was "less pressure on the environment and water resources" (De la Harpe and Ramsden 2006:9). It also extensively favoured the white minority of farmers. Research also stated that, because of this, agriculture was the main focus of water policy, which is why water use was tied to land ownership. The previous Act focused on developing dams, while ignoring issues such as protecting and conserving water (De la Harpe and Ramsden 2006).

The Act of 1998 was published with the "aim of fundamentally reforming the past laws relating to water resources" which were seen to be racially discriminatory and inappropriate to the conditions in South Africa (De la Harpe and Ramsden 2006:3). The NWA was designed as a three-pronged approach to water management, namely to achieve social benefit, economic efficiency and environmental sustainability (Braune *et al.* 2014). This is in stark contrast to the previous advantaged position granted to the agricultural sector (Pienaar and van der Schyff 2007).

The management of water as an all-inclusive social right requires a multi-angled approach to ensure equitable distribution, whilst providing for the needs of local economies to thrive. As part of this approach, the importance of the ecology and ecosystem health has to be understood, to ensure the longevity of water sources. Furthermore, because of the complicated history surrounding water in South Africa, it becomes a sensitive issue which is clear when engaging with stakeholders. Research on the matter has to be approached in a nuanced way, whilst incorporating all social groups and understanding the entirety of society's needs.

Study area

The Garden Route, sandwiched between the Tsitsikamma Mountains and the Indian Ocean (see Figure 1: Map of study area), faces unique ecological sustainability challenges, many of them related to water. Steep mountain catchments and fast flowing runoff are some of the issues faced by farmers in the area (Driver *et al.* 2011). Along with this, the entire Southern Cape region forms a climatic transition zone between winter and summer rainfall seasons. The combination of these factors increases vulnerability through droughts, floods and other implications of environmental change. Drought management plans have also been put in place for George, a uniquely fragile area because of the proximity to the mountains and the ocean.

George is located along the N2 highway heading towards Cape Town, and, being the middle point between the Eastern Cape and Cape Town, it facilitates mobility of goods and services. It consists of 65,7% Afrikaans speaking individuals with a nearly even amount of males and females. George has a population of approximately 193,672 people, according to the 2011 census, with most of the population obtaining their water from a local or regional water

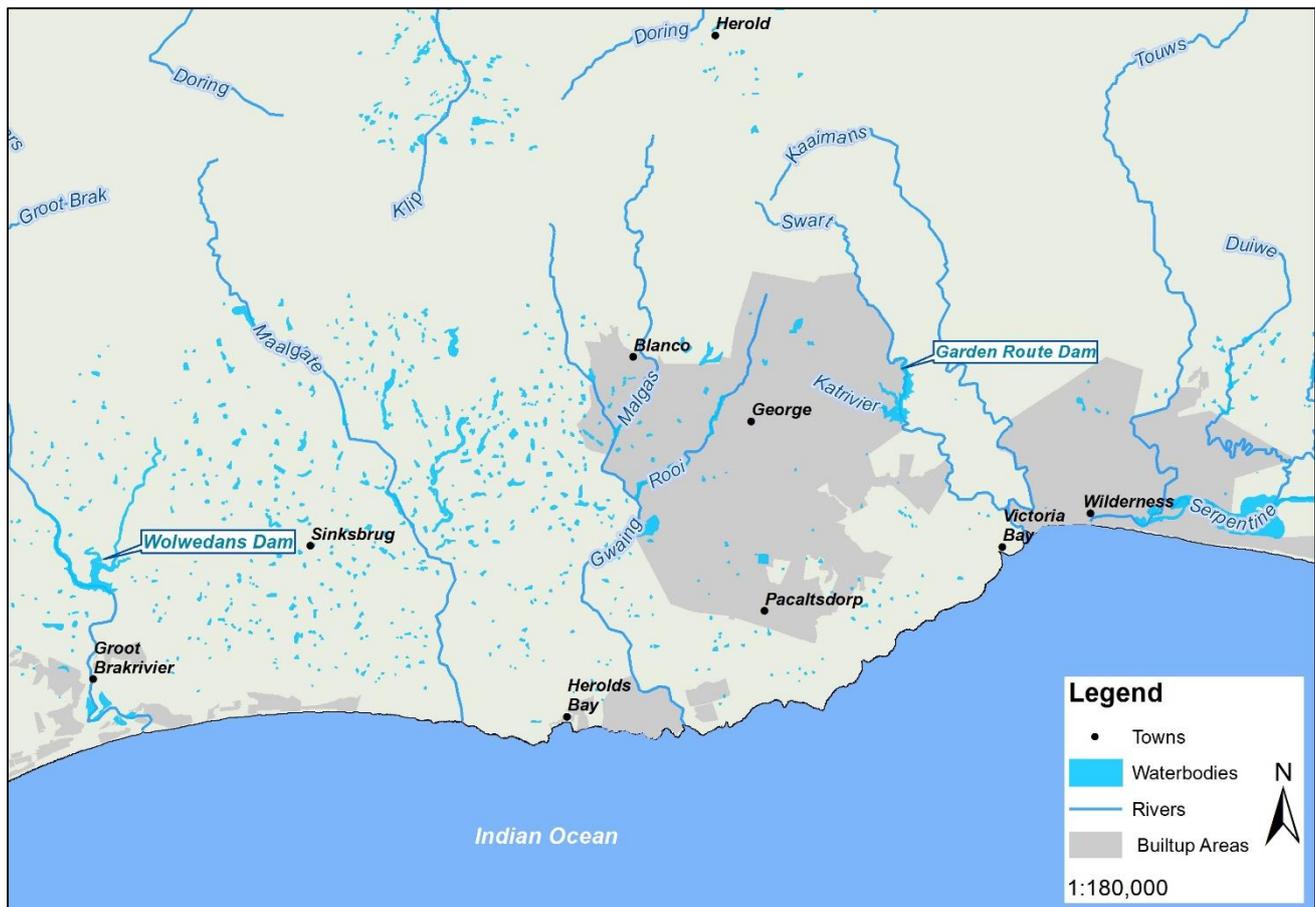


Figure 1: Map of study area

scheme. Eleven percent of the population lives on farm lands. (StatsSA n.d.).

There are 4,074 agricultural households in George, the demographics of which are represented in Table 1 and the education levels in Table 2. They mainly focus on Vegetables (31,1% of Agricultural households), Poultry (22,8%) and Livestock (19,6%) in the George area (StatsSA n.d.). The most prevalent population group in the area is Coloured with 1,701 households, followed by Black African with 1,139 households which is followed by the White demographic with 1,181 households in agriculture. Further, the household heads are split into 1,051 females and 3,023 males. Study participants were selected only if they had an impact on or were impacted by the rivers in the Garden Route.

The recent regional drought, experienced through 2008 to 2010, was intensified by the simultaneous global economic crisis. The cumulative effects identified in research suggested that “socioeconomic vulnerability was compounded by insufficient access to water” and that the economic effects saw a 29,7% decrease in the agricultural labour force between 2010 and 2011 (Holloway *et al.* 2012:7,9). Agriculture was critically effected by the drought (O’Farrell *et*

Table 1: Demographic data from agricultural households in the greater George area
Data from StatsSA: Agriculture in George (n=4074)

Variable	Number	Percentage
Gender		
Male	3023	74%
Female	1051	26%
Race		
White	1181	29%
Black African	1139	28%
Coloured	1701	42%
Indian or Asian	17	0%
Other	36	1%
Age		
15-34 years	637	16%
35-45 years	954	24%
46-55 years	1047	27%
56-64 years	785	19%
65+ years	648	16%

al. 2015). The effects were also exacerbated by the preceding three years of extreme rain events, causing infrastructural damage to dams. However, permits for fixing dam walls proved difficult to acquire due to administrative delays, and some farmers went into the drought period with lessened storage capacity than they are entitled to have.

Water restrictions, lack of pastures and pest animals were some of the devastating effects of the agricultural drought. In terms of the agricultural sector specifically, the effects of the droughts were almost immediate for the district because the livestock’s grazing conditions were compromised, especially considering that some farmers experienced severe restrictions and were expected to use 60% less water (Holloway *et al.* 2012), which affected irrigation practices. The secondary effects of the drought were found to be livestock diseases (Holloway *et al.* 2012).

Table 2: Education level of household head for George agriculture (n=4074)

Education	Number	Percentage
No schooling	301	7%
Grade 1 to grade 11	2344	58%
Grade 12	866	21%
Completed tertiary	535	13%
Other	29	1%

Agriculture in the Garden Route

There has been a lack of academic inquiry into the effect of mass communication, and other channels of communication, on the Western Cape Agricultural industry. The most similar study in the Garden Route was conducted by Cornelia Steyn in her thesis in Applied Ethics, titled: *Exploring ethical challenges, climate change and implications on land and water use within the agricultural sector of the Garden Route, Western Cape, South Africa* (2013). In her study, she looked at the ethical backdrop of the farmers’ adaptations to climate change, whilst asking the farmers to compare hypothetical futures. The findings highlight the immensity of the issues involving water, and the pivotal role it plays in future success (Steyn 2010).

In South Africa, Invasive Alien Plants (IAP) are becoming a major concern affecting water resources, and have reduced river flows by an estimated 6.7%. This is important, because water is identified as a key constraint to further economic growth in South Africa (Le Maitre *et al.* 2002). IAP management has been identified as an acceptable intervention for water resource management, with the South African government Department of Water Affairs investing over R116 million in the Working for Water programme. It was initiated in 1995. For the farmers, an ethical dilemma was identified in terms of IAP management and clearing. Although most of the farmers understand the importance of clearing their IAPs, downstream users are the main economic beneficiaries of the increased water yield (Steyn 2013). The farmers have no guarantee that their upstream neighbours are going to afford them the same benefits, and thus cannot always justify the expense of IAP management. Furthermore, clearing may bring with it other ecological issues that could affect their farming practices and productivity, including soil erosion and top soil run-off (Steyn 2013). Despite these findings in 2010, some studies suggest that IAP management is becoming profuse amongst the farmers in the area (Schachtschneider 2014; van Wilgen *et al.* 2008). This study investigates these adaptations, and aims to look at the possible influences on the farmers.

Modern farmers are more likely to adopt conservation practices than their traditional counterparts, if it helps achieve their economic, social and environmental goals (Greiner *et al.* 2009). However, the largest water user, worldwide, remains irrigated agriculture, and it is also one of the main water users in the study area (Ward and Pulido-Velazquez 2008). The industry has also been identified as a possible source of pollution through excess nutrients and pesticides, which would have negative impacts on the entire system (De Lange and Mahumani 2013; Schachtschneider 2014). It is therefore clear that farmers, as land users, have an impact on the catchment as a whole. Their water usage has, however, changed quite significantly over the years depending on the available technology and costs associated with these. Many farmers in the area employ water saving practices, including minimum till, technologically advanced irrigation systems with moisture probes, and scheduled irrigation at night (De Lange and Mahumani 2013).

Another major issue identified by the agricultural community in the area was their unique struggle with the lack of storage capacity of surface water. The farmers in Steyn's study stated that their storage capacity was too low, considering that the amount of rainfall that gets

recorded does not adequately represent their usage, because a lot of the rainfall happens in flood and then they are not able to store enough to last for the dryer periods (Steyn 2010). This was also found by Jacob (2011) who assessed the prevalence of floods in the area in his Masters study, designed from an economic perspective. He found that when the rainfall intensity exceeds the storage capacity, the evaporation rate and the capacity of the soil to be infiltrated by the water, excessive surface runoff will occur (Jacob 2011). It is disheartening, according to the farmers in the area, to see flood water washed into the ocean instead of stored for the dryer periods to come. The change in the rainfall pattern, they believe, should be accompanied by an increase of storage capacity to keep water usage stable, not increase it as often thought by Department of Water Affairs (DWA) (Steyn 2013).

The data collection phase of Steyn's study was in 2009-2010, a period of intense drought in the study area. This meant that the issues at hand, such as climate change, weather and water, were salient. Her sample group was acutely aware of the issues at that point in time, which could have increased participation, or may have represented a skewed perception of farmer interest in the topic (Steyn 2010). Leitch and Bohensky describe an occurrence such as a drought as a diffuse hazard because of the way it is covered by the media, and therefore rapidly filters the public discourse (Leitch and Bohensky 2014).

The study area predominantly focuses on dairy farming, with vegetable and beef cattle farming practised to a lesser extent. It is because of the nature of this farming that irrigation is of the utmost importance in the study area. A case study measuring climate change implications on agriculture for water and land use in the area determined that the human requirements for water, including agriculture, industry, urban and commercial usage, is running at a deficit of 64 million m³ of water per year. This exerts pressure on water allocation and availability (Lotter 2009). The dairy farmers in the area manage their pasture production, and thus their dairy production, by maintaining soil moisture levels. The main reason they irrigate is to ensure better pastures and thus higher productivity (De Lange and Mahumani 2013). Furthermore, there is possible pollution through the run-off of the dairy farms, which have to be meticulously managed with slurry dams (De Lange and Mahumani 2013; Schachtschneider 2014).

Problem statement

South Africa as a country has to implement water conservation and water demand management with pronounced urgency (van Vuuren 2010). This is especially of importance to the rivers in the Garden Route, which are characterized by their short distance to the ocean, and their steep gradients (River Health Programme 2007; Roux 2001). These geographical and climatic specifications contribute considerably to the water vulnerability of the region.

Sustainability science research, specifically with regard to the role of environmental communication, involves influencing social behaviour (Lindenfeld *et al.* 2012). It calls for communicating beyond information exchange (McGreavy *et al.* 2015). To further this, the likely adoption of conservation practices was investigated by determining pro-environmental perceptions of the farmers.

Stakeholder engagement has to play a large part in tackling these issues, if the campaigns are to be successful (Lindenfeld *et al.* 2012). Dynamic power struggles between stakeholder groups, related to various institutional and bureaucratic barriers, contribute to the community's frustrations about ecosystem degradation, pollution and water scarcity (Vromans *et al.* 2010). Along with this, lack of capacity for engagement and decision making regimes that do not allow for adequate participation become social barriers to communicating effective conservation practices to stakeholders (Biggs *et al.* 2011). Much of this animosity has centred on agriculture, a sector whose views traditionally often clash with those of ecologists, as was evidenced by a workshop in the study area (Fabricius *et al.* 2015). These disconnections have a direct impact on natural resources.

According to William Kilbourne, for sustainability communication to be effective in western societies, dominant social paradigm (DSP) research needs to be revisited to determine a new approach. Sustainability science should then aim to adhere to the functioning of the DSP. Promoting sustainable consumption is problematic because it seems to contradict the DSP, which hails consumption as good (Kilbourne 2004). This, along with other dimensions of the DSP, confirms the contradictions between the DSP and NEP research, discussed below and in the section in Chapter Two.

Research rationale

Freshwater sources will become scarcer in the future, whilst demand for water increases. Irrigated dairy and vegetable farming are water-intensive agricultural enterprises, inherently tied into the national food production chain. Due to media coverage of water scarcity, however, the public has developed negative perceptions of agriculture's impact on water resources. It appears that a fundamental shift is required in the stakeholder engagement process of government instances, in which the values, attitudes and worldviews of the stakeholders are taken into consideration to create an understanding of the various economic and socio-cultural values of the land to the community (Wilhelm-Rechmann *et al.* 2014).

Agriculture, specifically with regard to environmental change, faces many challenges and risks which affect farmers behaviour (Trautmann 2014). In this research project, the stewardship of aquatic ecosystems in catchments will be explored within the tension between environmental and economic considerations. Previous experiences and perceptions also influence the way individuals interpret messages.

While environmental communication in the area is assumed to have an impact on awareness levels of participants, communication and information dissemination is a complicated process informed by many factors. This research therefore assessed the above issues with a three-pronged approach: firstly determining what the perceptions of the participants are, thereafter identifying the possible influences on these perceptions, and lastly assessing a relationship between the perceptions and subsequent behaviours. An investigation of which type of messages could possibly have an effect on which types of audiences is necessary. Alongside this, the overall environmental inclination and view of water aided this research project in seeing how perceptions influence the uptake of information. The success of environmental communication usually focuses on the immediate effect on behaviour towards the physical environment. The effect on academic observation, as well as on public perceptions, and subsequently, behavioural change in the long term is often ignored (Stephens 2014).

Even though the research used Diffusion on Innovation theory (Rogers 1983) as a basis for investigation, it did not focus on innovation as such. Instead, this research utilizes the specific aspect of the theory which focuses on communication channels. This included the

effect of media and interpersonal channels as having an effect on individuals' practices, as well as the social system norms and the role of opinion leaders in influencing their community.

Dominant Social Paradigm and New Ecological Paradigm in conservation research

A paradigmatic approach to understand the stakeholders' views was adopted for the study. In perception research, it is important to explore the larger structures of thought rather than seeing them as singular concepts (Buijs and Elands 2013). Therefore, the Dominant Social Paradigm (DSP) and New Ecological Paradigm (NEP) are useful to elicit responses and gauge perceptions (Dunlap and Van Liere 1978; Dunlap *et al.* 2000).

A negative relationship has been found between conformity to the Dominant Social Paradigm (DSP) and pro-environmental attitudes (Kilbourne and Carlson 2008). According to them, a fundamental paradigm shift had occurred throughout society. DSP had been transformed to include more environmentally friendly norms. This is commonly referred to as the NEP. It is the NEP scale that is often used to determine individual's "affective, experiential connection to nature," and provides a framework to obtain insight into paradigms since they cannot be measured directly (Putnam 2006:401). The identified paradigms include seeing water as a commons or seeing it as a commodity (Bakker 2007). This forms an integral aspect of neo-liberal rationality which aims to provide a classification between a "responsible and moral individual" and an "economic-rational individual." This also relates to the inherent social responsibility some individuals identify with (Lemke 2001:12).

Furthermore, it has been found in studies using flood management as an example that a deep paradigm shift could be occurring (Rockstrom *et al.* 2014). The traditional paradigm is identified as protecting the landscape from the river through flood management strategies. A new emerging paradigm, moving away from "agricultural intensity" and toward "landscape productivity," suggests that the public expect flood management strategies to determine how to live with the river instead of being protected from it (Rockstrom *et al.* 2014:236). Considering the erratic seasons and the derailment to agriculture that sporadic rainfall causes, these paradigm shifts are possibly imminent in the area. This makes investigation into what encourages adaptations as opposed to maladaptation to environmental changes in the area necessary. Please see Chapter 2: Theoretical Framework and Literature Review in the section

about the transition from the From the Dominant Social Paradigm to the New Ecological Paradigm for an in-depth exploration of DSP and NEP literature.

Purpose of Study

The purpose of this study is to a) investigate farmers' perceptions of water management and conservation, b) explore various possible influences, including communication, on these perceptions, and c) determine how these may filter into farming practices. This research forms part of a larger project on stakeholder engagement to enhance the implementation of the catchment management strategies (Schachtschneider 2014).

Aims and Objectives

- Develop an understanding of the relationship between risk perceptions and water conservation practices by agricultural water users.
- Link different forms of communication, including environmental and interpersonal, to perceptions surrounding water conservation and ecosystem functioning.
- Contribute to the theoretical understanding of the effect of current mass media representations of water-related issues, as well as local-ecological information and fiscal concerns as influences on farming practices

Research Questions

The following research questions were used to design the data collection procedure:

1. How do farmers in the study area view the quality of water and ecosystem functioning?
 - Which risks to their water sources do they identify?
2. What are the farmers' perceptions of water regulations?
 - How did their past and present experiences of media texts influence them to form these perceptions?
3. What are the relationships among communication, knowledge, financial considerations and farmers' perceptions and conceptions about the water conservation in catchments?

Chapter 2: Theoretical Framework and Literature Review

Environmental communication is becoming increasingly important because of the ecological impact humans are having. Swan argues that determining the essence of the ecological crisis has to begin with factoring in the fundamental values on which society has been built (1971). According to Buijs and Elands (2013), communication and collaboration between professionals and stakeholders in the natural environment context can be greatly aided by the understanding of people's "structures of thought" (Buijs and Elands 2013:184). It is further suggested that studies into understanding and investigating peoples' way of thought on the environment could potentially offer solutions to improve collaboration and communication between environmental professionals and various stakeholders from the public (Buijs and Elands 2013).

It is imperative to contextualise attitudes and opinions by situating them in larger overarching paradigms people subscribe to (Engelen *et al.* 2008). This is mainly due to diverging views between the general public and conservation professionals, which leads to ineffectiveness of conservation efforts (Buijs and Elands 2013). If an individual is partial to the idea of being an integral part of nature, pro-environmental behaviour is more likely.

The way in which an individual perceives nature has a large impact on their environmental behaviour (Pienaar *et al.* 2013). People have cognitively constructed "representations of nature" that are integral to the way they understand and communicate about conservation (Buijs and Elands 2013:185). This was found in Buijs and Eland's 'Does expertise matter? An in-depth understanding of people's structure of thoughts on nature and its management implications'. In 2013, Levin and Unsworth collaborated to observe the positive relationship between pro-environmental behaviour and a subject's perception of themselves as overlapping with nature. They published an article titled 'Do humans belong with nature? The influence of personal vs. abstract contexts on human-nature categorization at different stages of development' (Levin and Unsworth 2013). Problematic social paradigms have been linked to unfavourable environmental views and have thus been used to ascertain levels of pro-environmentalism (Kilbourne and Polonsky 2005). It can then be hypothesized that an individual's mental model regarding his or her relationship with nature will affect their stance on conservation. Furthermore, research has proven that one's culture and language also plays a formative role in how one positions humanity with the rest of nature (Levin and Unsworth 2013).

From the Dominant Social Paradigm to the New Ecological Paradigm

The concept of the Dominant Social Paradigm (DSP) was developed to illustrate the prevalent societal worldview. It was introduced to define the “constellation of ‘common values, beliefs, and shared wisdom about the physical and social environments’ which constitute society’s basic worldview” (Dunlap and Van Liere 1984:1013; Pirages 1977). The DSP refers to the “values, metaphysical beliefs, institutions, habits” that provide a collective “social lens through which individuals and groups interpret their social world” (Cotgrove 1982:7). The DSP is characterized by various beliefs and attitudes. In short, these are: 1) a low evaluation of the importance of nature, 2) limited compassions for humanity, specified to close acquaintances, 3) Viewing risks as an acceptable trade-off for maximum wealth, 4) disagreement with the concept of limits to growth, 5) there are no dangerous futures contemporary society is facing and 6) markets and experts are valued above dissent in terms of politics, and should be used as a means of government (Sunderlin 2002). These six beliefs are further categorized under political, economic and technological dimensions.

The three dimensions of the DSP each have numerous perspectives and attitudes which combine to create a worldview. The paradigm consists of “political, economic and technological dimensions” (Kilbourne *et al.* 2002:195). It is used to gauge an individual’s attitudes regarding a variety of factors. Only the aspects of the dimensions that have been found to have an impact on environmental concern and attitudes will be discussed in its study. These include the support of progress and material abundance, the inherent “goodness of growth,” “faith in the efficacy of science and technology,” and viewing “nature as something to be subdued” (Dunlap 2008:5). The environmentally relevant aspects of each dimension will be explored below.

Dimensions of the Dominant Social Paradigm

The main components of the DSP, identified by different literature, is outlined in [Table 3](#), and discussed further. The DSP maintains that government have a role, limited to ensuring that legislation is followed. In the political dimension, the DSP involves the belief that the government should have limited impact on their stakeholders, with their primary objective being protecting individuals’ property and enforcing contracts. It is emphasised by the belief in private property and citizens being unrestricted in consumption practices (Kilbourne *et al.*

2002). It is important to note that the aspect of private property evolved from mere possession to individuals having a collection of rights attached to those possessions (Kilbourne 2006).

The increased awareness of environmental problems is argued to have dramatic political significance. It has become the focus of radical protests on a global scale, and has challenged the “central values and ideology of industrial society” (Cotgrove and Duff 1980:333). Closely linked to the political dimension, the economic side of the DSP explores market environmentalism and various other economic and environmental theories.

Economically, the DSP considers development and growth of the utmost importance and accentuates the positive aspects of free markets, whilst reiterating the political view of limited government control (Kilbourne *et al.* 2002). To further the economic growth

Table 3: DSP Components identified from various sources

Catton and Dunlap (1980)	Cotgrove (1982)	Dunlap and van Liere (1984)	Kilbourne et al. (2002)
1) People are fundamentally different from all other creatures on earth, over which they have dominion	1) Economic growth	1) Support for free enterprise	<i>Economic dimension</i>
2) People are masters of their destiny	2) Nature valued primarily as a resource for humans	2) Belief in unlimited economic growth	1) Support for free markets
3) The world is vast and provides unlimited opportunities for humans;	3) Domination over nature	3) Commitment to limited government	2) Belief in unlimited economic growth
4) The history of humanity is one of progress and progress need never cease		4) Devotion to private property rights	<i>Political dimension</i>
		5) Emphasis on individualism	1) Limited government regulation
		6) Faith in science and technology	2) Focus on private property
		7) Faith in future material abundance and prosperity	3) Focus on the free individual
		8) Support for the status quo	<i>Technological dimension</i>
			1) Faith in technology to fix problems: ‘techno fix’

(Adapted from Shafer 2006)

characteristic, accumulation of private property is also seen as an inherently good aspect (Kilbourne 2006).

A convergence of the DSP and New Ecological Paradigm (NEP) is evident in market environmentalism, which uses DSP values to attain NEP goals (Dunlap and Van Liere 1984). Market environmentalism uses economic principles to further conservation, by using markets and resource regulation as a solution to environmental problems (Bakker 2007; Clapp and Dauvergne 2005). It is an inherent part of the DSP, which places a lot of faith in markets as the solution to environmental problems. Conversely, the lack of privatizing natural resources is seen as a major flaw (Kilbourne *et al.* 2002).

Often, ecosystem degradation is blamed on the failure of markets, partly because capitalism emphasizes economic growth as superior to environmental concerns (Smith and Heise 1992). Market liberals argue that even though economic growth encourages increased consumption and consequently deteriorates environmental conditions, there is another side to the issue. Within this increased economic growth from markets, a wealthier society emerges. This leads to citizens raising their environmental standards. They argue that this is supported by the acute presence of environmental degradation in third world countries and first world countries, where economic growth has occurred, having cleaner environments (Clapp and Dauvergne 2005). The degradation that economic growth causes is only temporary, market liberals argue.

Against this backdrop, water management becomes an acutely polarized issue. It is argued that the scarcity of water, coupled with the subsequent high value and cost of it, will inspire water conservation and responsible usage. Market liberals also argue that if the growth is slow, this eventual good environmental outcome does not happen (Clapp and Dauvergne 2005). This theory provides for debate around the commodifying of resources and using the outcomes and profits to further conservation.

Opponents to market environmentalism reason that water is a “non-substitutable resource” and that denying it to some because of economic reasons is infringing on their human rights (Bakker 2007:432). This argument draws on the concept of social justice while moving from the rhetoric of sustainable development (Bond and Dugard 2007). However, some critics argue that environmental degradation is caused largely by the lack of markets as regulatory bodies, rather than their presence (Smith and Heise 1992).

The above could be considered as two opposing ways of thought, or paradigms. It is also suggested that the DSP allows for the environmental issues to be sidestepped at certain points. It is within this premise that using market principles to further environmental concerns come into play (Kilbourne and Carlson 2008). This is one example of the underlying DSP affecting the way in which society operates and reaches solutions.

The belief that technology has the power to solve all of humanity's problems is an inherent part of the DSP. With regard to the technological dimension, a "rampant technological optimism" has been identified with society having a firm belief that technology will solve most of its problems (Kilbourne *et al.* 2002:196). It further suggests that most people see technology in isolation, and thus fail to adequately examine the actual implications their technological usage may have. This is closely related to the misunderstanding of the underlying causes of environmental problems (Kilbourne *et al.* 2002).

Overconsumption is also born out of conformity with the DSP. The DSP of the United States of America has, for the past three decades, been linked to the "ideology of consumption" which equates consumption to happiness (Kilbourne and Carlson 2008:109). This thinking has led to the market economy that has been created under the premise of supposed "sustainable consumption" (Kilbourne and Carlson 2008:109). It is also suggested that the DSP allows for the environmental issues to be sidestepped at certain points. It is within this premise that using market principles to further environmental concerns come into play again (Kilbourne and Carlson 2008).

Transition from the Dominant Social Paradigm to the New Ecological Paradigm

Many studies have found an inverse relationship between the endorsement of the DSP and the NEP. Marketing researchers have observed a gradual shift in consumer's purchasing decisions, from DSP to NEP beliefs and motivations. It has been used extensively in marketing to determine environmental and non-environmental motivations behind actions and purchasing behaviour. William E. Kilbourne, Professor Emeritus of Marketing, has published several articles regarding the DSP and its integration within the field of marketing. He reported a fundamental change in society's perceived acceptance of the inherent principles of the DSP, versus the

observed environmental motivation of the New Ecological Paradigm (NEP) (Kilbourne 2004, 2006; Kilbourne *et al.* 2002).

The NEP was initially created as the measurement of pro-ecological worldviews, even though it has been highly utilized and has evolved since then (Pierce 1997; Hawcroft and Milfont 2010). When the scale was designed, Riley Dunlap was quoted as saying: “Environmental problems cannot be solved without understanding how society works” (Jussila 2002:6). An in-depth exploration of humanity is thus required if any solutions are to be designed. The relevance in using the DSP has become evident in various literature which argues that the traditional DSP, developed in America, could possibly be contributing to environmental problems, or could be debilitating efforts to ameliorate them (Dunlap and Van Liere 1984). This realisation led to the challenging of these views by various academics and eventually to the creation of the NEP.

The notion of using paradigms to analyse worldviews and their respective impact on environmental issues has become popular in the field of the social sciences. It was within this enquiry that the shift from the DSP, which emphasized economic growth, to the New Environmental Paradigm, which transformed into the New Ecological Paradigm (NEP), was identified. A scale was developed which measured the endorsement of two contradicting worldviews, that of the HEP and NEP (Catton and Dunlap 1978; Sunderlin 2002).

Dunlap and van Liere developed the New Environmental Paradigm scale after observing a conflict between traditional American values and environmental views. Environmental paradigms have been thoroughly explored through various disciplines and have generated a “broad base of knowledge about individuals’ values, beliefs and perceptions concerning the natural world and humanity’s place therein” (Putnam *et al.* 2006:401). As early as the 1970s, an “ecological worldview was diffusing” from the scientific community to society at large, and it became evident that the “new social paradigm represented a challenge” to the DSP (Dunlap 2008:3). Dunlap and van Liere introduced the concept of the New Environmental Paradigm in 1978. Since its inception, it has been used extensively in the social sciences for empirical research. Dunlap recently connected the inspiration of the paradigm to an environmental controversy with farmers and their practice of field building. It was within the interaction with the public, farmers and the government that he realised the prevalence of using traditional American values as a method of mediating the masses. In combination with the 1970 Earth Day

observations, he used this to construct a questionnaire later published as the “Concern for Environmental Rights Scale,” which focused on the relationships between political views, traditional American rights and environmental items. These theories were then developed further to gauge the relationship between DSP endorsement, HEP views and environmental concern (Geno 2000; Sunderlin 2002).

Dunlap set out to ascertain the levels of unsustainable beliefs. He focused on devising a survey which would include measuring “public commitment to the DSP and its relationship to support for environmental protection” (Dunlap 2008:5). He goes on to explain the flaw in the uncritical acceptance of the DSP, when it has become outmoded and unsustainable in its’ current state. It specifically impacts the environment of the future. Furthermore, it is also suggested that the DSP fulfils the duty of guiding a society in survival (Pirages and Ehrlich 1974). Even though this text provided a construction of the DSP, it did not indicate tools for the measurement of such a social paradigm. Dunlap and van Liere thus conceptualized the DSP as multidimensional and devised a scale to measure these. They simultaneously analysed environmental literature and designed a three-pronged measurement tool focusing on “existence of ecological limits to growth, importance of maintaining the balance of nature, and rejection of the anthropocentric notion that nature exists primarily for human use” (Dunlap 2008:6). These have been dubbed the three facets of the New Environmental Paradigm (NEP). There were some key weaknesses identified in the original NEP scale, including limited theoretical backing and focusing primarily on pro- NEP items. The NEP was revised in 1981 to be a part of a large environmental survey to represent a balance between pro-NEP and anti-NEP in a shorter six question survey. It became widely used, thanks to John Pierce’s research (Pierce 1997; Catton and Dunlap 1978; Hawcroft and Milfont 2010).

Another revision of the scale was inspired by a perceived shift in global environmental concerns. Dunlap attempted another revision of the NEP scale prompted by the work of Stephen Cotgroves’ *alternative environmental paradigm* and other literature of the time (Cotgrove and Duff 1980). This revision included focus on distinguishing between values and beliefs, such as beliefs about the finite nature of the natural world and values about “how society should be organised” (Dunlap 2008:9). In the late 1980s, however, Dunlap outlines the paradigmatic conflict inherent in the emergence of the term sustainable development, which essentially offered a “synthesis of the traditional growth-oriented and new environment-

oriented paradigms” (Dunlap 2008:9). This is hypothesized to be one of the drivers of the success of the New Ecological Paradigm scale to subtly elicit its endorsement, in that it took the societal consequences of sustainable development rhetoric into account.

The revised NEP scale

It wasn't until 2000 that the latest version of the NEP scale was published (Dunlap 2008; Dunlap *et al.* 2000). Instead of investigating the transition from a DSP to a new environmental paradigm, the new scale is often used to ascertain the degree to which participants endorse an ecological worldview. It measures their ecocentricity, and is sometimes referred to as Ecoscores (Dunlap 2008). This emphasized testing a view of nature represented as fragile, and the opposing idea of human domination over nature, as well as the notion of faith in technology and the prevalence of seeing it as a solution to most issues (Clayton and Myers 2009; Dunlap *et al.* 2000). The revised NEP scale, used in this study, has been widely used as a measurement of pro-environmental attitudes.

The NEP is a summative scale, which encompasses NEP and DSP items, and examines five themes of inquiry. The first section measures the “limits to growth” belief, regarding lack of faith in the ability of the planet to sustain population growth. Secondly, the scale measures “balance of nature” perception, the belief that nature and natural ecosystems are vulnerable to the impacts of development and human intervention. Thirdly, it gauges a participant's belief in anti- anthropocentrism, which argues against the belief that humans have rights above animals and plants to exist, and that humans are the most significant, central species on earth. Fourthly, it tests endorsement of human exemptionalism, which encompasses the view that humans are exempt from the constraints which nature puts on other living beings, and faith in human ingenuity to solve eco-problems. Fifthly, it probes at the participant's belief in the possibility of catastrophic environmental disasters and changes, or an eco-crisis (Hawcroft and Milfont 2010; Lalonde and Jackson 2002; Wilhelm-Rechmann *et al.* 2014).

Unlike the original scales, which were exploring participants' transitions from a DSP to a new environmental paradigm, the scale measures the level of endorsement of the NEP and their rejection of the DSP (Dunlap 2008). This is evidenced in Table 4, illustrating the two paradigms which combine to form the scale. It also illustrates the inverse relationship between

endorsement of the NEP and the DSP.

The use of the NEP scale has had broad implementation. It has been used as a way to determine overall value systems of whole populations, to determine the impacts of education on attitudinal change and more importantly to this study, it has been used as a mediator to determine the likelihood of environmental behaviour (Noblet *et al.* 2013). Furthermore, Givens and Jorgenson argue that there is a causal link between relevant economic issues and the NEP. They also identified a lack of research on the NEP scale and similar environmental measures in the Global South, hypothesizing that the dominant focus has been on affluent nations (Givens and Jorgenson 2011).

NEP scale use in Africa

NEP studies in the African continent have been conducted for many years, however, the usage in South Africa has been limited. Spinola used the NEP scale as a part of an integrated

Table 4: New Ecological Paradigm scale divided into NEP and DSP sentiments

New Ecological Paradigm	Dominant Social Paradigm
<ul style="list-style-type: none"> • We are approaching the limit of the number of people the Earth can support. • When humans interfere with nature it often produces disastrous consequences. • Humans are seriously abusing the environment. • Plants and animals have as much right as humans to exist. • Despite our special abilities, humans are still subject to the laws of nature. • The Earth is like a spaceship with very limited room and resources. • The balance of nature is very delicate and easily upset. • If things continue on their present course, we will soon experience a major ecological catastrophe. 	<ul style="list-style-type: none"> • Humans have the right to modify the natural environment to suit their needs. • Human ingenuity will insure that we do not make the Earth unliveable. • The Earth has plenty of natural resources if we just learn how to develop them. • The balance of nature is strong enough to cope with the impacts of modern industrial nations. • The so-called “ecological crisis” facing humankind has been greatly exaggerated. • Humans were meant to rule over the rest of nature • Humans will eventually learn enough about how nature works to be able to control it.

(Adapted from Boiral *et al.* 2009; Dunlap *et al.* 2000; Jarbandhan 2014)

questionnaire to test for ecological knowledge, attitude towards the environment, and environmentally responsible behaviour. This was done for a paper about environmental literacy in students, comparing 'Eco-schools' to standard schools (Spinola 2015). The NEP scale was used to measure the pro-environmental attitude in the middle section of the questionnaire. Spinola recognised the limitation of using questionnaires as the sole data collection because of the complex learning processes researched. However, Ogunbode investigated environmental attitudes amongst students in Nigeria, and found the NEP scale to be the most valid and reliable measure to do that (2013).

The NEP has been limited in its local South African use, but there have been some studies which utilized it. Angelika Wilhelm-Rechmann and her colleagues used the NEP scale and assessed its potential as a component of socially evaluating conservation projects. At the time in 2014, it was considered to be the first application of the scale in the African continent. It was used, according to the researchers, because of its widespread use as a tool for investigating the degree of ecocentricity of people. Ultimately, they found that the scale had merit in determining individuals' pro-environmental views, with some deviations around culture and rank (Wilhelm-Rechmann *et al.* 2014).

A Master's study by Meyer in the field of Consumer Science research used the NEP in the city of Tshwane to ascertain environmental and recycling attitudes. It has also been tested extensively, across samples and cultures, and is therefore considered to offer internal and external validity (Meyer 2013). The above two are the only available studies which utilized the NEP in its true form in South Africa.

Diffusion of Innovation research

The diffusion of innovation theory offers insight into the workings of interpersonal communication in the farming sector, as well as knowledge acquisition and awareness theory. The theoretical framework which forms the basis of the theory's exploration is that in order to gain understanding of any social system, the focus of research should be on individuals and the interactions between them (Srivastava and Moreland 2012). The theory allows for analysis of individual's within a social system, as well as the social system itself (Stuwe 2009). Another aspect which makes this theory valuable for this type of research is the merging of

communication and the media with agricultural practice (Srivastava and Moreland 2012; Povellato et al. 2001).

Stages of adoptions

As an avenue of research inquiry, diffusion of innovation has seen exploration in the various stages of innovation adoption. The stages are Knowledge of the innovation, Being persuaded to adopt the innovation, making the decision to adopt or reject the innovation, Implementing the innovation on a trial basis and then confirming its usefulness, or lack thereof, as can be seen in Figure 2 (Lynch 2007; Rogers 2003). The theory is used, in this study, for its explanation of communication channels and the role of the media and the community in the awareness, knowledge and persuasion stages (Sahin 2006).

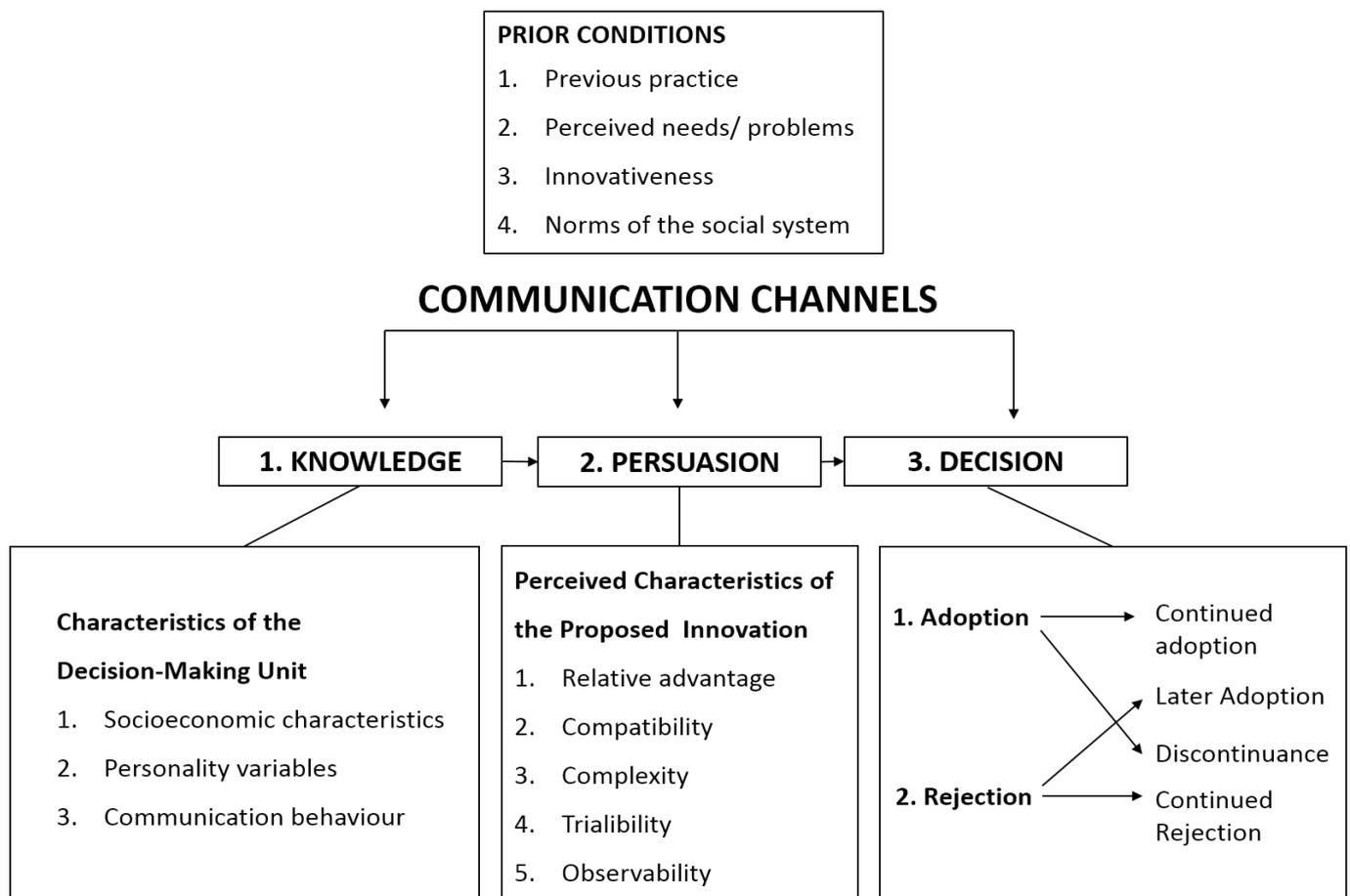


Figure 2: Three stage model adapted from five stage model in the Innovation-Decision Process
(Adapted from Rogers 2003)

Interpersonal channels as part of information acquisition

Farmers rely heavily on interpersonal communication channels for information acquisition, as is illustrated in (Rogers 2003). At the inception of a new innovation into a social system, most of the individuals' who adopt are innovators and opinion leaders who source their information from outside, including the media. This is evidenced by the media being responsible for 70% of awareness levels, whilst responsible for only 3% of adoptions. Fellow farmers, conversely, are responsible for only 13% of awareness but account for 51% of adoptions. Extension officers also have a role in adoption, as is evidenced by their being responsible for 23% of adoptions (Havenga 1974).

In addition to this, Figure 3 illustrates this point visually. It has been found that the external influence mainly plays a role in awareness and knowledge, and that internal influence is particularly effective in the persuasion stage (Stuwe 2009). However, Rogers integrated the media and interpersonal communication into the model, equating the media with external influence and interpersonal communication with internal influence (Rogers 2003). This indicates the differences and links between mass media and interpersonal communication channels as they influence information diffusion.

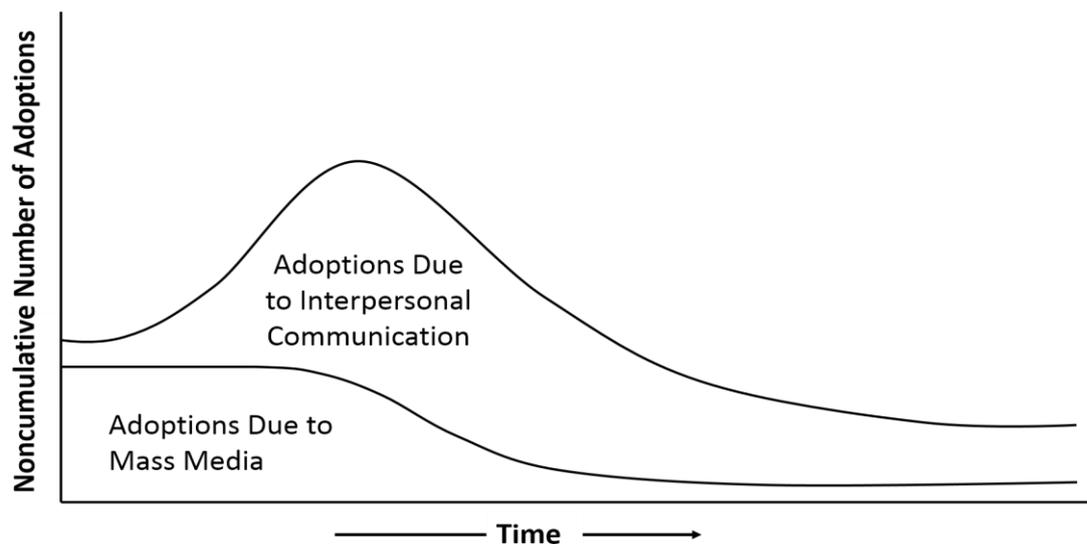


Figure 3: The Bass Model

(Source: Mahajan, Muller and Bass (1990) as reproduced in Rogers, E.M. (2003:210)).

Research also showed that adopters of innovations had better perceptions of environmental issues and were concerned about the potential damage of certain farming practices (Povellato *et al.* 2001). Following the initial adopters, opinion leaders are mostly cosmopolite and have an above average connection to external information, such as the media and the extended community (Sahin 2006). They also generally confine to the social norms of a system, have good social status and participate in social gatherings (Havenga 1974). The opinion leaders' influence in a specific system is also determined on how well the innovation fits into the social norms (Rogers and Everett 1983). Opinion leaders are different from innovators in that they are more cautious and selective when adopting a practice or idea, and often rely on practical use of an idea as proof of its' worth before adopting it (Havenga 1974).

Furthermore, opinion leaders are believed to fit into two categories, one of these pertaining to individuals who can give advice on a wide range of topics, and the other category for individuals who have one area of expertise which people ask their advice on. The former is referred to as a polymorphic leader, whilst the latter is called a monomorphic leader (Rogers and Everett 1983). Most opinion leaders in conservative and traditional communities are polymorphic. In modern and progressive communities, opinion leaders are more likely to be monomorphic (Havenga 1974).

According to Rogers, an innovation adoption increases dramatically once interpersonal networks are engaged. Communication amongst members of a social system is crucial in the diffusion of innovations (1983). Povellato and her colleagues also confirmed that interpersonal communication has more influence on individuals than the mass media does, specifically with regards to adopting innovative practices (2001). This exchange becomes even more meaningful and impactful in changing attitudes and behaviour if the two or more participants share like characteristics, such as culture and language (Rogers 1983).

It is also important to note that the information tends to flow through interpersonal communication networks which allow opinion leaders to disperse their innovations, and become models for behaviour (Rogers 1983). Individuals are more likely to adopt these new practices when they have been recommended by their interpersonal farming networks because they trust a practice which has proven itself under farming conditions (Havenga 1974). Simin and Jankovic demonstrate that innovations are linked to prevalent social paradigms, which influence the adoption process. For example, organic agriculture is seen to be the result of a

broader context, including environmental discourses in the public as well as modern development goals (Simin and Jankovic 2014).

Although a lack of inquiry into the effect of interpersonal communication amongst farmers in South Africa has been noted, it has been the topic of research in other parts of the world. A Masters study in Nordic Media explored the role of communication in the Malawi Agricultural sector, with a special emphasis on conservation agriculture. It was found that interpersonal communication played an integral part in relaying information to farmers, and needed to be taken into account should agricultural interventions be necessary. Ndilowe also found that interpersonal communication was the most effective way to influence an individual, specifically with regards to the adoption of new and innovative practices (2013). In South Africa, the governmental Department of Agriculture, Forestry and Fisheries is intended to play a role in encouraging eco-innovations and encourage sustainable, productive and profitable agricultural production (Jacobs and Meissner 2011).

Environmental communication and the mass media

From environmentalism to environmental communication

The appreciation of the environment for its intrinsic and aesthetic values was initiated by Christine Oravec in 1981. Her book, *John Muir, Yosemite, and the Sublime Response* is often credited with being the origin of the field of environmental communication (Cox 2007; Oravec 1981). It describes the experiences of John Muir, an environmental activist responsible for the preservation movement, which involves the protection of wildlife areas for their inherent, scenic and recreational values (Oravec 1981). She also traces Muir's role in elevating the issue of preservation of natural wonders for their own sake to the forefront of public discussion. Thus, John Muir's articulation of threats to a specific environment is credited with the birth of environmental journalism, and more broadly of environmental communication, as we know them today (Rademakers 2004).

This contributed to the powerful discourse it became in future, and aided in starting the social movement against environmental degradation. Muir also succeeded in transforming this appreciation of the environment into public demand for preservationist legislation (Oravec

1981). Environmental communicators who aim to inform and influence the public to command the protection of the remaining biodiversity still face challenges (Cox 2007).

Scientists are particularly challenged at communicating environmental threats and concerns to society and decision makers to influence public perceptions. Some blame the scientists and the media, and sometimes the general public, which is based on an underlying assumption that the public does not understand the dire state of the environment (Contractor and Dechurch 2014). Likens of the Cary Institute of Ecosystem Studies, with specific interest in human impacts on aquatic and terrestrial ecosystems, outlines the need for better communication amongst scientists, managers, policy makers, the media and the public with regards to human-accelerated environmental change (2010).

There tends to be a time lag between the detection of environmental problems and widespread public knowledge of the fact. Furthermore, even more time lapses before the issues filter through into policy. This means that environmental interventions are often crisis-driven, because once they are implemented the issues have escalated. Thus, it is necessary for scientists to provide understandable and accessible information to allow for well-informed public perceptions of such problems, as well as their management, through communication (Likens 1998).

This translates to the ethical duty and responsibility scientists have as environmental communicators, as well as the need for them to consider communicating their science differently (Cox 2007; Leggett and Finlay 2001; Likens 1998). Some studies, for example, have found that there is an intrinsic distrust in the general public of the word 'sustainable,' whereas the term 'natural' did not carry those connotations because it allows for subjective associations with selected aspects of nature for aesthetic reasons (Leggett and Finlay 2001). It is important for communicators to be aware of these preconceived ideas before attempting to influence the public and public norms within the target audiences.

Environmental communication often lacks pragmatism, and environmental communication practitioners have been called to abandon the traditional communication models in favour of focusing on particular challenges in this specialised field (Flor 2004; Ralston 2011). This needs to be remedied by making environmental communication a practical field of inquiry in order to achieve tangible non-academic results (Cox 2007). This has already been successfully attempted by some innovative sustainability scientists (Lindenfeld *et al.* 2012).

Furthermore, it has to depart from conventional communication methods that are contextually ineffective in achieving the numerous goals environmental communicators often set for themselves. The traditional approach needs to be reconsidered in order for environmental communicators to achieve their often elaborate goals.

Alexander Flor approached the concept of environmental communication from a deep ecology perspective in *Principles, Approaches and Strategies of Communication Applied to Environmental Management* (Flor 2004). He recommends a restructuring in the communication process, disregarding communication models in favour of focusing on the particular challenges environmental communicators are faced with. Firstly, they have to be equipped with knowledge of ecological laws, sensitivity to the cultural dimension of the issues, have the ability to network effectively, be able to use the media as a social agenda setting agent, appreciate and practice environmental ethics and be able to resolve and mediate conflict (Flor 2004). Although this idealistic approach will offer more meaningful environmental communication, it fails to account for the realities of the mass media and the way information disseminates through society.

Sustainability science, by definition, needs to influence and inform society. Herein, environmental communication could play a crucial role. In the article, 'Creating a Place for Environmental Communication Research in Sustainability Science', Lindenfeld and her colleagues investigate the emergence of sustainability science (2012). They specifically assess how environmental communication can increase the effectiveness of various scientific sustainability approaches. In their understanding, environmental communicators are able to create and design communication that actively influences the target audience into changing their behaviour in regard to an environmental situation (Lindenfeld *et al.* 2012).

Environmental communication is outlined as the dominant driver of change affecting public perception surrounding environmental issues. This is done primarily by highlighting the importance of environmental communication in creating "useable knowledge" which helps transform knowledge into action by stakeholders (Lindenfeld *et al.* 2012). Furthermore, the need for environmental communication is also critical in order to reorganise disciplinary knowledge within sustainability science (Cox 2007). This is because researchers are challenged to "engage with groups outside academe" within research teams which are trans- and interdisciplinary. However, this collaboration is complicated and often time-consuming

because approaches have to be scrutinized in order to find successful implementation practices (Lindenfeld *et al.* 2012:31; Ralston 2011).

Environmental Journalism

Environmental journalism is a relatively new sub-field of journalism, which emerged in the 1960s spurred on by awareness of environmental issues (Boarassa *et al.* 2013). Environmental journalism calls for an understanding of the audience's needs, comprehension of the topic before reporting on it, covering environmental issues in-depth, being able to translate the science, historically outlining the topic, focusing on risk, using a range of diverse sources, maintaining the coverage over a period of time, being able to objectively disseminate the information and increased specialized training for journalists (Rademakers 2004). These needs are apparent because journalism education often does not include practical skills to better frame environmental and sustainability issues (Boarassa *et al.* 2013).

Journalists are often criticized for being too conventional when reporting on environmental issues. The usefulness of this specialization is prevalent in the criticism of environmental journalists trying to adhere to the traditional values of news reporting (Rademakers 2004). Conventional journalism has been argued to depreciate environmental journalism (Rademakers 2004). Detjen suggests that blending objectivity and education would guide journalism to provide adequate coverage of sustainability (2002). He calls for journalists to be a part of the solution to environmental problems, going beyond their traditional role, and argues that the professional practices should be in line with what the world should ultimately look like (Detjen 2002). Another stumbling block for reporting on any science topic includes the difficulty for journalists to relay the research process to publics who are not necessarily familiar with the drawbacks of various research methods (Rademakers 2004).

There are various other challenges associated with environmental journalism. Research conducted with focus groups regarding global warming unearthed the following concerns: lack of adequate information, insufficient background and context information, confusion about the stories and content from different viewpoints and confusing use of frames (Rademakers and Rademakers 2004).

The media coverage of science, which includes environmental topics, often sees journalists as intermediaries between scientists and the public. This environmental subsection of science mass communication is often unique in its coverage and interpretation, because it has an ethical duty to fulfil as well (Cox 2007; Lakoff 2010). The media has a critical role in setting agendas and framing messages, which influences public understanding (Lugalambi *et al.* 2011).

Agenda-setting refers to the valuation of newsworthiness by select individuals, or elite media who function as gatekeepers. When reporters present topics prominently and frequently the public gains a deeper understanding of important issues (Coleman *et al.* 2009). By being selective, editorial staff may act as gatekeepers who predetermine public discourses. The theory suggests that the media, through mere selection of articles, predetermines what the public will think and talk about. This was corroborated by McCombs and Shaw, who found an almost perfect correlation between the media's and the public's agenda, indicating that there might be a causal relationship both ways (Coleman *et al.* 2009; McCombs and Shaw 1972). It is also determined through the intensity of focus on various topics (Wilcox and Cameron 2012). Public opinion seems to be guided by emphasis placed on various issues. (McCombs and Shaw 1972). Furthermore, it is theorised that the elite media set the agenda for smaller news organisations, therefore having a ripple effect of agenda-setting (Coleman *et al.* 2009). It can also cause misconceptions and lead to the oversimplification of environmental issues.

There are those who disqualify agenda-setting as a theory, claiming that it serves more as a metaphor than a theory. Iyenger and Kinder justifies this by claiming that the research into agenda-setting is inadequate and primitive (1989). Qualter argued that the main function of the media is to uphold conformity, protecting society from disconcerting and distracting information (1985). Agenda-setting does not merely involve which stories are selected, but also how they are told, or framed, to the public.

Framing, as a discourse tool, refers to how a certain topic are reported on, and indicates the angle through which the story is constructed. It is very often powerful enough to affect public opinion (Wilcox and Cameron 2012). Framing is usually engaged strategically, to control the outcomes of a message to a certain agree (Entman *et al.* 2009). It thus potentially has the power to misinform the public by focusing on some aspects of a story and ignoring others.

There is also a positive outlook on the use of framing, which includes well recognised frames which aid in quick understanding by the public. In this way, framing becomes an structuring idea central to the providing meaning to the reader (Entman *et al.* 2009). It can be useful to elicit immediate audience understanding through pre-established frames which have been familiarized through the media over time. This leads to an over-reliance of framing to ensure the information is thoroughly understood by the audience. It therefore follows that careful consideration is necessary to determine the effects of framing on public perception and understanding of environmental issues in a given research context (Lakoff 2010).

Chapter 3: Research Methodology

Research approach of overall study

This project forms part of a larger project, “Linking social networks and social capital to ecological infrastructure” (see: <http://sru.nmmu.ac.za/Projects>), funded by the Water Research Commission and implemented by the NMMU Sustainability Research Unit (SRU) and the Council for Scientific and Industrial Research (CSIR). Interdisciplinary investigations have become common practice to explore issues such as resource scarcity and degradation, and dealing with the issues against a SES framework (Binder *et al.* 2013). It focuses on understanding the system as a whole, with all the various drivers of human behaviour and the subsequent impacts on ecosystem health (Binder *et al.* 2013; Will 2008). This project does not stand alone. It is a part of a multidimensional approach to determining the drivers of the quality of the Ecological Infrastructure (EI) in the Garden Route, specifically the Touw and Duiwe River Catchments. This larger project lends focus to the merging of scientific and societal knowledge, with this project forming a part of the latter.

The motivation behind the study involved the ecological uncertainty which comes with global complexity and change. It stemmed from the acknowledgement of not only the widespread changes in the SES, but also the possible risks and consequences to society if these were not addressed (Folke *et al.* 2011). This study aimed to promote social-ecological transformation to achieve a sustainable future for the catchment areas. It did this through providing opportunities for knowledge exchange, stakeholder engagement and networking across traditional stakeholder spheres. The study hoped to highlight the significance of preserving the state of South Africa’s water sources to provide stakeholders with ecosystem services (Schachtschneider 2014).

Research Approach

This research project approached the above issues, and aimed to achieve the objectives, through a constructivist and pragmatist lens (Bryman 2012). The participants have constructed views about the issues which were formed through experience and interaction with others. This understanding was developed through recognizing how the issues have manifested, involving

multiple participants and their views, exploring the social and historical construction of issues to eventually develop an understanding of the possible flows of communication. This was corroborated with environmental communication theories. In addition to this, the research is constructivist in that it focuses on the social and historical contexts in which the stakeholders operate (Creswell 2003). It also opens the researcher up to identifying constructions of reality within these contexts. The constructivist theory also implies that participants make sense of their experiences and views based on social and historical perspectives, which are informed by farming culture specific to South Africa, and can then be interpreted by the researcher (Creswell 2003). Furthermore, meaning creation is considered a social phenomenon, being attributed to interaction within their community (Creswell 2003). The research was conceptualized from problems and consequences in the area, and is thus real-world practice oriented (Creswell 2003). Because of the above approaches, a mixed methods approach was identified as being the most suitable.

Different strategies are used in quantitative, qualitative and mixed methods research approaches. For the study, a mixed methods approach was initially selected because of the inherent biases in most research and mixed methods' ability to curtail biases. Mixed methods allow methodological triangulation through convergence of quantitative and qualitative methods and approaches (Creswell 2003). This is also the fundamental reason methodological triangulation is being used to validate, corroborate and compare findings because it often offers deeper understandings of the research inquiry.

Research Methods

Initially, a sequential two-pronged tactic was planned, starting with questionnaires to the agricultural water users, which were to be analysed and integrated into the interview schedule design. These results would then have been triangulated with follow up in-depth semi-structured interviews. The approach had to be adapted due to the time constraints of the stakeholders, as they were only able to offer once-off participation. Furthermore, the social and professional gatherings attended by the researcher, such as the Farmer's Association meetings and the Study Group meetings, did not give the researcher adequate time to engage with every possible participant throughout the questionnaire process. Instead, the gatherings

offered an opportunity to collect contact information for potential participants, who were called at a later stage to be asked for their willing participation.

The qualitative data collected during the questionnaire through discussion was found to be a valuable source of data and the availability of the researcher to answer questions promptly whilst the participants' filled in the questionnaires ultimately made them more comfortable. Therefore, the questionnaire and interview schedule were reconsidered and combined, to create a concise interview schedule. It combined quantitative questions triangulated by some in-depth probing questions for a deeper understanding of the reasoning behind the answers and the emerging themes. This project thus incorporated mixed methods concurrently (Creswell and Plano-Clark 2011; Creswell 2003).

The semi-structured interview method was selected due to the qualitative nature of the intended data collection and because it is considered effective in systematically drawing out "interviewees' own perspectives" (Bryman 2012:470). It allowed for rich and detailed answers where the rambling proved to be as important as the structured questions. Therefore, a set of prompts were prepared for the interview part of the session as opposed to structured questions (Bryman 2012).

Furthermore, a broad selection of news articles from a regional newspaper (74 from the George Herald) and farming magazines (32 from the Landbou Weekblad and Farmers Weekly) were analysed to provide an overview and analysis of media content. Content Analysis was incorporated to process the data, followed by Critical Discourse Analysis on selected articles with a narrower selection criteria (Fram 2013; Leitch and Bohensky 2014). This was done due to the volume of articles acquired in the first selection process. The selection process and criteria are explained in the Sampling procedures and Data Collection section below.

1) The 24 semi-structured interviews included questions about the participants' origins and their farming history and experience; farming practices and the willingness to explore alternatives; the effect of regulations on their water practices and the ideal water regulation scenario; water, water conservation and river conservation practices and the reasoning behind these; and knowledge and information acquisition specifically regarding the media. This included the reading habits, media use for information gathering and which topics they actively seek information on. In addition to this, the participants were questioned in the interview regarding where, or through which medium, they access their media information.

2) This was followed by a 15 point scale and a 10 point demographic section, which included the New Ecological Paradigm (NEP).

- i) The NEP was used to ascertain the farmers' perception of nature as a determinant of their environmental concern, or their ecocentricity (Dunlap *et al.* 2000). The NEP scale seemed effective at the outset of the research project in its use of tapping into people's cognitions (as expressed through their thoughts and knowledge) as well as their personal feelings or evaluations (Corbett 2006). The scale was envisioned in the 1970s as the New Environmental Paradigm scale, and revised in 2000 as the NEP scale used recently to measure the ecocentricity of the public (Catton and Dunlap 1978; Corbett 2006; Dunlap 2008; Dunlap *et al.* 2000). The revised NEP scale consisted of 15 questions, eight measuring endorsement of the NEP, and seven measuring endorsement of the DSP. The DSP questions are reversal items, which needs to be taken into account when coding responses.

The 15 questions were measured with a five point Likert scale, ranging from Strongly Disagree to Agree. The NEP statements were coded as a five for strongly agree and a one for strongly disagree, while the DSP statements were coded as a one for strongly agree and a five for strongly disagree. The scale was partitioned into five dimensions, each having three questions dedicated to gauging the level of endorsement. Participants could score a minimum of 15 and a maximum of 75, the higher the score the more pro-environmental their attitudes and views (Meyer 2013). Unlike the original scales, which explored participants' transitions from a DSP to a new environmental paradigm, the scale measures the level of endorsement of the NEP (Dunlap 2008). The scale is also categorised by five sections, as mentioned above: 1) The reality of limits of growth, 2) Anti-anthropocentrism, 3) Awareness of the fragility of nature's balance, 4) the Rejection of human exemptionalism and 5) the Belief in the possibility of an eco-crisis (Bakker 2007; Dunlap 2008). It has been found recently that treating the scale as a unidimensional composite score for ecocentricity is problematic, and suggested that the NEP scale has value in being a "multifaceted measure of environmental concern" (Amburgey and Thoman 2012:250). Consequently, this research analysed the scale in its entirety first, and followed this with analysis of the five dimensions.

Some participants expressed concern over the generalised statements used by the NEP scale, which has also been found in other research (Amburgey and Thoman 2012).

Therefore, the researcher restructured the collection of NEP data to include a discussion during the scale should the participants want to speak about concerns or justify their views.

The demographic questions included age, race, marital status, education and agricultural education, farming experience, association's belonged to and professional travelling endeavours. It aimed to provide the researcher with a sufficient background to use for tracking different perceptions according to age, farming experience and education.

For the media content and discourse analysis:

- 1) Relevant media texts were acquired through various processes. These included scanning articles at the George Herald archives, located at the George museum, Western Cape, South Africa. The online database of Farmers Weekly and Landbou Weekblad were also utilized to obtain articles for analysis. After exclusion criteria were finalised, a total of 106 articles were used for the media content analysis.
- 2) As background, the legal frameworks for water use were overviewed, paying attention to frameworks particularly relevant to farmers, and with specific focus on changes from 1994 to 2015. This is done to determine the socio-political contexts which inform the farming community of South Africa in their views.

The tools that were used included a notepad, pen and a recording device. However, if it was sensed that the participants seemed suspicious and on guard due to the recording device, note-taking was the sole data capturing technique. The participants were also asked if they were comfortable with the device, ensuring them that they could refuse to be recorded (Taylor and Bogdan 1998). Notes were taken by the researcher during the interviews which allowed for the further exploration of prevalent terms and themes. Other details that were recorded included the date, time and location of the interview (Taylor and Bogdan 1998). If the interviewees displayed discomfort or appeared to be uncomfortable with the questions, the interviewer only asked pertinent questions to ensure standardization of data (such as demographic questions and the NEP scale), but did not probe as extensively as with participants who seemed eager to share information. This was to ensure that participants were not forced to surrender information they did not want to impart, and to ensure the willingness of participation in

accordance with the Belmont Report (The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research 1979).

Sampling procedures and Data Collection

Farmer Surveys and Interviews

The farmers were initially approached through Farmer's Associations and study groups, namely: the Knysna Farmer's Association; Outeniqua Land Farmer's Association and the Outeniqua Dairy Study Group. These were identified as the sampling frame. Their water sources, and the catchments they are possibly impacting, included the Touw, Maalgate, Gwaing and Great Brak rivers. Chan referral was also utilized, and brought the final number of participants to 24.

The Farmer's Associations and study groups were approached telephonically for further contact information on their database of farmers. It was suggested by the Chairmen of these Farmer's Associations and study groups that a presentation of the research projects aims and objectives, as well as sampling procedure, be done at their meetings to ensure buy-in from the members. This was done at three meetings. Upon completion of the presentation, a request for contact details was made to the farmers personally. This was to ensure participants' willingness. The researcher acquired the contact details of 19 stakeholders through this process, as well as through networking after the meetings. The researcher stayed for the social aspect of the gathering after the formalities were handled, at the request of the members. The importance of sharing in their social space was evident in the increased buy-in acquired by the members after networking. Some members of the community needed face-to-face assurance that their water practices would be kept confidential, and that the research was merely investigating perceptions of water conservation and the ultimate influence on behaviour. The individuals were then contacted telephonically from the database and asked if they were still interested in participating. Interviews were then scheduled at the convenience of the participants. Due to geographic and personal constraints, only 17 of the contact details were valid. Three of the participants were also too busy at the time of data collection to participate, because of various farming demands on their time.

To further increase the sample, chain referral method was used, to ensure that a large enough sample could be reached to ensure that the data is representative of the stakeholder group. This was done because the stakeholder group was often located in remote areas, which made it difficult to get contact details or approach them directly. Participants were asked, after the interview had been concluded, if they knew other farmers in the topic of study area who had a perceived interest in the study and would be willing to participate (Newing 2011). Thus, such referrals and personal introductions ensured buy-in from the possible participants.

When data had been collected, the recordings were transcribed by the researcher. The 18 Afrikaans interviews were simultaneously translated and transcribed by the researcher, who is fluent in both Afrikaans and English. The English interviews were merely transcribed. Constant analysis was done throughout the data collection process to ascertain emerging themes. Coding was only done after the translations and transcriptions on the English transcripts to ensure consistency.

This was also done, after the minimum amount of participants were interviewed, to determine when saturation was reached. Saturation referred to the point in data collection when adding more cases to the sample does not produce much important new information and understanding relevant to the research questions. When saturation was reached, the researcher took it as an indication that the remainder of the referred to participants could be contacted for possible interviews, but that no new chain referrals should be asked for (Newing 2011). This point was reached after the 24th participant.

Media Article analysis

The articles from the George Herald (<http://www.georgeherald.com/>) for the floods in July/August/September 2006; November/December 2007 and November/December 2008 were selected. For the drought, the period of December 2008, through to the end of 2010, were used as a sample. The total number of articles for the local newspaper was 74.

For the niche agricultural publications, namely the Landbou Weekblad (an Afrikaans version of the Farmer's Weekly: <http://landbou.com/>) and the Farmers Weekly (<http://www.farmersweekly.co.za/>), the time period was extended to include any flood coverage in the region. It also included some coverage on the regional drought in 2011 to

ensure an adequate sample. The total number of articles for the niche agricultural publications was 32. The extended time periods were selected to ensure salience of environmental communication framed around water issues. It also correlated with the farmer interviews and questionnaires. At the archives, each George Herald was manually scanned through to find articles surrounding the drought or any other environmental or water-related issues. The headings, as well as every article's first paragraph, were perused to ensure all relevant articles were included in the selection. These were then scanned and stored electronically. In order for the articles to be included, the following terms were scanned for: Water, drought, flood, wet, river, dam, rain, threat, opportunity, sea, disaster, fear, hope, sustainability, and impact. Even if the following words were not present but the article focused predominantly on floods, droughts or climate change/global warming risks, it was included. Conversely, if the article included the words from the inclusion criteria but did not focus on relevant subject matter, it was excluded (for example water sports). After this initial sample proved to be too extensive and repetitive in nature, the articles were further analysed according to the interview responses and the most relevant ones were selected.

The article selection from the Farmers Weekly involved searching their database for the words "drought" and "George." The search did not need to be narrowed because of their limited online database. The article selection from the Landbou Weekblad repeated this process, but had to account for included selection criteria due to the size of the online database. These were (English words included in brackets where applicable): "droogte" (drought), "melk" (milk), "George," "Tsitsikamma." The first criteria had to be present in the article (drought), but the other criteria were entered in a bracket, so that the articles only had to contain one of the other words. The same was done to find coverage of the floods, using the search terms "George" and "flood" in English for the Farmers Weekly and in Afrikaans for the Landbou Weekblad.

Data handling, coding and analysis

Farmer Surveys and Interviews

The responses from the survey were entered into a database to store the participants' NEP scores, hereafter referred to as Ecoscores. The individual NEP and DSP scores were also

calculated, as well as the five paradigms the scale aims to test. The demographic information of the respondents was also entered into this file, to be analysed in accordance with finding relationships between the variables. The file used participant numbers with a separate file with names and contact details which was encoded with a password to ensure confidentiality.

The interviews were transcribed, capturing everything that could possibly be relevant to the project themes and questions. Summaries were made after the interviews and media data collection so as to document recurrent themes and topics that emerged through the interview, before being entered into the digital database (Schreier 2012). Thereafter, a coding framework was built around the preliminary data before more detailed coding can be applied. Once this was been done, the Constant Comparative Analysis (CCA) Method was used. This allowed the researcher to identify commonalities and differences, and to determine relationships between variables of the data (Harding 2013).

Open coding was used to sort the relevant data from the irrelevant, which often required extensive interpretation. By creating a code, we hoped to eliminate some of the potential bias from this process of analysis (Babbie 2005; Schreier 2012). The codes that emanated from the data, as determined by the responses and the research questions, included: How participant views water; How participant views ecosystem functioning; water saving practices; conservation perception; conservationist perception; challenges around water; media coverage of drought; mentions of drought; how media affects participants practices; primary source of information; mention of internet usage; agricultural communication and information; media publications mentioned; interpersonal communication; farming history and experience; reliance on generational teachings; financial implications; size of farm; commodity; irrigation practices; Invasive Alien Plant Management; farming innovations employed.

Coding was loosely based on responses relevant to the research problem to ensure focus, and thereafter using the questions to identify broader themes and dimensions, omitting unrelated responses (Schreier 2012). According to Harding (2013), the first step to creating relevant and useful codes is reading the transcripts and identifying categories of information for the various questions and responses. Thereafter, codes were allocated to various sections of the transcripts in order to summarise and identify relevant exerts, as well as interpret the correlating data efficiently (Schreier 2012). Sub-categories were then determined inductively

through the data gathered and the prevalent codes identified, and conceptually through analysing similar study findings and review of the literature (Schreier 2012).

Media Article analysis

The analysis of newspaper and magazine articles used predominantly content analysis to ascertain common themes amongst the articles (Berg 2001). This involves analysing the articles as social communication artefacts, and coding them with a word processor, which was then converted into a spreadsheet, to find patterns and themes. This was originally done to filter for relevant articles which had a long term focus and which the farmers indicated an interest in. The frequent drought coverage articles were also included to ascertain the focus of the media discourses. Thereafter, themes of risks to water security and solutions to the water crises were identified from the media articles and combined with the interview and questionnaire findings, to find possible points of commonality. The 106 selected articles for in-depth analysis were then reanalysed to create a frequency table and to extrapolate possible influences on farmer's views. The most relevant quotes were then extracted as proof of the themes, and presented in tables.

Statistics

The internal consistency of the NEP scale responses was tested using the Cronbach Alpha test (Oppenheim 1996; Vaske 2008). This test was used on the Ecoscores as a whole, as well as the NEP and DSP sections of the scale, to determine the consistency of the responses.

To observe possible correlations between Ecoscores and various other variables tables with bivariate data were created. This simply indicates that the Ecoscores were compared to the age, experience and farm size variables. A Pearson's correlation test was run to determine the significance of the possible relationship calculating a correlation coefficient. For a sample size of 24, it was determined that the correlation coefficient had to be smaller than -0.404 and larger than 0.404 to be statistically significant ($P \leq 0.05$), and smaller than -0.3 and larger than 0.3 to be practically significant ($P \leq 0.1$). It was taken into consideration during the analysis process that this does not necessarily indicate a cause and effect relationship (Rumsey 2010).

Thereafter, scatterplots were created for the significant bivariate data samples and simple linear regression lines were inserted, to indicate the direction of the relationship.

Ethics clearance

This project has obtained ethics clearance from two Faculty Research, Technology and Innovation (RTI) committees. The overall research project under the auspices of the SRU has received ethical clearance from the Faculty RTI Committee of the Faculty of Science. The listed title of project is: *Building Resilient Landscapes by Linking Social Networks and Social Capital to Ecological Infrastructure*. PRP: Prof C Fabricius, PI: A. Roos. Faculty RTI Committee (Faculty of Science) Ref: H14-SCI-SRU-01, Date: 19 May 2014. The proposal for this particular study towards a MA in Media Studies was additionally submitted to the Ethics Subcommittee of the Faculty of Arts at Nelson Mandela Metropolitan University (NMMU). The project received Ethics clearance with reference number: H/14/ART/JMS-005 on the 5th of November, 2014. The document granting approval is attached as Appendix 4. Additional individual ethics clearance for this project was necessary because of institutional policy, the degree being situated in a different Faculty and because the study was heavily dependent on the participation of stakeholders. Interactions ranged from informal conversations as ice breakers, through questionnaires to semi-structured interviews.

The questions of ethics is often a dynamic one, because of diversity of opinions amongst researchers. This is particularly true for social research (Bryman 2012). This particular research project had no deceptive requirements, the basics of ethical considerations when researching human perceptions apply. Informed consent was acquired, while ensuring confidentiality and privacy, as well as causing no physical or emotional “harm to participants” (Bryman 2012). Information regarding the study’s goals and objectives was shared with the participants verbally, in order to ensure they made an informed decision with regard to their involvement in the project. Furthermore, the data was coded when analysed to avoid the identification of individuals.

The Belmont Report, by the National Commission for the Protection of Human Subjects of Research, informed the design of methods and the overall study, in order to protect the human subjects through the ethical principles and guidelines. It was ensured that the subjects

fully comprehend the purpose of the study, as well as how their responses will form a part of it. No subjects were coerced into participation to ensure the information was given voluntarily (The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research 1979).

In accordance with the ethics clearance granted for the research, the researcher did not aim to identify possible unsustainable water uses of the respondents, nor attempt to observe any activities on the premises of the farm as part of the sampling. The information gathered was solely that which was provided verbally and in writing by the respondents. This was communicated to the respondents before the interviews began, and reiterated at the end of the interview process.

Chapter 4: Results

The methods described in Chapter 3: **Research Methodology** were applied to answer the research questions. Semi-structured interviews were used to elicit perceptions of water regulations and conservation practices, as well as determining motivators for various farming practices. Questionnaires were used to determine the participants' Ecoscores and to collect demographic data.

This chapter provides a backdrop to the 24 participants' perceptions of water regulations and conservation, and explores the influences of various communication channels. Furthermore, the impact of financial considerations were also prevalent throughout the discussions, highlighting the shift from farming as a lifestyle to farming as a business. This data was triangulated by the Ecoscore (NEP scale) questionnaires, to determine the participants' overall ecocentricity. These scores, as well as the narrative data collected during the NEP scale, echoed the qualitative interview data of conflicting ecological and economic views.

This chapter will explore the relevant results and determine the relationships between various variables. It is structured as six sections: A. Demographic and farm details of the participants, including farming experience and education levels, as compared to the greater George area to determine similarities and differences; B. Perceptions of water outlined as risks to water security and solutions to ensuring consistent water supply identified by the participants; the C. New Ecological Paradigm scale results and discrepancies in the Ecoscores; the consequent F. Farming practices; and lastly, D. Information acquisition by participants, including via the media, formal knowledge channels and interpersonal communication and a content analysis of media articles in the study area, to determine the E. Media Representations of Water-related Issues.

A. Demographic and farm details

The majority of the participants were white, Afrikaans-speaking males between 40 and 60 years (Table 5). Participants were experienced farmers, with years of experience ranging from two to 50 years. The mean farming experience for the sample was 23 years and the median and mode were both 20 years. Most of the participants were career farmers, having no other source of income. However, five participants had other means of income. There was no participants who only practiced subsistence farming.

The participants' of this study had an average farm size of 529 hectares, varying greatly with a standard deviation of 586.69. The farm sizes ranged from 25 hectares to 2100 hectares, indicating the different levels of corporate farming and merging properties to incorporate the principles of economies of scale.

In Table 1 in the Study area, the agricultural households in the greater George area is presented. However, the StatsSA sample included all households involved in agriculture, which included labourers. This research study focused on the decision-makers of the farm, which included owned and rented farms. The main discrepancy which was evident was the homogenous race of the sample for this study, whereas Table 1 above shows the regions agricultural distribution across the other races.

Even though the sample size included the entire Garden Route, and this was indicated when asking participants for chain referrals, most of the participants were sourced close to George.

The majority of the research participants farmed with cows, either in beef, dairy or both (Figure 4). Vegetables were the third most common commodity. This is relevant because of the intensive farming practices in the area with regards to dairy and vegetable farming. They are both heavily irrigated, either for pastures or for various vegetable crops. A breakdown of the different types of farming in Table 6.

The types of farming making up the 'other' section mostly included only one or two participants per commodity. These were Blueberries, Horse radish, Peppadews, Macadamia nuts and Avocados. Participants were not restricted to only picking one commodity. The mixed commodity section indicates the amount of participants who indicated that they practiced more than one of the commodities.

Table 5: Demographic information from the participants in this study

Data from research participants in this study (n=24)

Variable	Number	Percentage
Gender		
Male	22	92%
Female	2	8%
Race		
White	24	100%
Black African	0	0%
Coloured	0	0%
Indian or Asian	0	0%
Other	0	0%
Age		
15-34 years	3	13%
35-45 years	8	33%
46-55 years	10	42%
56-64 years	1	4%
65+ years	2	8%
Language		
Afrikaans	18	75%
English	6	25%
Farming history		
Family farmers	17	71%
Farming experience		
0-9 years	4	17%
10-19 years	5	21%
20-29 years	7	29%
30-39 years	6	25%
40-49 years	2	8%
50-59 years	1	4%

Most of them indicated that this is a way to counteract various risks associated with the farming industry. For example, some farmers have included vegetables because of the drop in milk prices in recent years, most mentioned was the drop during the drought times, and the vulnerability associated with changing markets. Furthermore, many of the participants who farmed with dairy also included beef cattle to utilize all the land on their farm which could not be turned into pasture, which meant that the land which was not arable would also become profitable. The drop in dairy prices also streamlined the dairy industry, as they couldn't afford to keep feeding cows which were providing below average return on investment, and also sold the dairy cows who were no longer economically viable as beef cattle, especially during the drought and periods of economic distress. The artificial insemination movement has also taken hold in the area because of the rising economic pressures on the dairy industry, and ensures that farmers breed cows which produce the highest possible amount of milk and butterfat.

Most of the participants were relatively well educated with 79% having post-high school education, compared to the average higher education level in the town of George of 11.6% (StatsSA) (Table 7). All participants had completed 12 years of schooling, compared to 65% of agricultural household heads completing 11 years or less in the greater George area. Sixty



Figure 4: Dairy cows grazing in the study area
(Source: Christo Fabricius)

percent (60%) of farmers' qualifications were in agricultural and related fields. The other fields of education included engineering, accounting and plumbing.

Table 6: Types of farming amongst the participants for this study

Commodity	Number	Percentage
Dairy	16	67%
Beef	10	42%
Sheep	4	17%
Vegetables	9	38%
Poultry	0	0%
Other	5	21%
Mixed commodity	11	46%

Table 7: Education levels of participants for this study (n=24)

Education	Number	Percentage
Matric	5	21%
Some post-matric education	4	17%
Diploma (other)	2	8%
Diploma (Agriculture)	5	21%
Degree (other)	3	13%
Degree (Agriculture)	3	13%
Postgraduate degree (other)	1	4%
Postgraduate degree (Agriculture)	1	4%

B. Perceptions of water

The participants seemed to hold multifaceted views on water and their usage thereof. This section is structured with two main sections: Perceived risks to water supply and consequent Identified solutions to ensuring consistent water supply. They valued water in a quasi-spiritual sense, but also understood the economic impacts of losing the custodianship of their water sources. Furthermore, there are various risks to water security identified through this study, mostly linked to the implications of climate change, as well as legislation change, in the area. Competition for water resources, as they seem to be dwindling in the eyes of the participants because of changing weather patterns, was also identified as a concern. The participants also identified solutions to these concerns, religion and storage capacity to lessen their vulnerability to the climate and sporadic rainfall. These themes are all outlined below, and their frequencies represented in Table 8.

The following information was acquired through semi-structured interviews and questionnaires. Farmers were asked to rate their water use efficiency between one and five; one being the least efficient, and five being the most. None of the farmers believed their water

Table 8: Frequency table for themes identified through interviews with participants

Identified theme	Number	Percentage
Distrust of government and conservation authority involvement	13	54%
Steep catchment and fast flowing water	11	46%
Storage capacity as solution	9	38%
Economic value of water	9	38%
Upstream and downstream user dynamics	6	25%
Ecosystem protection	6	25%
Changing rainfall patterns	5	21%
Competition for water	3	13%

use was inefficient (Table 9). There were only three participants who rated themselves as average in their water use efficiency, with the majority rating themselves as efficient (15 participants, 63%). Farmers who rated themselves as average claimed that they still needed to invest in moisture sensor probes to optimize their centre pivot irrigation, but cannot afford to do it in the current economic position they're in.

Firstly, when asked what water means to them as farmers, the participants used extremely emotive language. This did not, however, change their sense of the economic value of water and the necessity to retain their share and store as much as is viable to remain profitable. Some of the answers included that water was the "ultimate limiting factor of farming," that it was their "lifeblood." This view was reaffirmed by the need to utilize water efficiently because of its scarcity, and contradicted somewhat by the economic value the participants attached to it, for example:

"Because water is so expensive and scarce, I try to use it as efficiently as possible." (Participant number 19, a dairy/vegetable farmer)

Even though the participants held very strong spiritual feelings attached to water, these were coupled with responses that indicate an economic reliance on water and seeing it as a commodity to use and fight for, for example:

"I mean electricity is expensive, which makes water expensive. Economics and water are usually linked. Save water and you also save money, they're linked." (Participant number 15, a dairy farmer)

This economic aspect of water conservation seems to be a strong motivator for responsible water use practices, linking to corporate farming strategies which have emerged in the area as an adaptation to changing markets and higher input costs.

Table 9: Participants' water use efficiency self-rating (n=24)

Rating	Number	Percentage
Not efficient at all	0	0%
Not efficient	0	0%
Average	3	13%
Efficient	15	63%
As efficient as possible	6	25%

In what follows, the participants' responses have been outlined according to identified risks and proposed solutions to these. It became prevalent during data collection that there were various risks troubling the participants and some bureaucratic barriers preventing them from implementing their identified solutions.

Perceived risks to water supply

Throughout the interviews, the participants identified various risks to their water supply, and indicated possible solutions. These were Risk 1: Competition for water with the local towns which keep expanding; Risk 2: Steep catchment and fast flowing rainwater and the implications on water extraction as well as the ecological-economic internal conflict the participants are experiencing between their need for water and their understanding of the importance of the ecological reserve; Risk 3: Changing and more erratic rainfall patterns experienced by the participants, mostly attributed to climate change; Risk 4: Upstream and downstream user dynamics and the conflicts which arise through competition for water security; and Risk 5: Government and conservation authority involvement and the participants' frustrations with regulations which they do not agree with. These perceived issues will be described in more detail below.

Risk 1: Competition for water

Water demand is rising in the study area, with constant development and a growing population. This worried the participants, and they mentioned their concerns. The emotive responses identified included fear of loss of income and loss of custodianship. The participants had predictions of a much drier future, not only locally, but globally. Their fears stemmed from the fact that the population of George, as well as surrounding towns, keeps growing. They are worried that the water allocated to them from the various "dwindling" rivers will be lessened as the population grows, because the Garden Route dam will not be able to support the rapid urban development and expansion. Their custodianship of the water sources is also tied to inheritance and taking care of nature for the next generation, pointing out that water availability and regulations are inextricably linked to storage capacity and their perceived risks to water security.

Water regulations and governmental involvement proved to be a major concern for the research participants, because they often felt victimized.

“And they’re going to want our water that we’ve been allocated. A big clash is going to come in the future, because people also need food. It’s already started.” (Participant number 20, a dairy/vegetable farmer)

“Water causes wars. Since forever, water has been rife with controversy.” (Participant number 5, a blueberry farmer)

Participants identified the possibility of future clashes over water in the study area, and expressed a fear that agricultural practitioners are going to be blamed if there is another water crisis. This was the case during the drought in recent years. For example, one farmer mentioned that farmers try to avoid general public meetings about and during droughts.

“We get targeted as farmers. You go to a water forum meeting during a drought, it’s nasty because everyone is just blaming everyone else and the farmers are normally seen as the absolute villains.” (Participant number 21, a dairy/beef farmer)

The participants are worried that the same negative attitude will be held by the public when more water is needed for the towns, as irrigated agriculture is seen as water-intensive.

Risk 2: Steep catchment and fast flowing rainwater

This perception of risk is underpinned by a moral dilemma for the participants. Even though they held an understanding and reluctant acceptance of the importance of the ecological reserve, contrasted by the fact that their water supply is decreasing because of the changing rainfall (below) and the associated water loss of a steep catchment.

Participants were acutely aware of the topographical considerations of the sloped area, in that they are sandwiched between the mountains and the ocean with a steep rainwater runoff angle. Some participants described their frustrations in seeing the water running off and not being able to utilize it for food production. This fast flow of the rainwater was identified as a risk because it hinders efficient storage of water before it reaches the ocean.

“But when it floods, then all the water ends up in the ocean. Because the mountain is so close to the ocean. It’s not that this water would take ages to run down, it rains and ‘schloop’ it’s gone.” (Participant number 8, a dairy/beef farmer)

Compared to other rivers in South Africa, the participants claimed, they only had a fraction of the time to extract water from the river. This is worsened by the sporadic rainfall patterns that have been noticed in recent years, because the farmers’ pumps have a fixed extraction tempo and cannot compensate through the high rainfall times for the drier ones.

“Our rivers are short, steep, fast flowing, they don’t have enough capacity or flow rate to irrigate from. But they’ve got more than enough capacity to fill reservoirs and dams and, if that was done and encouraged, there would be more than enough water for almost any eventuality without trying to irrigate out of rivers when things got dry.” (Participant number 21, a dairy/beef farmer)

Eleven of the participants mentioned their frustrations at seeing the rate at which rain water and runoff travels from falling on the mountain and reaching the ocean without the farmers being able to extract any water. Even though six of the participants understood the importance of the ecological reserve, most still expressed concern with all the flood water ‘running away’ into the ocean.

The respondents claimed that the steep mountain catchment, in combination with the heavy rainfall events, lets most of the rainfall run into the ocean. The problem was outlined by the participants as most of the rainwater ending up in the ocean, which is considered a waste because then it is unusable.

“The other problem, specifically in our area, is the intense slope with which the rivers run. If it rains a lot in the mountains, it’s probably two hours and then all of that water is in the ocean. It’s like a flash flood, it’s just gone.” (Participant number 12, a dairy/beef/sheep farmer)

This happens mainly because the mountain is so close to the ocean, and many farmers called for these catchments to have specific water legislation which suits the geography. For example, the Gouritz Water Management Area operates under the same mandate for all the catchments involved, which the participants find ineffective and discriminatory. This can be linked to Risk 5: Government and conservation authority involvement below. They indicate the need for individual management decisions, based on the practical considerations for their catchment, to make farming and water harvesting efficient. However, many of the participants claimed to understand the importance of ecosystem functioning as a whole.

The participants displayed an understanding of the ecological reserve for water, and the important role this plays in the ecology of the entire river. At least six participants directly mentioned the importance of water for the ecosystem downstream, while more participants alluded to it.

“What you must bear in mind, is that we’re trying to farm with nature and not against nature. That’s the key principle. And the resources that you’ve got, your soil and water. Make sure you’re optimizing them and you’re maintaining them in a pristine condition.” (Participant number 20, a dairy/vegetable farmer)

“It’s in everyone’s interest to protect water sources because there still needs to be water going through to the ocean for the ecosystem lower down in the river.” (Participant number 1, a beef/sheep farmer)

One participant indicated that the communication between the upstream and downstream neighbours of their particular river community aided in protecting the ecosystem. The downstream users would communicate to the upstream users when the river stops flowing, and they would rectify their extraction in order for the ecology to function. This alludes to governance and collective decision making. This ecosystem protection discourse was contradicted by the participants' economic mind-set, which indicated utilizing their properties to their fullest potential. This also alludes to the distrust of government entities to manage the water sources properly, and the farmers taking the custodianship of the river upon themselves, evading the state's custodianship.

Even though some participants realized the need for an ecological reserve, their solution to the water issues were still to extract more water with the use of dams.

"I know the estuary needs its water, but it will get that water, and we need to store more water."
(Participant number 10, a dairy farmer)

These perceptions seemed to contradict each other, and reflect the above multifaceted views on water. The storage capacity issue is discussed below, in the section Solution 1: Increasing storage capacity. This can be seen as an incomplete perception of system functioning, indicating a level of ignorance or disregard for the need of an ecological reserve for the river. Most of these perceptions were underlined by the implication of water ownership they believed they should have as land owners.

Risk 3: Changing and more erratic rainfall patterns

This theme was brought up in numerous interviews and is one of the main reasons for water security becoming a concern for the participants. Mainly, the participants have noticed that the weather patterns are changing. They also have concerns about the impact this will have on their farming, since they do not have an irrigation scheme in the area. This indicates an increase in vulnerability. This is mostly tied to erratic rainfall patterns contrasted to the evenly spread rain reported by the participants in the past. The rainfall in the area used to be constant, leaving George renowned for its persistent wet conditions. When some of the participants were younger, water was the main deterrent to their farming because it rained too much and caused the vegetables to drown. The participant claimed it is a stark contrast from that experience to what he is experiencing now, which is sporadic rainfall with long hot and dry periods.

“With the rainfall and the river now, it’s either feast or famine.” (Participant number 21, a dairy/beef farmer)

“The rainfall is changing... George used to get rain winter and summer, now you sometimes don’t get any in winter or any in summer, so it’s totally sporadic.” (Participant number 22, a dairy/beef farmer)

This observed change is influencing the farmers’ perception of water management and storage.

Nine participants highlighted the region-specific weather changes are made more severe by the steep catchment, and reaffirm the need for dams.

“With the climate changing, we seem to be getting big lots of rain and then drought spells. Instead of the rain being spread over months, you get the same amount of rain in one hit. So you need storage.” (Participant number 10, a dairy farmer)

Many participants claimed that the drought of 2008-2010 had changed the way they viewed and managed water. Some of them were severely impacted by it, especially because of the floods in 2006, 2007 and 2008 (see Figure 5), prior to the drought, which caused infrastructural damage which could not be repaired in time to allow for adequate water storage for the rainfall between the floods and the start of the drought.

This drought had a large impact on the farmers’ perception of water availability and changing rainfall patterns, as many of the participants were severely impacted by the drought,



Before



After

Figure 5: Flood damage on a farm in the study area due to a flash flood in 2011

(Source: Roger Titley)

emotionally and financially. The Garden Route Dam, main source of George’s water supply, was only 25% full towards then end of 2009. At one point, there was a mere three-month supply left (Figure 6). This variability in the rainfall, with increased risk of floods and droughts, was identified as one of the major risks to water security and effective farming practices. Many farmers have adapted from the time of drought and have adopted practices that aimed at minimizing their vulnerability in future.

George has a colloquial stigma of being “Cold and Wet,” a humorous acronym of the CAW vehicle number plates of the area. This label was mentioned by some of the farmers, stating that it no longer applies to the area. One participant went as far as to claim that George is now “Hot and Dry,” the complete opposite of the weather 20 years ago. Some participants accredit it to climate change, whilst others say they are feeling the impact more because of the intensive farming that is happening in the area and their reliance on irrigation.



Figure 6: The Garden Route dam during the 2009 drought with Outeniqua Mountains
(Source: Eden District Municipality)

Risk 4: Upstream and downstream user dynamics

Even though the solution to the water security risks is identified as implementing increased water storage capacity, this can be considered a transferal of risk and vulnerability to downstream users. Many participants identified the dynamics of upstream and downstream users as a possible controversy. These dynamics include miscommunication, increasing dam size and conflict of interest. Some users accused farmers upstream of them of being ecologically and socially irresponsible in their water extraction. The participants' claimed that it has negatively affected the availability of water to downstream farmers and the community as a whole.

"There's a huge problem with upstream users, not allowing enough water through for the downstream users." (Participant number 2, a sheep farmer)

These comments are linked to the historic riparian rights paradigm, where users of a river are allowed to extract only as much water that would still allow for the downstream user to have an adequate amount. This historic water management did not allow for the ecological reserve, and this historical shortcoming could be a possible deterrent to contemporary ecosystem thinking (See Chapter 1, Water Rights in South Africa). One participant believed that the riparian rights system of water allocation is the only way river systems could be managed effectively:

"There isn't actually a different way to do things than how the riparian rights work." (Participant number 6, a dairy/vegetable farmer)

Water allocations, however, are governed according to the NWA and not the riparian rights system. Domestic use, firstly by humans and secondly by animals, is prioritized, with farming practices being managed more stringently. There were numerous participants who appeared to view the ideal water management system in accordance with the riparian rights paradigm, indicating their entitlement of a certain allotment because of their location on the river.

Furthermore, some farmers mentioned that they made their own decisions along the river - an apparent adaptation to DWAF's lack of support. Some farmers were alleged to have undertaken their own stakeholder engagement process before circumventing the legislation around dams. They were alleged to have spoken to their downstream neighbours to get permission from them to erect an upstream dam. These farmers are attuned to their downstream neighbours and pride themselves on acting fairly towards them, but with scant

consideration for the ecological reserve. This attitude is in accordance with the riparian rights paradigm, mentioned above.

“There’s a lot of valleys that aren’t perennial river courses- that only flow one week a year, where you can put dams up. Then it’s not actually going to affect guys lower down.” (Participant number 10, a dairy farmer)

This comment reflects shortcomings in farmers’ understanding of river hydrology and connectedness between groundwater, surface water and river flow regimes.

The identified risk of upstream and downstream dynamics, including the dynamics of water rights and extraction and the increased vulnerability brought on by climate change, becomes relevant when combined with the identified solution to changing rainfall patterns, which is identified in the section below, Solution 1: Increasing storage capacity. This will, in essence, increase the controversy between the various water users identified in the above section, and create a vicious cycle.

Risk 5: Government and conservation authority involvement

The participants held negative views of some South African government departments, specifically the Department of Water Affairs and Forestry (DWAF) and the Department of Environmental Affairs (DEA), while collaborating readily with the governmental experimental farm. One of the many issues with the current water management is that there is no direct financial reward for using less water.

“My problem with water rights today is, I pay the same whether I extract the water out of the river or whether I don’t.” (Participant number 20, a dairy/vegetable farmer)

However, there is some financial incentive through saving on electricity costs by pumping less.

Another identified issue was that you are not permitted to maintain your amount of water storage by clearing your dam of excess soil and silt. In response to the question: *“How do regulations affect your farming?”* one participant responded as follows:

“You can’t do anything. You have to apply to increase size of dam or to create a dam. You must apply to clean it. You build a dam that’s six meters deep, but now there’s soil in it. A meter of soil in front, but you can’t take it out when the dam is dry. It’s unreasonable.” (Participant number 4, a beef/sheep/vegetable farmer)

The participants highlighted the hypocrisy of the hindrances they are experiencing with their applications to build dams on their property, pointing out that the nearby Wolwedans dam,

built by the government and completed in 1989, has resulted in major environmental flow impacts on the system, whereas the dams the farmers propose to build would supposedly not have the same effect on the ecosystem (Allanson and Baird 2008).

“Farmers have never built dams that have caused the river to stop flowing, contrasted to the Wolwedans dam that the government built.” (Participant number 14, a beef farmer)

This underlines the frustrations and perceptions of unfairness experienced by the research participants, especially in light of the contrast to past water regulations.

The participants believed that the post-democratic regulatory bodies lacked the practical knowledge necessary to manage the area’s water allocations, and that they did not understand the real-life implications of their stringent legislation.

“There’s not that many people in Water Affairs that know how things are meant to run, don’t understand the realities of farming.” (Participant number 10, a dairy farmer)

This also suggests incongruence within the acceptance of the new inclusive government, especially because there are unresolved issues with food security and expansion of the farming sector.

The participants believed that they should have autonomy of their water sources, because they have the knowledge and expertise to manage it properly. The perception is likely due to the approach by the former government, and their agricultural privilege standpoint, instilling a sense of autonomy for the farmers (See Chapter 1, Water rights in South Africa). Thirteen farmers mentioned their frustrations with government, conservation authorities and the law directly and felt victimized by the current system. Eleven of them did not merely mention it, but went into great detail about the problems they have faced. They feel that the government agencies, instead of attempting to work with the farmers and try to understand what is happening in the study area, only get involved with the farmers when it is time to penalize.

“Our farm is next to SanParks boundary and we are not allowed to control the baboons, bush pig and other pests which cause so much damage.” (Participant number 12, a dairy/beef/sheep farmer)

“The government isn’t on our side. It’s a circus at the moment. They don’t know what’s going on.” (Participant number 3, a dairy/vegetable farmer)

This distrust of the government may carry over into distrusting members of the farming community who do not have similar negative attitudes about the government. For example, one participant has a good relationship with the Departments of Labour, and Water and

Sanitation, and claimed to be ostracized by some members of the community for this. The participant suggested that his deviation from the traditional family farming system, being a non-family farmer, and having to learn everything through trial and error, has caused this ostracism.

The participant also mentioned his frustration with the traditional farming systems in the area, and the inherent practices associated with it. He is of the opinion that the traditions are what is causing the older farmers and family farmers to disregard nature and that it hinders innovations and new technologies. This view is, however, contradicted by the pooled interview results which found no relationship or pattern suggesting a link between family farming and disregard for nature or wasteful water management practices.

It was noted that conservation, as a term, has some contradictory connotations for some of the participants. They referred specifically to exclusionary conservation, when referring to protected areas.

“Conservation isn’t even part of my vocabulary anymore. Because it’s coupled to a “don’t touch” mind-set. Locking out, museum type of conservation. They made the mountains museums. It has actually caused plants to die. I prefer the term Environmental Management.” (Participant number 14, a beef farmer)

Furthermore, they criticized environmentalists they have experienced who “cannot think of the bigger picture,” and cannot “understand the importance of expanding farms to ensure food security.” Conservationists have a stigma of “bunny huggers,” which undermines the acceptance of any positive changes they are trying to encourage with agriculture in the area. A participant claimed that the farmers “do conservation in [their] own way,” by planting indigenous trees and removing IAPs, while the conservation agencies allegedly refuse to see the positive changes the farmers have made to their practices.

“And the problem with the bunny huggers is the don’t want nuclear power stations, coal power stations, windmills put up... Because they’re sore eyes. But when there’s load shedding, they get highly pissed off. When they can’t boil a kettle. The bunny huggers are totally unreasonable.” (Participant number 17, a vegetable farmer)

Participants also found that there was an inherent hypocrisy in certain governmental Departments regarding Environmental Impact Assessments (EIAs), and the lengths farmers have to go through to get approval for altering the environment, whereas with the case in the Karoo regarding fracking is considered from a purely economic perspective.

“That’s what I don’t understand. I have to go through so much to be able to plant crops. And I have to go through all the processes that Environmental and Water Affairs ask of me. Because it’s a

drainage line. But these people are prepared to sacrifice the entire Karoo so that a couple of people can become fat cats.” (Participant number 5, a blueberry farmer)

It was also mentioned that governmental conservation agencies created blanket water managing strategies, and treat all river systems the same, which should not be the case with such a unique catchment.

“Government doesn’t have a clue, they make assumptions. Even these catchment management associations, they generalize. And my experience is that one estuary and one river system isn’t the same as the next one. We get bundled into the same thing. The type of water changes and everything changes.” (Participant number 20, a dairy/vegetable farmer)

As is evidenced by the above quote, the stringent regulations placed on water extraction, in the name of conservation, are seen as unfair by most of the participants. A participant claimed that after the ecological reserve has been taken into account, the Southern Cape still has the lowest extraction tempo in South Africa, even though the regional agriculture is mostly focused on irrigation-intensive farming. Such a statement claims to reaffirm the perception that the farmers are behaving responsibly toward the environment and their water sources.

Identified solutions to ensuring consistent water supply

The main solution identified to most of the above concerns was the increasing of water storage capacity, which is succinctly summarized by the following quote:

“They don’t want us to build dams. But when it floods, then all the water ends up in the ocean. Because the mountain is so close to the ocean. It’s not that this water would take ages to run down, it rains and ‘schloop’ it’s gone. And that’s what the big fight is about. Garden Route agriculture should be studied on its own, not in conjunction with the entire Gouritz catchment”. (Participant number 8, a dairy/beef farmer)

This storage capacity is proposed in the increase of dam size as well as conservation agriculture. Other than storage capacity, strength of faith and belief in a higher power was considered a necessity to deal with the vulnerabilities associated with agriculture.

Solution 1: Increasing storage capacity

Participants believed very strongly that building more dams would resolve the agricultural challenges associated with rainfall variability, drought and flooding. All of the risks to water security identified above were also mentioned by the participants as being solved by increased storage capacity.

“That’s why I’m going the biological, the conservation agriculture route, because I want to increase the storage capacity of my soil. When it rains, the humus layer can hold the water. If I could have more water, I could expand my carrying capacity.” (Participant number 13, a beef farmer)

Figure 7 shows farm dams in a portion of the area, along with the irrigated pastures which they are predominantly used for.

The participants claimed that dams would lessen the risks associated with changing rainfall patterns, as it would allow them to store the surplus rainwater for the drier periods.

“Dams have to be priority number one to store water because the rainfall has changed so drastically.” (Participant number 2, a sheep farmer)

These dams would also serve as protection against flooding, for their own upstream farms as well as for downstream users.

“Catching that water in the high rainfall periods, because most rivers in this area are too small to irrigate out of during normal flow times, because it’s such a small stream. But when it is raining it’s like the Zambesi. It’s feast or famine. We want to store more water as a safeguard. Also, it’s a means of protecting the downstream users.” (Participant number 21, a dairy/beef farmer)

It would curtail the impacts of the steep catchment if they were able to extract enough water and store it before it reaches the ocean. The participants believed that this should be first priority in the areas’ water management strategy, to ensure consistent water supply for all



Figure 7: Aerial view of farm dams and pastures in the study area

(Source: Roger Titley)

users. Nine participants proposed this directly, while some alluded to storage capacity increases needed and their frustrations with government who fails to recognize this.

Solution 2: Religion

Some participants mentioned their religions during the interviews, without being prompted. They mentioned their dominant religion in the interviews. This became relevant because it seemed to interfere with the accuracy of the Ecoscores, which will be discussed in the next section.

A couple of the participants mentioned their reliance on Christianity with regard to farming. One participant explained his strategy for dealing with crises as: "First knees, then experts." He then explained how important prayer has been to his farming.

"You have to believe in God, otherwise you can't farm." (Participant number 4, a beef/sheep/vegetable farmer)

"We have to rule over nature, it says so in the Bible." (Participant number 6, a dairy/vegetable farmer)

Many other participants brought up their religious beliefs during the NEP scale discussion. Participants agreed that their role in nature is to rule over it, but added the addendum that this includes conserving and protecting nature for future generations. Please see the section on the C. New Ecological Paradigm scale for more information about religious inclination amongst the participants.

The perceptions of risk and solutions identified above forms a precursor to the participants' responses to the NEP scale, which indicates their overall environmental attitudes. It is worthwhile to outline the specific issues identified, so that a better understanding of the salient issues can offer a backdrop with which to analyse the responses to the scale, which may have been influenced by the preceding interview.

C. New Ecological Paradigm scale

Overview

The results of the NEP scale showed that the farmers' responses are surprisingly consistent with NEP thinking. The participants scored consistently high and disagreed with most of the traditional DSP sentiments, which assert that unlimited economic growth is the ultimate goal. For example, a large majority of respondents (92%) believe that there are limits to growth and all of them (100%) believe plants and animals have the same rights as humans to exist and an overwhelming majority (96%) also indicated that humans are subject to the laws of nature. An overwhelming majority (96%) also believe that there is a delicate balance in nature which humans can easily upset. Please see a summary of these, broken down into the 15 statement scale, as well as the five dimensions the scale made up of, in Table 10.

The scale is comprised of seven DSP and eight NEP sentiments, even though the overall scale is merely referred to as the NEP scale. The white items reflect NEP statements, whilst the grey items are in adherence with the DSP paradigm. The scores are referred to as Ecoscores. These are calculated by scoring high for NEP sentiment adherence and low for DSP sentiment adherence. A score of one to two in the white rows means that the participants disagreed with the statement and a score of four to five meant that they agreed. A score of one to two in the grey rows means that participants agreed with the DSP sentiments and a score of four to five meant that they disagreed. A score of three is always unsure.

The mean Ecoscore calculated out of a score of 75 was 55.63, the median was 56 and the mode was 60. The standard deviation was considerably low at 6.06, which indicated that the scores did not vary greatly. As will be discussed below, there seemed to be discrepancies amongst participants who tended to be more religious, or more connected to external information sources, such as academic journals and study groups.

Table 10: New Ecological Paradigm scale frequency distribution (n = 24)

Dimensions	Ecoscore statements	1 to 2		3		4 to 5		Mean	Median	Mode
Limits to growth	Q1: We are approaching the limit of the number of people the Earth can support.	1	4%	1	4%	22	92%	4.3	4	4
	Q6: The Earth has plenty of natural resources if we just learn how to develop them.	20	83%	1	4%	3	13%	1.8	1.5	1
	Q11: The Earth is like a spaceship with very limited room and resources.	1	4%	2	8%	21	88%	4.2	4	4
Anti-anthropocentrism	Q2: Humans have the right to modify the natural environment to suit their needs.	7	29%	5	21%	12	50%	3.3	3.5	4
	Q7: Plants and animals have as much right as humans to exist.	0	0%	0	0%	24	100%	4.7	5	5
	Q12: Humans were meant to rule over the rest of nature	13	54%	2	8%	9	38%	2.6	2	4
Balance of nature	Q3: When humans interfere with nature it often produces disastrous consequences.	0	0%	2	8%	22	92%	4.3	4	4
	Q8: The balance of nature is strong enough to cope with the impacts of modern industrial nations.	5	21%	1	4%	18	75%	3.8	4	4
	Q13: The balance of nature is very delicate and easily upset.	0	0%	1	4%	23	96%	4.5	5	5
Human exemptionalism	Q4: Human ingenuity will insure that we do not make the Earth unliveable.	11	46%	6	25%	7	29%	2.8	3	2
	Q9: Despite our special abilities, humans are still subject to the laws of nature.	1	4%	0	0%	23	96%	4.5	5	5
	Q14: Humans will eventually learn enough about how nature works to be able to control it.	5	21%	3	13%	16	67%	3.6	4	4
Possibility of eco-crisis	Q5: Humans are seriously abusing the environment.	2	8%	2	8%	20	83%	4.2	4	5
	Q10: The so-called “ecological crisis” facing humankind has been greatly exaggerated.	6	25%	1	4%	17	71%	3.5	4	4
	Q15: If things continue on their present course, we will soon experience a major ecological catastrophe.	3	13%	6	25%	15	63%	3.7	4	4

Statistical validity

The Cronbach alpha test was utilized to determine the internal reliability of the scale as a whole, and in the NEP and DSP sections (Table 11). The test is used to determine the average inter-question correlation (Terre Blanche *et al.* 2006).

Results between 0.50 and 0.69 are seen as acceptable, and results under 0.5 should be treated with caution (Oppenheim 1996). The scale was therefore not split into the two paradigms for analysis, as the consistency thereof is too low. It was only analysed as a scale in its entirety, and where correlations are found, the paradigms will be further explored.

Table 11: Cronbach alpha test

Variable	Internal reliability
NEP section of scale	0.47
DSP section of scale	0.52
Overall scale	0.63

It was determined that the correlation coefficient, which indicates the linear relationship between two variables, had to be smaller than -0.404 and larger than 0.404 to be statistically significant, and smaller than -0.3 and larger than 0.3 to be practically significant to determine a p-value of less than -0.05 and more than 0.05, respectively. The Pearson correlation values are represented in Table 12.

Table 12: Correlation between Ecoscores and age, experience, farm size and education

Variable	Correlation co-efficient	Significance (**=P<0.05; *=0.05<P<0.01) NS = Not Significant
Age	-0.017	NS
Experience	-0.2	NS
Farm size	-0.462	**
Education	0.07	NS

The comparable variables of Age, Experience, Farm size and Education proved to be mostly insignificant, with the exception of Farm size. Since farm size proved to be both statistically and practically significant, it is presented in the graph below. Furthermore, the correlation between the two paradigm scores and Farm size was investigated. The NEP and farm size had a correlation co-efficient of -0.51, and the DSP score had one of 0.31. This suggests that the NEP paradigm, being of statistical significance, has an inverted relationship with farm sizes and that it decreases as the farm size increases. The relationship between the farm sizes and Ecoscores was both practically and statistically significant. It had a -0.462 correlation co-efficient (Please refer to Figure 8).

This is corroborated by a participant mentioning the troubles with larger farms:

“How I see farming is, It has to be kept small and close to nature. As soon as you take it too big, commercial, you don’t know what’s happening and you can’t keep an eye on things and then events occur such as your staff dumping dead cows in the river beds and you don’t know anything about it. That’s the problem with farmers today, they’re only interested in the economic side of things.”
 (Participant number 2, a sheep farmer)

Another farmer mentioned the importance of having a manageable herd of cattle, stating that you *“have to be able to look each cow in the eyes every day,”* to ensure that they are healthy and that you respect nature. The smaller farmers are of the opinion that corporate farming might be linked to ecological degradation, and the Ecoscores and farm size correlation seems to validate this belief. However, it has also been found that corporate and commercial farming, being economically focused, is more profitable and therefor have more money to invest into ecological restoration of degraded lands on the farms. This will be discussed in the Money matters and Economy of scale sections below.

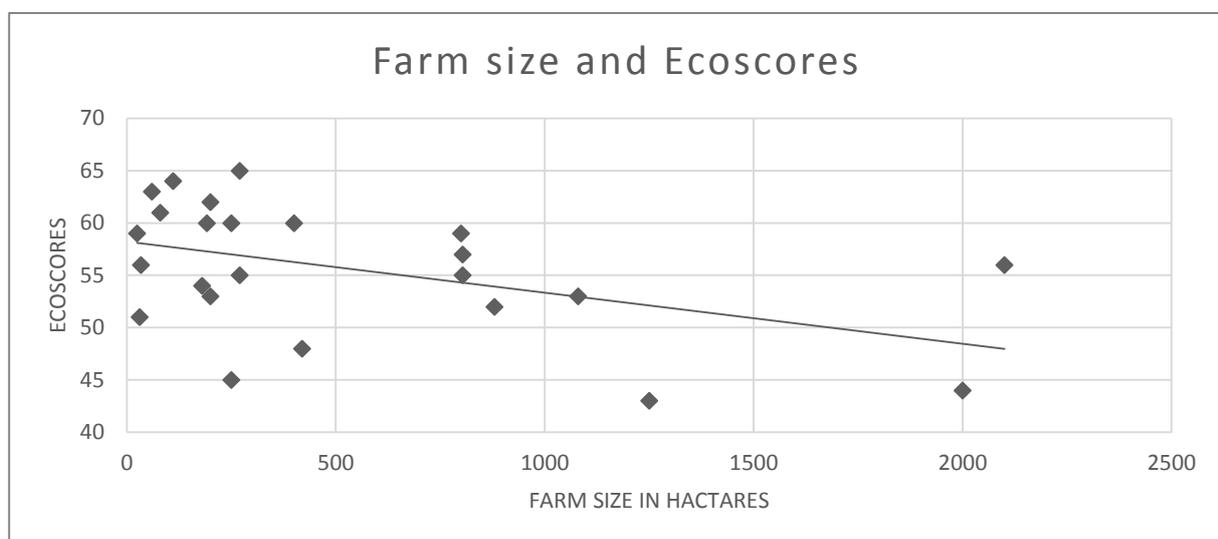


Figure 8: Relationship between farm size and Ecoscores

The Ecoscores consisted of five dimensions, or themes, which were each constructed out of three questions. These dimensions were (please see Table 10):

- Knowledge of the limits to growth
- Belief in anti- anthropocentrism
- Awareness of the fragility of nature’s balance
- Rejection of “human exemptionalism”
- The belief in a possible major ecological crisis

The dimensions that proved problematic were Limits to growth and Anti-anthropocentrism. This is because of specific questions and the participants’ reaction towards them. Most of the discrepancies were in accordance with the Human Exemptionalism Paradigm (HEP). The relevance of this, the religious aspects and the economic side of modern farming contradicting the Limits to growth dimension, will be discussed below.

Limits to growth included the statement “The earth has plenty of natural resources if we just learn how to develop them.” The results for this statement is represented in Figure 9. Many of the farmers in the area, struggling with the Eskom electricity crisis and the negative effect of load shedding on their farming, have started researching how to generate energy with their cow manure. Others report a lot of exposure to the renewable energy discourses in the media and through interpersonal channels, and therefor agree with the statement specific to wind and solar power.

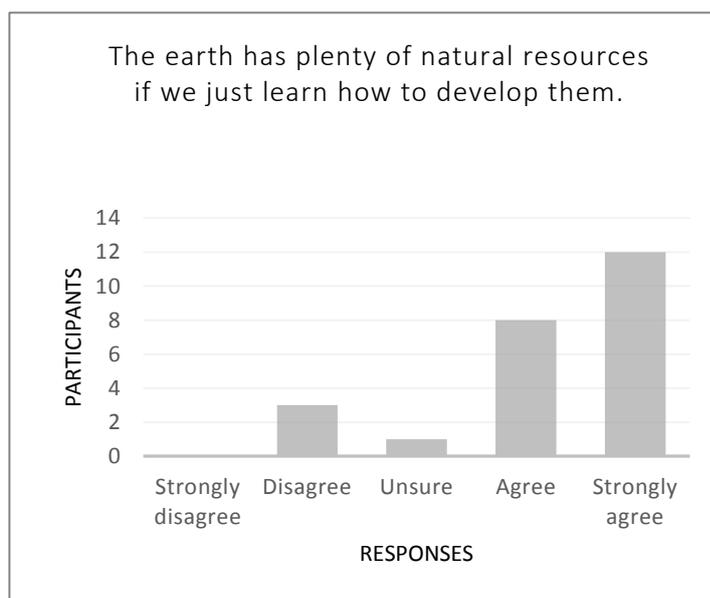


Figure 9: NEP Scale Question 6 Responses

They claim, however, that if the question refers to coal other non-renewable resources that they would disagree completely.

“Depends on what sort of natural resources. If you’re talking about fossil fuels, disagree 100% completely. But wind, sun, solar, water energy sources, renewable side I agree 100%.” (Participant number 13, a beef farmer)

“Coal can be used up. Water, if we dam properly look after it properly and avoid soil erosion and mismanagement, then it’s agree. So it depends which resource. Solar energy, wind energy, wave energy, then I strongly agree. Then you go to natural gas and fracking, then I strongly disagree.” (Participant number 17, a vegetable farmer)

This question thus caused a lot of confusion and a positive result did not necessarily indicate an inclination towards the DSP, as the scale was designed.

Anti-anthropocentrism included the statement: “Humans were meant to rule over the rest of nature.” The participants who were religious had trouble with this statement, and led to many participants responding with “strongly agree,” but adding their amendments to it (See Figure 10). They cited the Bible whilst strongly agreeing with the statement. The New International Version of the Bible states in Genesis 1:26. Thirteen respondents (54%) of participants either agreed or strongly agreed with the statement, and would not challenge a declaration that links clearly to the Bible.

They said that, even though they have been instructed to rule over the rest of nature, they have a stewardship responsibility for conservation, as well. Even though their responses indicated inclination to the DSP, it was not without NEP qualities.

“Yes, I agree completely because the Bible says we are supposed to rule, but not to screw up. Ruling also needs to be thought about, what does it mean? I think it includes conservation. Then it’s alright.”

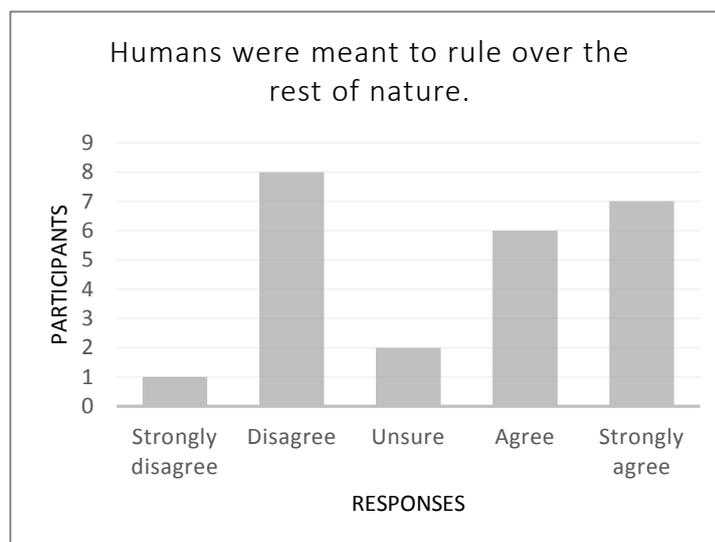


Figure 10: NEP Scale Question 12 Responses

Otherwise it isn't. You need to let nature lead you, so you can see how to manage it.” (Participant number 4, a beef/sheep/vegetable farmer)

“This is a difficult one. Because we are supposed to, because we've got brains to be able to make certain decisions, which the rest of nature can't. But how should we rule? To rule means to make sure that they don't go extinct either. Conservation included.” (Participant number 5, a blueberry farmer)

The Christian faith advocates dominion over nature, but within a custodian capacity:

Then God said, “Let us make man in our image, after our likeness. And let them have dominion over the fish of the sea and over the birds of the heavens and over the livestock and over all the earth and over every creeping thing that creeps on the earth.” (The English Standard Version Bible, Gen 1:26)

Another statement in the Anti-anthropocentrism dimension was, “Plants and animals have as much right as humans to exist.” In the interview prior to the questionnaire, the issue of Invasive alien plants (IAP) was discussed at length. Twenty-three of the participants identified the IAPs as an ecological problem in the study area.

Even though participants only agreed or strongly agreed with the statement, those who agreed indicated that they would have strongly agreed if it were not for their experience with IAPs. This could have caused them to get less in their scores, even though their responses are back by ecological sentiments of restoring the environment through IAP management.

“Because when I think about it, I think about the Bugweed for example. And other Invasives. Then you see our rivers with all the Black Wattle.” That's why I don't strongly agree.” (Participant number 11, a dairy/vegetable farmer)

For this question to measure an accurate perception of anti-anthropocentrism, plants and animals should be split into two questions and it should be specified that it refers to indigenous plants.

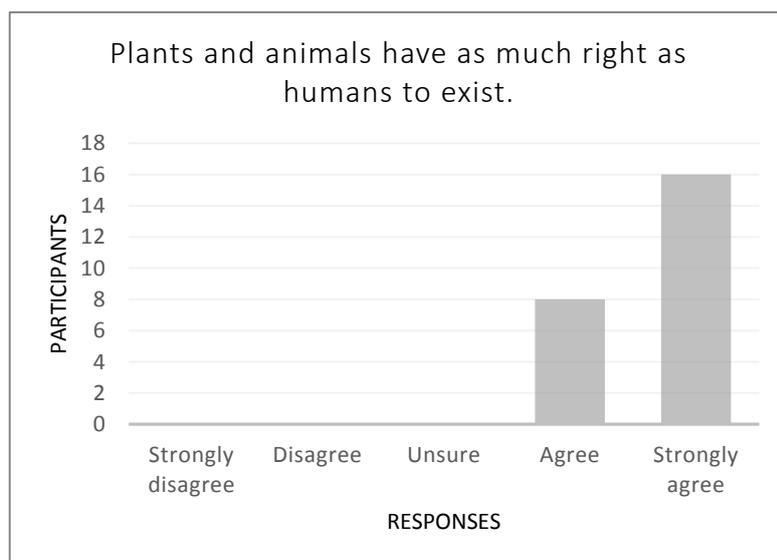


Figure 11: NEP Scale Question 7 Responses

F. Farming practices

The participants were asked about their general farming practices, as well as their frequency and types of irrigation. The motivations behind these were also sought, in order to determine the possible linkages to the above perceptions and media coverage.

1. Importance of adaptation

Most of the farmers in the area are highly adaptable, with mantra's such as: "Adapt or die;" "Be as efficient as possible." One participant, who was the oldest in the sample, was of the opinion that a farmer who stagnates in practice will go backwards in efficiency in comparison to the other farmers in the area. And if you cannot keep up, according to the participants, you will not survive in this industry. They also claimed that there have been many farmers in the area who have elected to stop farming, because of the pressures in the business. They claim that all the farmers in the area are above average, because otherwise they would have failed already.

"If you're farming today, you've got to be an above average farmer. We've all made huge mistakes in the past." (Participant number 20, a dairy/vegetable farmer)

Most of the participants were of the opinion that farmers have had to adapt to changing conditions, and those who have failed to do so, have moved on to different careers.

Furthermore, some participants framed the need for adaptation as part of a solution to the global food security movement and the constant increase in global population. The fact that the population is increasing and the resources are not makes it that much more important for farmers and industry to optimize their water and resource usage. The farmers claim to "farm with nature, not against it," which prioritizes their looking after their resources. One participant has adapted to his lack of water storage and governments unwillingness to allow farmers to increase their dam size by using biological farming to increase the storage capacity of his soil.

"I think there's a healthy interest in biological farming: We're all moving away from the NPK (nitrogen, phosphorus, and potassium) regime. We use mulching. We try to farm biologically." (Participant number 5, a blueberry farmer)

This willingness to adapt can be seen in the irrigation practices and IAP management that is happening in the study area. Even though most of the participants agreed to the need for adaptation, there were some who indicated that it is a slow process. One participant conceded with the following statement:

“A farmer is a difficult person to change, we change slowly.”

There were still some hindrances to adaptation identified by the participants. Mostly, these referred to regulations and not having the adequate support to farm in the most efficient way possible.

“What frustrates me personally at this stage is: globally, we have to get more technologically efficient. Global population increases, resources aren’t. And to do that, you need to be more energy efficient and there needs to be investment into that to protect the environment. But the current processes make it impossible.” (Participant number 18, a dairy/beef/vegetable farmer)

Many of the participants were willing to adapt to various conservation agriculture practices, specifically because of the global and local food security concerns. The participants accept this as their responsibility, and some equate farming as a quasi-spiritual calling. The belief that they are not only farming for themselves, but for the country as a whole seems to increase the feelings of victimization when they are the target of legislation.

2. Irrigation practices

The most popular irrigation method used was centre pivot (see Table 13), and many of the participants indicate increasing their irrigation size with more centre pivots in future. This is because of the effective scheduling system, which allows the farmers to irrigate at night to decrease evapotranspiration. Furthermore, many of the farmers using the centre pivots use them in conjunction with moisture sensor probes, which measure six meters into the soil to optimize water use.

Table 13: Irrigation and IAP management practices of the participants (n=24)

	Number	Percentage
Irrigation method		
Centre pivot irrigation	18	75%
Drip irrigation	3	13%
Sprinklers	11	46%
No irrigation	2	8%
Invasive Alien Plants		
Clearing practices (affirmative response)	21	88%

Eighteen of the farmers use centre pivots. Ten of these farmers also have sprinkler irrigation (Figure 12), whilst only one farmer has only sprinkle irrigation on their farm. Three of the farmers use drip irrigation. Two of the farmers do not use any irrigation and rely on rain (Refer to Table 13).

The ones that rely only on rain have no irrigation systems, and usually no adequate water source nearby from which to extract. They do have reservoirs, but these are mainly used for storing drinking water for the cattle. There is also one participant who irrigates out of rainwater dams, using the centre pivot system, relying heavily on run-off water from the mountain. He has no other water source.



Figure 12: Sprinkler irrigation system on a farm in the study area

(Source: Christo Fabricius)

3. Invasive Alien Plant Management

Twenty-one of the farmers said that they clear their invasive plants, although some admitted that they needed to devote more resources to it to make actual leeway. The farmers are also more likely to clear if it is for pasture development and can be done with a bulldozer, because then it is cheaper and they will eventually get economic benefit from it. Some participants do

manage their IAPs solely for environmental reasons, though, sometimes mentioning the importance of managing IAPs to conserve the environment.

“I’m not clearing only because I have to, I’m clearing because I want to.” (Participant number 13, a beef farmer)

The participants mostly seemed to understand the risks involved, for their property and for the ecosystem, of not managing IAPs.

In terms of government support with IAP clearing, the farmers have mixed feeling about the Working for Water programme. Some said that it is a worthy cause and that the programme has potential, others said that the reputation of the programme has been tarnished. This is mainly due to previous bad experiences reported, where the farmers said that the workers do not do their jobs.

“Working for Water comes in and scratch around a bit and then leave.” (Participant number 15, a dairy farmer)

There is also a perceived risk to security by allowing the programme to clear on one’s property.

“We live in a very volatile country, so farmers are scared of letting people onto their farm to clear.” (Participant number 13, a beef farmer)

There were not only negative comments, however, with one participant stating that he had witnessed the way Working for Water has improved over the years. The improvements included better management of the clearing teams as well as improved mechanisms and practices for managing the invasive plants.

Many of the farmers mentioned conservation farming practices such as minimum till, crop rotation and recycling and reusing water as much as they possibly could. They also explained the extent to which they go to eliminate risks of polluting the water sources, through the use of slurry dams and proper water management.

4. Scaling up

The majority of the participants were particularly business-oriented, seeing their farms as business enterprises. They spoke about the need for economies of scale to make it in the current economy, with the current input costs and the markets.

“When I started farming, it wasn’t nearly as complicated a business as it is now. Now, it’s a business. You have to enlarge your farm without being able to buy more land, but you reach your maximum capacity of cattle.” (Participant number 4, a dairy/vegetable farmer)

“I have to utilize the seven hectare of sloped land I have on my farm, where I can’t grow pastures. That’s why I have beef cattle now. You have to use every single hectare of land, because you pay

for it. This is where economies of scale comes in. I have to expand everything in order to make money.” (Participant number 3, a beef/sheep/vegetable farmer)

Furthermore, it was observed that farmers who had the financial security which economies of scale offers were more likely to assign resources to conservation practices, such as sufficient IAP management.

The perceptions of water regulation and conservation correlated systematically with the media content analysis, echoing the themes of reliance on religion, economic value of water, steep catchment, fast flowing water and lack of ecosystem thinking leading to storage capacity as a solution for ensured water security. It also seems to be linked to the behaviour of the farmers, in their decision to clear their invasive alien plants and their choice of irrigation methods.

D. Information acquisition by participants

1. Participants interests

The participants displayed interest in a variety of environmental topics, as can be seen below. There were no participants who dismissed the idea of additional information, even though some claimed that their implementation decisions were not affected by new information in this way. They indicated that the decision to implement a new innovation or practice on their farm becomes a long-term process of gathering information, dominantly through interpersonal channels. The participants who did not read the print media indicated that they rely heavily on their networks as well as the internet for additional information.

The horizontally hatched light grey bars represent disinterest in a topic, whilst the vertically hatched bars represented interest. Of the interested participants, there were some who displayed an active interest, indicating that they seek information on these topics from various sources, these are represented by the dark grey bar.

The participants displayed interest in most of the topics. All of the farmers want to increase their efficiency, a theme that seemed to emanate from the discussion of the 2009 drought. The topics that had the highest responses indicating disinterest were Water Science and Purification and Alien Species Management. The former was seen as unnecessary to gather information on and for the latter, the participants indicated, they had enough practical and

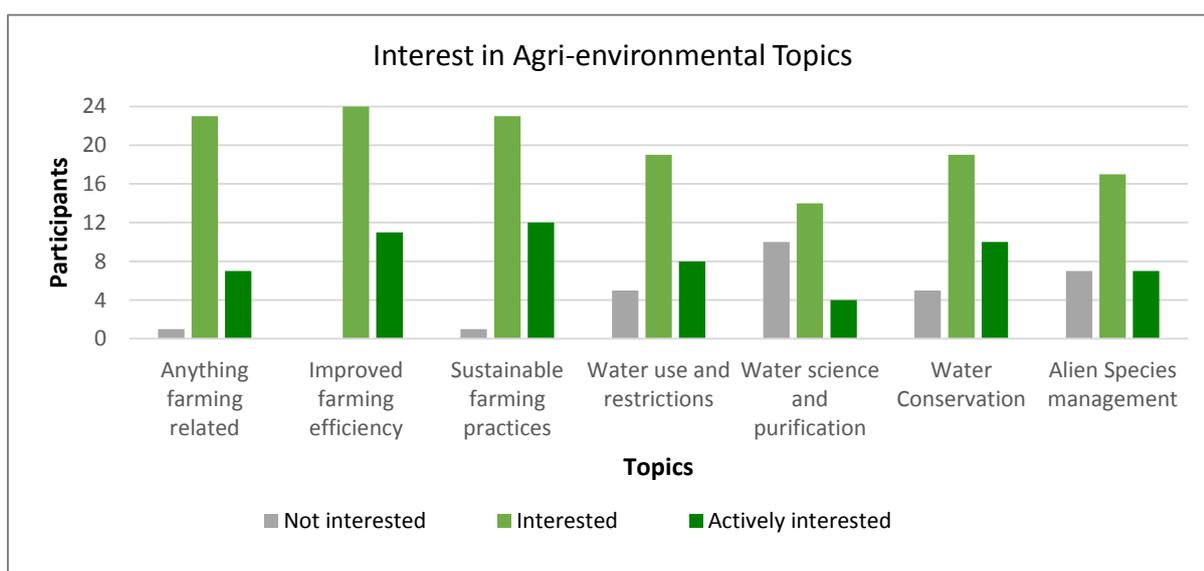


Figure 13: Participants' indicated interest in agri-environmental topics

personal experience and that more information would not benefit them. Please see 3. Invasive Alien Plant Management in the section **F. Farming practices**.

2. Information acquisition

The participants were mostly well connected individuals, with various communication channels open to them for agricultural research and information. This included local Farmer’s Associations and study groups, as well as the local government experimental farm. This provides them with formal knowledge, including academic journals and local research experiments geared specifically to the needs of the farmers in the area, as well as interpersonal communication channels (Table 14). Furthermore, most of the participants were connected to the internet on a daily basis, and indicated readership of the local media publications.

Table 14: Participants’ information acquisition processes

Theme	Number	Percentage
Consult fellow farmers for advice	18	75%
Consult experimental farm for advice	17	71%
Consult experts for advice	15	63%
Consult Farmer’s Associations	13	54%
Media influences farming practices (participants affirming)	9	38%

Formal knowledge

Most of the participants praised the experimental farm as a reliable source of information, catering to their specific research needs.

“I changed my whole pasture management system after going to the experimental farm to ask advice about it.” (Participant number 1, a beef/sheep farmer)

“Study group is one of my most important sources. “To be efficient” was our slogan for the study group when the milk price was down.” (Participant number 11, a dairy/vegetable farmer)

“George experimental farm is probably the best one there is one. We use that and we would consult them for anything we couldn’t really handle. I think their dairy section and pasture section is excellent.” (Participant number 18, a dairy/beef/vegetable farmer)

There were also some participants who relied heavily on research papers through their study groups, being connected to global experts and have ordered textbooks from overseas with specialized information in their various interests and passions. The farmers also indicated that they rely heavily on formal knowledge during times of crisis. Fifteen of the farmers mentioned that they consult experts (locally and internationally) and 17 mentioned trusting and using information from the Outeniqua experimental farm.

Interpersonal communication

Most of the sample group mentioned the value of community, while eighteen of the farmers said they go to fellow farmers for advice. They also relied heavily on social gatherings when dealing with issues, such as the Farmer's Association meetings and the various study groups.

"The dairy industry, unlike many industries, is uncompetitive, because everyone is selling a uniform product. Standard product. So there's no reason to hide trade secrets. Everyone wants everyone else to succeed as well. Getting good tips and avoiding pitfalls from fellow farmers is quite commonplace." (Participant number 10, a dairy farmer)

The participants identified various subject-specific opinion leaders in the area, farmers who are known to have a speciality and are open to sharing that information with their fellow farmers.

"If you know a farmer with a lot of knowledge, you call him. And you know who to call in which terrain. We know who is the most able in different fields." (Participant number 3, a dairy/vegetable farmer)

"I have a famer friend who I've known for years. We sat and discussed things a lot. He's got a lot of knowledge and I ask him a lot. He helped me with strategies during the drought." (Participant number 7, a dairy farmer)

The importance of opinion leaders was discussed in Chapter Two in the Diffusion of Innovation research section and the relevance to information dissemination in the area, has been outlined in Figure 2.

Media usage

Although the participants often relied on their farming networks, they were also connected to various external sources of information, specifically the internet and the agricultural media (Refer to Table 15).

Five participants indicated excessively negative attitudes toward the media, citing the sensationalism and negativity focused on as the deterrent to them reading the local newspapers.

“It’s just all negative, news is negative. It’s sensation feeding into anxiety.” (Participant number 16, a dairy farmer)

“It dampens one’s mind the statements the media make against the farmers.” (Participant number 19, a dairy/vegetable farmer)

When asked if the media influences their farming practices, only nine of the famers replied affirmatively. They also indicated that it is mostly with regards to the media’s watchdog function and labour relations with their employees. They indicated that there have been past instances where they have been unfairly made to be villains by the media for their employee relations. Furthermore, some of the farmers felt victimized by the media, claiming that the journalists do not make adequate effort to understand labour relations from the farmers’ perspective, and instead rely on conflict and sensationalism to appeal to their readership.

Additionally, they claim that other industries all have spin doctors who deal with the media.

“Often half the stuff is not written by people to be read by people. They need to be read and understood by the citizens, that’s why you need spin doctors which could change the public perceptions of farmers. The public shouldn’t only understand, but should be make it that they are sensitive to their food source.” (Participant number 17, a vegetable farmer)

They were worried by the media’s alleged tendency to exaggerate wrong-doings by the farmers without taking the time to understand the entire story.

None of the farmers indicated that the media has a direct impact on the environmental side of their farming practices, even though many of the interview themes correlate with the identified media content analysis themes, outlined in the section on E. Media Representations of Water-related Issues.

Table 15: Participants’ local media readership

Publication	Number	Percentage
George Herald	10	42%
Landbou Weekblad	22	92%

Internet usage

Many of the participants were highly connected individuals, with 16 participants (67%) using the Internet at least once a day, as can be seen in Table 16. The participants also reported being connected to various information sources through online subscriptions and association update emails.

Table 16: Participants' internet use practices

Usage	Number	Percentage
All day	10	42%
Daily	6	25%
Weekly	3	13%
Monthly	3	13%
Never	2	8%

As was discussed in this section, the farmers are avid researchers and independently research topics which pertain to their farming practices. The primary channels utilized by the farmers were their interpersonal and formal networks, as well as agricultural media. The media content analysis below provides the major themes in the publications' water and environmental coverage, in order to investigate similarities between the above perceptions and the agenda set by the media.

E. Media Representations of Water-related Issues

Initially, a broad content analysis was done on the selected articles to find reoccurring themes. The articles were revisited after the interviews with the participants, to ascertain overlapping themes as well as separate themes.

After the inclusion criteria was applied, 759 articles were archived from the George Herald. These were then broadly analysed, and 160 articles were selected. However, the sample was still too big. The sample was then analysed and the most prevalent themes identified, in order to select articles which reflect this. The articles were then analysed in depth and 74 were selected for analysis alongside 32 Landbou Weekblad articles. The main themes found through the interviews, and through the initial media content analysis were identified.

These themes along with the amount of articles focusing on them are presented below in Table 17. The percentages presented in the frequency table were compiled into a bar chart to allow for a comparison between the two publications, and represented in Figure 14.

Table 17: Major themes identified in a mass media newspaper and magazine

Theme	Local Newspaper: George Herald (n=74)		Niche Agricultural Magazine: Landbou Weekblad (n=32)	
	Count	Percentage	Count	Percentage
1. Crisis orientation	40	54%	8	25%
2. Economic focus	19	26%	17	53%
3. Lower water consumption	19	26%	4	13%
4. Technology as solution	18	24%	1	3%
5. Religion	14	19%	6	19%
6. Ecosystem health responsibility	14	19%	0	0%
7. Rainfall changes	12	16%	3	9%
8. Social implications of drought	8	11%	6	19%
9. Storage capacity as solution	7	9%	2	6%
10. Accusing state/government	7	9%	1	3%
11. Lack of ecosystems thinking	5	7%	2	6%
12. Accusing agriculture	4	5%	0	0%
13. Fast flowing water/ steep catchment	2	3%	3	9%

Major media themes correlating with interview data

The most important themes which echoed the interview and questionnaire results were identified and the media quotes presented below:

1. Crisis- oriented articles

George Herald coverage took on a more crisis-oriented approach, explaining the dire straits the town and farmers were in and the need for immediate action. Vocabulary that classified articles as crisis oriented included “Worst” and “disaster” as well as phrases that indicated the severity of the drought. Articles which were framed to indicate the crisis of the drought and floods included: “Experts prepare for looming water disaster,” “Natural disaster unfolding,” “Farmers face worst drought in 40 years,” “Boere in stryd om oorlewing (Farmers in struggle to survive),” “Dit gaan benard onder groenteboere (It is critical amongst vegetable farmers),” “Drought intensifies,” “Water a serious issue,” “Disaster area declared,” “One of the worst droughts,”

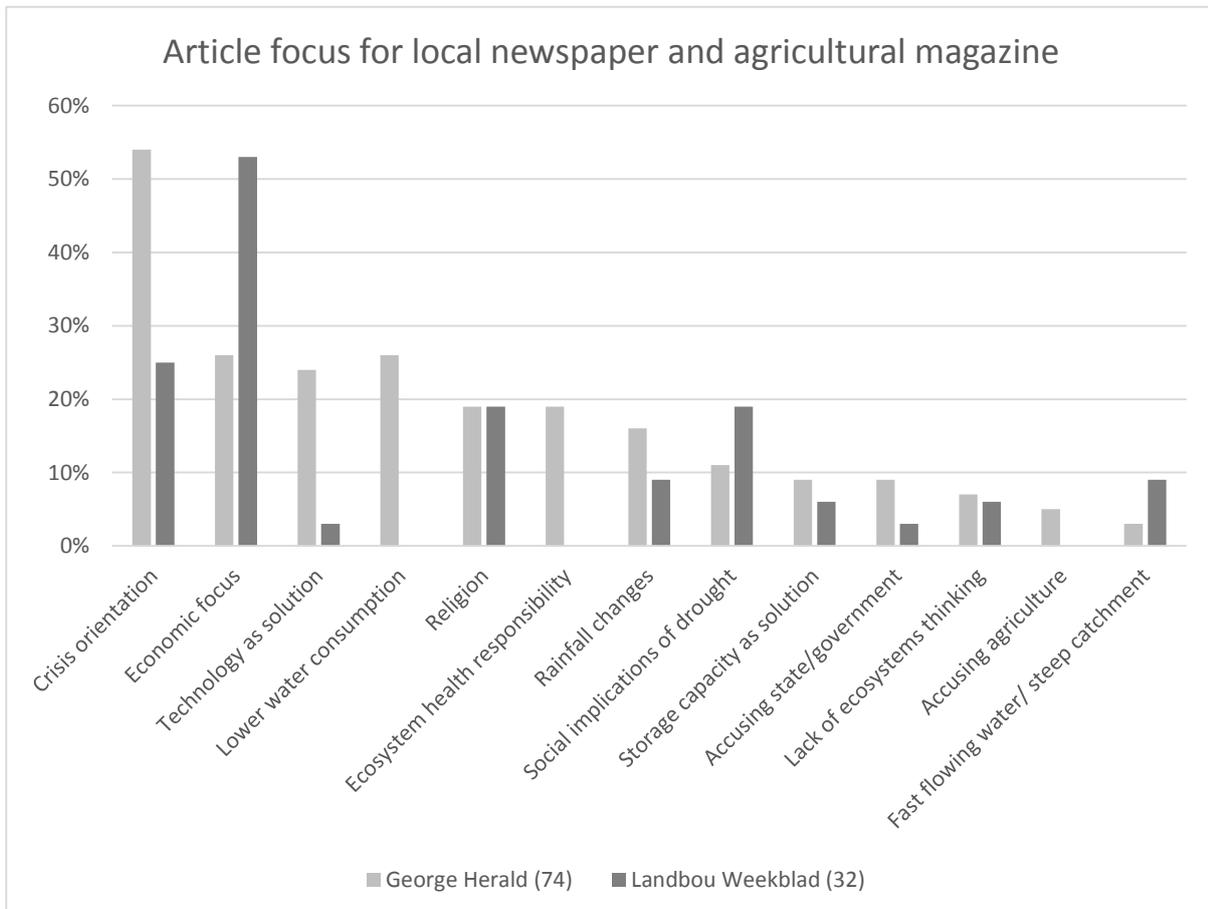


Figure 14: Comparison of article focus for George Herald and Landbou Weekblad

“Ongoing drought in Southern Cape huge concern,” “Droogte in Suid-Kaap ergste in 100 jaar (Drought in Southern Cape worst in 100 years).”

2. Economic impact of drought

The economic impact of the drought was the main focus of many Landbou Weekblad articles, which outlined the financial losses experienced by the farmers, as well as the possible future losses. This included financial losses, crop failures and other unfortunate impacts of the drought. Although less articles were economically slanted in the George Herald coverage, they echoed the same themes.

This theme was also more prominent in George Herald articles which focused on the interests and experiences of farmers. The articles which conformed to this criteria were mostly focusing on the financial impact of the drought.

*“The economic costs of weather-related disasters have increased dramatically in recent decades.”
(George Herald, Combating Global Warming: Eden plans to be proactive)*

The drought was intensified by the global recession and the changing markets and the compounded impacts of these crises.

3. Reliance on religion

Religion came through as a theme in both publications, calling for prayers and relying on faith to get through the crisis. The end to the drought and the subsequent suffering was referred to as a ‘divine promise’ (George Herald, It's Christmas on Kiewietsvlei).

“Nevertheless, it is wonderful to see the Lord working to break the drought... First the softer rain to make the hard, dry ground soft, and we trust He will send bigger rain, to fill the dams.” (George Herald, Prayer Service: Thank you and please)

I was so intensely aware of God, like never before in my life. It was as if he wanted to say: "Do not worry about the drought. I see it, I know it, be still, I'm in charge." (George Herald, Drought in the Garden of Eden)

It was equally prevalent in the publications. However, the Landbou Weekblad had articles focusing specifically on religion during the drought written by public pastor Angus Buchan.

God is unbelievable. Trust him in the faith... We prayed, sang and delivered our lives to God... we trust in Him. (Landbou Weekblad, Angus chats – God brings rain)

It included prayer and faith as the main solution to the drought, and called for dependence in the face of the crisis.

It does not matter what you are experiencing at the moment - whether it's a severe drought, devastating fires, economic calamity or even political pressure, remember one thing: If God is for us, no one can be against us (Romans 8:31). God bless you. Keep farming for him. Maintain your integrity and sincerity and, above all, keep Jesus Christ on the forefront of your farm, you will not fail. (Landbou Weekblad, The promised land)

This religious theme also correlates with the interview theme on religion, but focuses on it as a solution to the drought more stringently.

4. Ecosystem health

The theme of ecosystem health was prevalent in the George Herald (14 articles, 19%), but entirely absent in the Landbou Weekblad. Articles included here involved the weighing up of benefits to ecological impact, and surveying the environmental effect some actions would have.

"Eden is observing the effect in the here and now, acknowledging that global temperatures are rising and threatening valuable ecosystem services which support life on earth." (George Herald, Combating Global Warming: Eden plans to be proactive)

Articles were also included if they had an underlying environmental responsibility focus, or if they called for citizens to become environmentally responsible.

"[Aquifers] have to be used sustainably and responsibly... Aquifers are not inexhaustible sources." (George Herald, Indiscriminate groundwater use)

5. Changing rainfall patterns

The changing rainfall pattern was pointed out in a total of 15 articles, and seemed to be outlining future potential water issues for George. Articles were grouped here if they mentioned historic rainfall patterns and compared them to current day patterns, or if they directly stated the rainfall pattern has changed and adaptations are necessary.

An agricultural drought is about the distribution of rain. Our rainfall was, from summer of 2007 until the spring of 2008 about 1160mm. It is 460mm more than the average. How can you say it is dry if it has rained 1160mm? It's dry as a result of the change in rainfall patterns. Over the last 34 months we have had 20 months below the average rainfall. This is 59% below long-term average. (Landbou Weekblad, Learn lessons from drought)

Botha says that the last four years the Southern Cape experienced regular agricultural droughts. The annual rainfall for 2008 on the farm was 592mm, 158mm lower than the long-term average, but it is not considered one of the driest years. The rainfall, however, tells a different story. Five months of below average rainfall, five months with average rainfall and a month of flooding have occurred. (Landbou Weekblad, Manage grazing well after drought).

Many of the articles which focused on climate change framed the changing rainfall patterns as a permanent change and suggested adaptations to curtail the effects.

Current climate change predictions suggest a change in rainfall patterns for the area. More intense rainfall events (floods), increased run-off (water that is not absorbed by the soil) and a reduction in ground water result in less water available for run-of-river. (George Herald, Garden Route warned about water shortages in 2007)

Water and agricultural management methods will have to be adapted fast and drastically if these changes in rainfall patterns are a result of climate change. (George Herald, Drought intensifies)

They also suggested that the change in rainfall patterns would not return to normal, but could, in fact, worsen.

6. Steep catchment, Fast flowing water and lack of ecosystem thinking

The problem with the steep catchment allowing the water to flow into the ocean too fast has traditionally been a concern of environmentalists who claim that the ecological reserve and its' need for water.

Whenever it rains, 90 to 95% of the water ends up in the sea. (George Herald, More prayers for rain)

George rainwater runs off the mountain into the sea within six to ten hours. Consequently, the farmer's withdrawal time is very short. About 450 irrigation dams in the district are dry; many others have less than 20% water. (Landbou Weekblad, Learn lessons from drought).

For the Steep catchment theme, mention had to be made about either the fact that the water flows fast when it rains, or that the catchment is too steep for water to flow slow enough to extract adequate amounts.

"Southern Cape soils cannot take and store nearly as much rain at a time. Most of it runs into the sea within hours. Although the rainfall is high, the distribution thereof is a major problem." said Dr. Philip Botha, a specialist agricultural scientist at the Outeniqua research farm at George. (Landbou Weekblad, Be prepared for when rain falls)

The lack of ecosystem thinking theme was similar, but included the belief that water 'washes away' into the ocean, and suggesting building dams to trap water from getting to the ocean without mentioning the ecological impact this could have.

Nearer to the coast we need more storage capacity as it takes only hours for rainwater to run off to the sea. Only regular, soft rain that is spread over a number of months will improve the situation. (George Herald, Drought intensifies)

What we learned from this drought is the management and storage of water. We need to create storage capacity. There is currently a lot of rainwater that can be stored that runs into the sea. (Landbou Weekblad, Learn lessons from drought).

The rivers lie all around our district, but we don't have storage infrastructure. Whenever it rains, 90 to 95% of the water ends up in the sea. Farmers should also be encouraged by the state to build dams. (George Herald, More prayers for rain)

As is evidenced by the above quotes, the media also perpetuated increased storage capacity as the main solution to these concerns.

7. Storage capacity as solution

Increased water storage as the solution to the drought, particularly in light of the rainfall changes, were not mentioned in numerous articles. However, when they were mentioned, the coverage was in-depth and outlined the reasoning extensively.

What we learned from this drought is the management and storage of water. We need to create storage capacity. There is currently a lot of rainwater that can be stored that runs into the sea... One of the biggest concerns for future droughts in the Eden-area is the lack of storage capacity. (Landbou Weekblad, Learn lessons from drought).

This included the need to store the water in the short high rainfall periods to adapt to the longer dry periods, the drought being an example.

It may appear that there will be longer periods of drought, and more intensive rains and even flooding. This in fact confirms the need for dams to be built so that runoff can be contained during heavy rains and stored for longer periods. It strengthens the argument for dams." (George Herald, Water a serious issue)

Judging on the current weather conditions, it seems as if predictions of dryer patterns are coming true and we will need additional storage capacity for George. (George Herald, Disaster area declared)

Storage capacity was identified, by both the local newspaper and the agricultural publication, as being the first priority to curtail most of the above concerns.

8. Accusing government

The DWAF and DEA government departments came across as bearing the brunt of blame for the misfortunes, in some articles. It is not always clear which governmental authority this blame was aimed at. One article claimed that the Department of Water Affairs and Forestry (DWAF) had warned the local municipalities in the Garden Route that excessive water abstraction would have disastrous impacts in future.

Despite the warnings against excessive water abstraction for residential estates, and other developments, authorities continue to approve the latter – despite frequent water shortages and restrictions. (George Herald, Garden Route warned about water shortages in 2007)

The farmer-specific coverage also mentioned that the DWAF had halted applications to repair dams damaged in the previous years' floods which worsened the impact of the drought.

“To date, the Western Cape government has not paid out the R800 000 claimed by local authorities for the 2007 flood damages suffered in the Eden region.” (George Herald, Combating Global Warming: Eden plans to be proactive)

The above dynamic could be linked, because of the DWAF-funded study which determined that there was excessive water abstraction, and this might be why they halted applications for dams. This also indicates a lack of effective communication between the public and governmental authorities.

9. Minor themes

Accusing agriculture

Four articles in the George Herald were negative about agricultural impacts of water sources, particularly during the time of crisis.

“Intensive agriculture has had severe impacts on many rivers through over-abstraction of water, destruction of riparian vegetation, channelling of rivers for flood control and the incorrect use of pesticides and fertilizers.” (George Herald, Garden Route warned about water shortages in 2007)

The main concerns identified included over – abstraction and chemical pollution.

Social implications of drought

The George Herald had eight articles which focused on the social implications of the drought, on farm workers or the public, whilst the Landbou Weekblad covered it in six articles. These included the negative economic impact the drought and prior flooding had on lower income communities and the interventions that were put in place to remedy these social crises.

Lower water consumption

The George Herald had 19 articles calling for a lowering in the water consumption of the public, business and industry. Landbou Weekblad had none. Examples of articles calling for the public to lower its' water consumption were: *“Situation remains critical”* and *“Disaster area declared.”*

Technology as solution

George Herald also had 18 articles which presented technology as a solution to the water issues, including boreholes and a desalination plant, while the Landbou Weekblad only had one article which focused on using a technologically based system for increased milk yield.

The above media content analysis proved to be strikingly similar to the dominant interview themes identified in the previous sections. The question of relevance remains, and the practices of the individual farmers were investigated to ascertain whether the perceptions and media coverage could have a possible influence on behaviour.

The participants are highly interested in external information via various channels, including the internet and the media. They are also well connected through their interpersonal networks and information sharing groups, such as the Farmer's Associations and study groups. There is also evidence on the reliance on opinion leaders.

These findings indicate that there is a relationship between the farmers perceptions of water conservation and environmental communication, interpersonal communication, financial considerations and consequently on their behaviour. The theoretical and practical implications of the results, exploring the relevant literature as well as the relationships with various communication channels will be discussed in Chapter 5: Discussion.

Chapter 5: Discussion and Conclusion

This research reaffirmed some presumptions amongst the farmers in the area, and also offered insights into various new avenues for research and practice. However, the dominant findings proved to challenge preconceptions about farmers' environmental paradigms. In what follows, the research questions posed in Chapter 1: Introduction and Background will be answered. Thereafter, the two central theories explored in this research project, namely the New Ecological Paradigm (NEP) and the Diffusion of Innovation theory, will be discussed, along with recommendations for future research. To conclude the chapter, a hypothesis for the possible future of the farmers in the study area will be explored and will include how this research may contribute to solving identified problems.

Farmers' views of water quality and regulations, ecosystem functioning and risks to their water sources

The importance of the historical backdrop of water rights and the conflicted relationship between the economic and ecological value of nature and water was an important insight emerging from this study. The farmers in the area were acutely aware of water and ecosystem regulations in the area, and were strongly opposed to the various government departments regulating the usage of water in the area. Media usage of respondents seems to have played an important role, seeing that the media representation of water regulations illustrated a negativity toward certain governmental departments.

History matters

The history of water rights in South Africa proved to be a major influence on the farmers' opinion on water regulation. Mostly, the views agreed with the riparian rights paradigm that water rights should be tied to land ownership (Bond and Dugard 2007). Furthermore, the history of South Africa's water rights favouring agricultural practices contributed to the current conflict felt by the farmers in the area (Tewari 2009). By questioning government's ability to take informed decisions and opposing such authority by acting outside of legitimate regulations, they create a validating argument for their own authority.

What has become evident are the inefficient management strategies put into place by the relevant governmental departments and their questionable water conservation and regulation practices. This highlights the enormous amount of uncertainty prevalent with regards to South Africa's water law and the National Water Act (NWA) 36, even though it has been implemented since 1998 (Siebrits *et al.* 2014). Van der Merwe (1998) suggests that one of the key reasons this Act was changed was the growing demand for the dwindling freshwater sources in South Africa. This resonates with farmers' concerns about the growing competition for water by developers and industry.

Even though the riparian rights system in the Water Acts have been refined since 1956, this way of thinking is still prevalent amongst the farmers. It could indicate that they learnt from the previous head of household how water rights worked in the past, and how successfully it was implemented. Prior to the NWA, water used to be equated as a commodity, being allocated to various users by government departments. This has shifted with the current NWA focusing on water as a commons for the entire population, as is evidenced by the slogan "Some, For All, Forever" (MacKay 2000). These conflicting paradigms were also apparent in the farmers' opinions on water use and allocation.

Clash between nature for environmental and economic value

The clashing objectives of ecosystem management and financial profit emerged numerous times, and seemed to underline the decision-making process of the farmers. This process is discussed in terms of the Diffusion of Innovation to investigate channels of influence in the section below. The modern fiscal nature of farming influenced the participants to view ecosystem services as economic assets. It is essential to farming to turn animals and crops into an economic profit (Povellato *et al.* 2001). This includes utilizing the environment as efficiently as possible, and ties into the topic of 'Adapt or die,' discussed below. One participant claimed that their slogan for their study group was: "To be as efficient as possible."

It is essential to the farmers to view nature in an economic sense, because it is their livelihood. This sentiment is also echoed in the participants' views on flood water management. On the one hand, they understand the importance of the environment and the ecological reserves' need for water, yet on the other hand they also have a need for increased water storage.

The NEP scale responses demonstrated that farmers adhered to an environmental paradigm, even though they equate ecosystem services with economic value. Baker (2007) identified two paradigms of water rights in *The "Commons" Versus the "Commodity": Alter-globalization, Anti-privatization and the Human Right to Water in the Global South*. She focused on the emergence of market environmentalism as a convergence between economic growth and development, efficiency and conservation. This is made possible through private property rights and using markets as environmental mechanisms. She argues that environmental concerns can be effectively addressed if they were treated as economic goods, which would counteract environmental degradation and the inefficient usage of natural resources (Bakker 2007). The same phenomenon was evident in the NEP scale responses.

The findings from the NEP scale correlate this conflict between environmental and economic considerations directly by measuring the struggle between the DSP and NEP sentiments. As the interview responses indicate, the participants did show endorsement of the DSP. However, understanding the business side of farming does not indicate anti-ecological worldviews, which was triangulated by the NEP scale responses. Parallels can be drawn between these conflicting views and the influences investigated.

One of these influences is the intergenerational implications to be considered by farmers and their practices. This influences their decision making, as using the environment economically might ruin the ecological longevity, however, increased economic growth also influences the next generation positively. This links to some of the farmers viewing themselves as custodians of their land, taking the responsibility to preserve it for their children to be able to farm prosperously as well.

One of the main behaviours which underscores the clash between environmental views and economic considerations is the management of invasive alien plants. Most of the participants manage them to an extent, because they understand the ecological implications of not doing so. However, they cannot invest the necessary funds to tackle the problem properly, even though they understand the importance of it. These financial considerations will be discussed below.

The above perceptions have been formed by social, economic and historical influences over many years. For this study, four possible influences were identified and investigated. Firstly, environmental communication in the mass and agricultural media, secondly the influence of interpersonal communication and the levels of trust farmers have in their peers'

advice, thirdly the importance of inherited local-ecological knowledge of the land and farming practices, and lastly, the role financial and economic considerations have on perceptions and eventual decision-making.

Relationships among communication, knowledge, financial considerations and farmers' perceptions and conceptions about the water conservation in catchments

Media coverage, interpersonal communication, financial considerations and the impacts of markets proved to be contributing influences. Interpersonal communication, specifically, was identified as a major influence. The key insights identified for the above were the similarity between the agenda set by the media and the farmers' perceptions, the effects interpersonal communication has on the farmers, the mindset of importance of adaptability and the notion that economies of scale is a justifiable concept for survival.

Several possible influences were identified through literature and explored through the media content analysis, the semi-structured interviews and questionnaires. The most important communication sources, identified in the results section were explored to determine their possible influences on the respondents' measured perceptions of the environment, water conservation and regulation. The environmental mass media and agricultural media coverage proved to be strikingly similar to the perceptions found among respondents. The specific themes which are related to water conservation were: Risks of changing and more erratic rainfall patterns; steep catchment causing fast-flowing water; upstream and downstream user dynamics and identifying storage capacity as the solution to this.

Steyn found that most of the farmers in the Garden Route area obtain information on climate change and related topics on a regular basis (2010). This study's findings reinforce the procurement of information, and identifies three important channels of information for the participants: interpersonal communication, formal knowledge channels and agricultural media.

Even though the communication channels were explored as possible influences, it was also found that most farming practices were predominantly affected by interpersonal knowledge and financial considerations. However, as is argued in the literature and evident from the media content analysis findings, agri-environmental communication was still explored

as a source of knowledge as it makes important contributions to the farmers knowledge base and contributed theoretically to the science of sustainability (McGreavy *et al.* 2013).

Intersection between media coverage and farmers' views

There was striking similarity between the themes found in the media content analysis and from the farmer interviews. This could be due to the agenda-setting function of the media, or the media could be investigating the interests and views of farmers and catering specifically to their audience's needs. One of the identified links between the farmers' perceptions and the media's coverage is the utilization of the local experimental farm as a source of information. The farmers used it for scientific information, and the media's news articles often quoted experts from the farm. Furthermore, the direct quotations used in the media underlined some of the most salient themes identified in the interview responses, which reconfirms that the experimental farm is also a strong source of influence for the participants.

The farmers in the area indicated that they would be more inclined to read media publications if they offered practical advice from a source that understands their farming realities and culture. Lindenfeld *et al.* (2012) argue that environmental communication should form an inherent part of sustainability science, and that it is uniquely suited to transform stagnant knowledge to useable knowledge, which in turn transforms knowledge into action. They identify the difficulties that sustainability scientists, including environmentalists, have at producing knowledge which is applicable to their target audience and can influence actual decision making. Therefore, the importance of agricultural media covering environmental issues in an informed and practical way is apparent.

It matters how we frame the environment

Agenda-setting also incorporates how stories are told, or framed, to the public. Framing theory suggests that frames are conceptualized through various stages. They are transferred from culture, to the perceptions of elites and professionals, to other communication texts and finally to the minds of individual citizens (Entman *et al.* 2009). This could underline the similarities identified above in the measured farmers' perceptions and the media coverage about the solutions to water-related disasters. The media content analysis showed a difference between the agricultural niche publication, Landbou Weekblad and Farmer's Weekly, and the local

newspaper, the George Herald. The coverage was mostly reactive, and was dominated by crisis discourses.

How the environment is framed determines eventual public perceptions (Scheufele and Tewksbury 2007). The importance of framing environmental issues has been highlighted by Lakoff (2010) who examined the coverage and influence of climate change discourses. He found that environmental framing is prolific in the news media, and affects the public perception of environmental issues. In this research project, the main frames were identified as equating the environment with economic value, focusing on sensationalist crisis-oriented coverage, using technology to lower water consumption, storage capacity as a mechanism to counteract ecological vulnerability and reiterating farmers' identified concerns.

Journalists tend to be overly conventional when reporting on environmental issues. They have an important educational and awareness-raising role when reporting on environmental issues, and often overlook this role when reporting (Rademakers 2004). For conventional journalism not to depreciate environmental coverage of issues (Rademakers 2004), it has to offer a blend of environmental education and practiced objectivity (Detjen 2002). This seemed to be evident in this media content analysis. It showed a blend between conventional journalism and environmental education. Das (2012) also argues that in order for environmental journalism to challenge the conventional notions of journalism, reporters need to become active participants in dealing with environmental issues. This should be done by entrenching themselves in local debates and becoming active social agents. Lindenfeld *et al.* (2012) also found that if the traditional communication methods and rules were followed for environmental communication, it would in fact not reach the goals it set out to achieve. This research also confirms the need for a novel approach to communicating about the environment. Even though most of the articles analyzed followed the traditional writing models, some did depart from conventional journalistic practices. The media articles analyzed in this research contained an encouraging blend of environmental education and conventional objective journalism.

Farmers affect each other

As mentioned in the Diffusion of Innovation to investigate channels of influence section below, social norms form a large part of determining the farming community's behaviour. McGreavy

et al. (2015) suggest that in order to understand this, communication must be viewed as a complex system, where people who form part of the social system simultaneously create the norms of the system. The social system also provided the criteria for determining the chosen opinion leaders, which was also found by Rogers (2003). The behaviour of these opinion leaders was then used by the rest of the community to mould their practices, with individuals who did not conform to these norms often being distrusted by the other members.

These social norms also indicated the stark homogeneity of the group, being mostly white males. Even though the research did not aim to analyse this, it becomes problematic when taking the Sustainable Development Goals into consideration. These include reduced inequalities and gender equality (Sustainable Development Goals 2015). It is therefore problematic that there was not a demographic diversity in the sample.

Interpersonal communication and influences proved to be of utmost significance to the sample group, as most of the farmers indicated relying on and trusting fellow farmers for information. Also outlined in the Diffusion of Innovation section above is the ability of interpersonal communication channels to be powerful persuaders of ideas. It proved to be effective in adjusting attitudes and encouraging adoption of new practices (Rogers 2003). This is in accordance with Nykvist's argument that social learning amongst the modern farming community in Sweden is prevalent, but that it does not necessarily indicate improved natural resource management (Nykvist 2014). The same instances were identified through this research. Some of the social learning at formal and informal gatherings brought about knowledge to improve environmental governance, and some had the opposite effect: It was found to be highly dependent on the individuals who attend and the identified opinion leaders' stance on environmental matters.

Furthermore, the effect farmers have on one another was also explored inside individual families. As mentioned above, environmentalism and family-farmism seemed to be discernible dimensions on opposite poles. (Jackson-Smith and Buttel 2003). Their findings suggests that non-family farmers tend to be more environmentally friendly than farmers who inherited farms. It was also hypothesized that the older family farmers would be stagnant in their views; however, this was not the case. There was, however, no difference observed amongst the Ecoscores of family farmers as compared to non-family farmers, and as can be seen in the section on Adapt or die below, all of the farmers understand the importance of adaptation.

Relationship between farmers' perceptions and their behaviour

The key insight discovered for determining the farmers' behaviour were the financial considerations used to govern decision-making, underlined by the notion of environmental responsibility. Financial considerations proved to be a major influence in determining which practices diffused through the community and which were deemed unsuitable. The farmers' behaviour proved to be in accordance with their conflicting views on water regulations and protecting the ecosystem. These views clash at the intersection of wanting to protect the environment, and needing to utilize it to remain economically viable. Ogunbode (2013) argues that attitude is an important precursor of pro-environmental behaviour. It is therefore that the perceptions, influences and subsequent behaviours are analysed to determine an underlying link.

Adapt or die

Many participants identified adaptation as one of the main determinants of their survival in an economic climate where their peers had to quit farming or find alternative income sources. Some of the participants adapted to include eco-tourism practices to increase their income, whilst others optimized their natural resource usage to eliminate unnecessary expenditure. Vink (2004) found the same phenomena in Southern Africa, which included risk management strategies like asset and income diversification. Further adaptations in the area include diversification of farming, business models based on the economies-of-scale principle, corporatization of farming, and buying additional farming land in areas with irrigation schemes to substitute silage production. This indicates the farmers' willingness to change, which was not linked to the age of the participant or the duration of farming experience. All of the participants understood the nature of modern farming, as well as the importance of implementing the latest technology to ensure the longevity of their farm.

Money matters

The farmers in the study area are more likely to consider conservation farming practices, including water conservation, if these ensure a positive or neutral economic impact on them, rather than a cost impact. Steyn (2010) also established this in her study. She found that

farmers perceive ethical challenges in terms of behavioural terms. Invasive alien plant management and clearing is seen as an example of this. The upstream farmers do not consider clearing a priority because they would not benefit from the increased water yield, even though they understand the importance of clearing for the ecosystem's health (Steyn 2010). This indicates that they are more willing to partake in conservation practices if these are tied to economic benefit. To counteract this, Padel (2001) argues that organic farmers in Europe do not base their decisions based merely on financial considerations, and included stewardship, conservation and environmental concerns as motivators for decision-making. This study also found that the majority of the farmers in the sample indeed do clear their IAPs, as mentioned above. This could indicate a shift in perception in the last five years, or that the chosen sample group has a higher inclination toward eco-friendliness.

Economy of scale

Corporate farming in South Africa has taken off under the auspices of the economies-of-scale agenda. Thakur and Rao (2010) indicate that the increased competitiveness of agriculture is partly responsible for this shift, in a document prepared for the South African Department of agriculture, forestry and fisheries. The economies-of-scale paradigm has also been highlighted as a means of adapting to increased water scarcity in South Africa (Goldblatt 2010). Participants in the area highlighted their need for economic security as their primary reason for this adaptation.

The participants also argued that one of the reasons the farmers in the area are adopting economies-of-scale is because of increased competition in agriculture. Competition creates a need for expansion and agricultural mergers (Fotopoulos 2008). Furthermore, the changes in water legislation has mainly been brought about by increased competition for water, with an even bigger increase in competition expected (Van der Merwe 1998 , Brown *et al.* 2010). It is therefore expected that more farmers are going to adopt the economy-of-scale approach to their farming.

It was found that the publication the participants identified as trustworthy and influential to them, the Landbou Weekblad, had a stronger economic slant in its framing than the George Herald, which as they indicated did not affect their farming practices. A study titled *"Diffusion of information and communication technologies (ICTs) in communication of*

agricultural information among agricultural researchers and extension workers in Kenya” found that there were serious constraints with regard to information exchange and dissemination and that it negatively affected agricultural production. They also identified the importance of various communication sources, including the media, as invaluable sources to diffuse agricultural information (Kiplang’at and Ocholla 2005). This study, however, highlights the importance of trust along with these sources, in order to ensure adequate acceptance of information.

However, the financial costs proved to be the major contributor to which practices became popular amongst the participants. This indicates that communicators need to be aware of financial aspects of the practices which they are reporting on. The economy-of-scale paradigm underpinned a lot of this research’s findings and was acutely evident in the decision-making process of the participants.

Diffusion of Innovation to investigate channels of influence

Diffusion of innovation theory shed light on the way communication, through knowledge, persuasion and decision making, affect personal beliefs and social norms. The theory proved pragmatic in its use of investigating communication channels in the farming community. These three stages, which were relevant to this research project, were investigated. The key findings are presented in Figure 15.

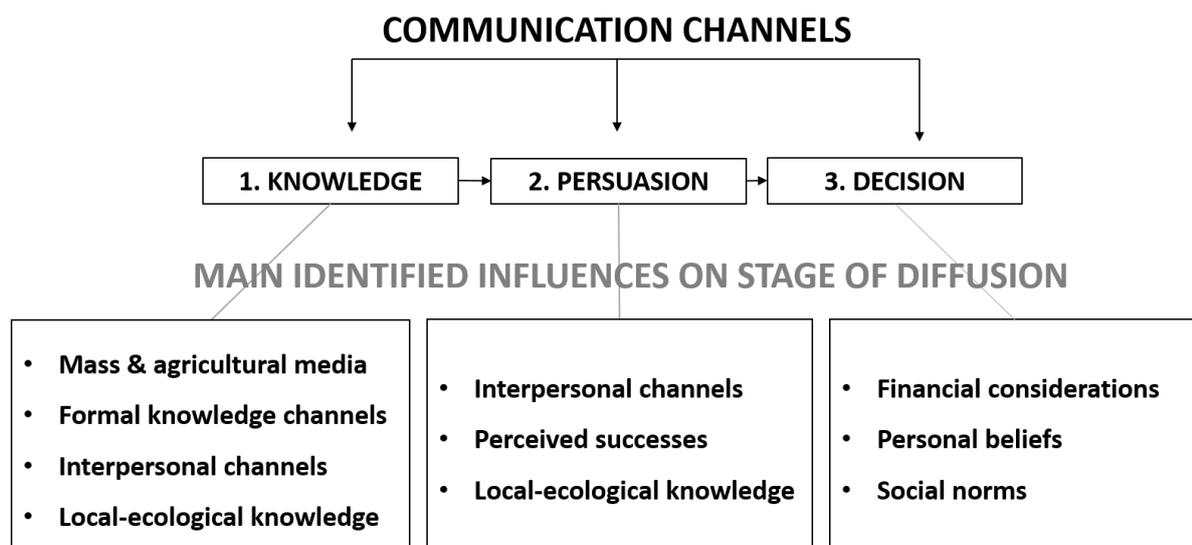


Figure 15: Identified influences on different stages of diffusion

The first stage in the diffusion process of an idea is knowledge. The participants indicated firstly that they are actively seeking information on agri-environmental topics, including water conservation, and that they have various sources from which they acquire this information. They also have levels of trust for different sources, which would determine which information they retain and choose to follow.

The farmers indicated a higher level of trust in agriculture specific media sources, including the Farmers Weekly, and the Afrikaans version of it, the Landbou Weekblad. This trust has been built over many years, starting from when the participants were younger and the publication was widely available in households. The George Herald was used as a source for general information relating to farming, such as farm murders. However, the participants indicated that they would not trust or follow farming advice from the George Herald without exploring the information first. Thus, the local and agricultural media proved to be effective in the knowledge stage to create awareness of ideas, but was discredited as a persuasive technique by the participants. Therefore, the media had a role in informing the farmers about the environment and introducing new and innovative ideas to them. However, they do not rely on the media to make their final decisions, but rather use it as an information source to find ideas to further explore.

Such exploration is usually practised through the respondents' formal or interpersonal information channels. Formal knowledge is in the form of Farmer's Associations, which the participants were extremely enthusiastic about, and informal study groups. Particularly interesting about this finding is the deferred distrust of the government. Farmers tend to trust and rely on information emerging from their self-governed Farmer's Associations, but mistrust the governmental departments which make policies and regulate their activities. This is similar to the agricultural extension model, investigated by Rogers (2003). He highlights the success of the agricultural extension model, which is based on the assumption that the organizational structures of diffusing agricultural research to the farmers in the United States is successful because of the increased farming productivity. He also suggests that this model is one of the most duplicated globally. Even though government extension services in South Africa are not utilized by farmers, they use personal networks, supplemented by the media as a substitute. These formal channels were effective in all three stages, i.e. knowledge, persuasion and decision, providing the participants with knowledge, persuading them with reliable information and research, and influencing their eventual decision.

Their interpersonal networks also provide the farmers with trustworthy information and knowledge. The farming community proved to be a powerful mutual influencer in farming practices and individual behaviour. Rogers (2003) suggests that the conformity to the social norms of a system is one of the determining factors in acceptance of individuals as opinion leaders. The sample group of the study was mostly homogenous. The vast majority of the respondents were white males who shared similar belief systems, including religion and views on governmental regulations. The interpersonal channels were effective not only as a knowledge source, but also proved useful in persuading participants of certain ideas, provided they adhered to the societal standards expected of them.

The individuals who could have been opinion leaders, but who did not conform to the social system, claimed that they were ostracized by the rest of the community in terms of any influence. This suggests that there exists intra-group pressure to conform to the social systems' norms. Individuals who were identified as opinion leaders, both to the participants and who were hailed by the media as reliable sources, generally fit into the social system.

To further this, this research found the prevalence of two types of opinion leaders. Polymorphic opinion leaders were identified by many participants, claiming that most of the farmers in the area have their one area of expertise. There were, however, a couple of monomorphic leaders identified. These results, as interpreted by Havenga's research (1974), states that in traditional farming communities there is a proliferation of polymorphic opinion leaders. This indicates that this farming community leans more towards modern and progressive beliefs.

Accepting custodianship of the environment was identified as an influence on pro-environmental behaviour. They also criticized fellow farmers who did not implement these pro-ecological practices. Similar phenomena were found through a study by Bramston *et al.* (2011) using the Environmental Stewardship Motivation scale (ESMQ), namely, social belonging, helping the environment and learning. This aspect of social belonging emerged in this study, with most participants conforming to the social norms.

Participants claimed to have inherited farming wisdom from their fathers about the practices, culture and lifestyle of farming. This knowledge is handed down generationally, and most of the family farmers indicate their hope to hand it down to their own sons. With the patriarchal exchange of profession and information, the theme of gender inequality is reconfirmed. This knowledge of farming culture and traditional practices proved to be

influential in farmers' perceptions on water regulations. Family-farmism is suggested to indicate anti-environmentalism (Jackson-Smith and Buttel 2003). Jackson-Smith (2003) and Buttel found, whilst measuring the Alternative-Conventional Agricultural Paradigm, that there were two discernible dimensions in their results, namely environmentalism and family-farmism, perched on opposite poles. This would suggest that non-family farmers tend to be more environmentally friendly. However, in the current study, there proved to be no significant difference between the family farmers and non-family farmers' responses to the NEP scale.

Use and abuse of the New Ecological Paradigm scale

The New Ecological Paradigm (NEP) scale has an extensive history as a measurement of pro-ecological worldviews (Anderson 2012). It has, however, been suggested that the scale has outlived its usefulness (Hawcroft and Milfont 2010). This research underlined the usefulness of the scale as a standardized tool for measuring environmental attitudes, but calls for a more contextualized approach when dealing with specific stakeholder groups.

To extend the notion of stakeholder engagement, Noblet *et al.* (2013) suggests that the NEP can be used to better understand the differences between the researcher and the community, and offers a unique opportunity to investigate environmental challenges further than merely looking at the data collected. Furthermore, they acknowledge that the use of the NEP has shortcomings, and thus use it merely as a measure of environmental ideology.

The influence of the preceding interview topics on the participants' responses became evident through the discussions during the questionnaires. Hawcroft and Milfont (2010), who determined the importance of the context in which the items of the scale are presented. For this study, there were three statements on the NEP scale which proved problematic. Firstly, the participants felt that they would be hypocritical if they disagreed with the statement "The earth has plenty of natural resources if we just learn how to develop them" which formed a part of the Limits to growth paradigm set of statements. This echoes the above sentiment of nature as a commodity to be utilized.

Furthermore, the topics of the interview affected the scale responses, and included Invasive species management. The participants referred to this when answering the question: "Plants and animals have as much right as humans to exist" which formed a part of the anti-

anthropocentrism section of the scale. They claimed that it influenced their responses, when taking into account the nature of both indigenous and invasive alien plants.

This section on anti-anthropocentrism also included the statement: “Humans were meant to rule over the rest of nature.” The participants found this to be a problematic statement to rank on the scale, as they proclaimed to be religious. Even though the participants agreed with the statement because of its correlation with the Bible verse, they also indicated that they understand dominion to include stewardship. Research into the link between Christianity and anthropocentrism is abundant, and argues for the same stewardship sentiments as the participants identified.

For instance, Koger and Winter (2010) argue that the phrase “dominion over nature” is a mistranslation from the original Bible texts, and does not refer to domination. Instead, it implies environmental stewardship. Stewardship has been defined, by Worrell and Appleby (2000), to be the responsible use of natural resources, which includes environmental conservation. This must be done in a way that takes into account the social interest of this generation and the next, as well as other species, and includes private needs. To account for the religious interpretation often equated to stewardship, accountability to God has to be added to the definition. When considering the responses in the interviews, as well as with the NEP scale, it is substantially evident that this is the sentiment expressed by the participants.

However, Koger and Winter (2010) also argue that even though the term should be understood as stewardship, this has not necessarily been the case. The Biblical basis of dominion over nature has been used by anti-environmentalists to justify their approach. Some studies have also found a correlation between church attendance and anti-environmental attitudes. However, in this study, the principles echoed through the responses to the NEP scale indicated an adherence to the stewardship paradigm rather than the anti-environmental paradigm. It leads this study to conclude that religious inclinations do not indicate negative attitudes or behaviours towards the environment.

Wilhelm-Renchmann *et al.* (2014) employed the NEP scale in the South African context, attempting to measure the possible application of conservation priority maps by councillors of local municipalities. They found the need to adapt the scale to culture, as it showed significant deviations between participants of different groups which were not indicative of their ecocentricity. This research also proved that there is a need for the NEP scale to be adapted to the socio-cultural contexts of the participants to provide meaningful Ecoscores. Furthermore,

past media discourses about environmental issues and topics should be considered as a deterrent to the accurate measuring of eco-centricity.

This study found discrepancies in participant responses which indicated that that scale was ineffective in measuring a pro-ecological worldview. The scale was found to be effective in increasing understanding of conflicting DSP and NEP sentiments, but also found that these are not always conflicted, and that individuals can accept both paradigms as true.

Recommendations

Media coverage of environmental topics proved to be informative and fulfilled an awareness-raising role for the farmers. Lindenfeld *et al.* (2012) outlines the difficulties faced by environmental communicators, including linking media analysis and engagement research. They call for a deeper understanding of discourses in popular media outlets, specifically in order to create an understanding of how it influences behaviour. Entman *et al.* (2009) calls for similar research agendas when it comes to journalism coverage of global environmental issues and how the public perception is influenced by global media formations and global communication flows. This research aimed to bridge these identified gaps, in order to understand how media and communication influences perceptions and subsequent actions, with the ultimate goal of exploring the cultivation of actions through various media discourses.

A structured communication plan should be launched for such projects, with data gathering before and after the implementation. This can then be used to measure the shift in perceptions of ecologically friendly farming practices. The implementers should be careful in choosing their publications to ensure that their information disseminates through a source which has built trust amongst the targeted community. The diffusion of information throughout the farming community can then be adequately measured, and Roger's (1983) understanding of mass media for awareness and interpersonal channels for persuasion could be further investigated in this respect. Furthermore, an adequate understanding of the social norms of a community is essential. To achieve this, extensive engagements have to be initiated throughout the entire agricultural production chain, in order to ensure true sustainability (Goldblatt 2010).

For environmental communicators to be truly effective as change agents, they need to adopt a multi-angled approach to convey environmental problems to the public. An

understanding of environmental communication as an important branch of sustainability science has been suggested by Lindenfeld *et al.* (2012). This research seconds that suggestion, along with an emphasis on interdisciplinary research. While environmental journalism is prolific in the study area, it often lacked a multi-angled focus. In order for the information to disseminate adequately throughout society, different approaches and disciplines should be merged to reach maximum coverage and needs to be matched to a diversity of target audiences.

There is an evident need for substantial inquiry into the issues at the intersection of sustainability and communication. This sentiment is echoed by Lindenfeld *et al.* (2012), indicating how much there is to gain by bringing environmental communication into the growing field of sustainability science. Investigating the effectiveness of environmental communication and the link between knowledge of environmental issues, and the subsequent behaviour, would further the understanding of sustainability issues.

The Diffusion of Innovation theory used to investigate the communication channels within the farming community proved effective in determining the various influences upon the participants. Further research into the structure of the community could be valuable to determine the particular influences of the social norms on the system. It would also be valuable to investigate the actual communication channels and flows for future communication plans to be based on.

The use of the NEP scale was problematic in its' application after the in-depth interviews, which indicated conflicting views between their environmental worldviews and the business of farming. Using methodological triangulation proved crucial to highlight any shortcomings of the scale by the participants. The participants were able to communicate their conflicting views through narrative, instead of simply filling out the questionnaire without explaining the reasons for their answers. The shortcomings of using the NEP scale has been documented by various authors. Noblet *et al.* (2013) suggest that the scale merely be used as a means of measuring the way in which one interprets information about the natural world, considered the underlying environmental ideology. Due to the limitations identified, this research suggests that it be used in this way as well.

Measuring Ecoscores by inclination toward NEP sentiments and deviations from DSP sentiments was challenging and perhaps somewhat deterministic. Some of the farmers in the area practice corporate farming out of economic necessity, and therefore agree with various

economic growth and development sentiments, but this does not necessarily indicate the negative ecological worldview that their eventual Ecoscore suggests. Thus, the scale should be edited further, and contextualized adequately for new research problems and stakeholder groups. This needs to be done for each individual community, and edited in accordance with the media and social discourses prevalent in that society. It could strengthen the results and offer a more nuanced and insightful view into the environmental perceptions of the participants. Although the scale is still useful as a general measure of pro-ecological worldviews, it lacks the contextualised backing which would give truly meaningful results.

The methodological approach of the study had various strengths and weaknesses. Methodological triangulation was used to ensure that the qualitative results were augmented by quantitative data, and allowed for decreased bias. The multidisciplinary nature of the larger project of which it formed part, titled, *Building Resilient Landscapes by Linking Social Networks and Social Capital to Ecological Infrastructure*, gave this project input and support from various disciplines. The study approached the research problems from a wide range of disciplinary literature, allowing an extensive multi-angled strategy to be utilized to answer the research questions.

There is also an inherent bias in qualitative research, especially through the use of interviews as a data collection method. This was circumvented by employing additional questionnaire data to analyse the research questions (Creswell 2003). The results could also have been more extensive should a more culturally-inclusive sample group be surveyed. The hypothesized reason for the homogenous cultural group is the chain-referral method utilized for data collection or the social system adherence suggested by Rogers (2003). To further deal with the bias, every effort was made by the researcher to remain objective. Interview responses were coded, and participants were assigned numbers to protect their identity. The sample size of the study was limited, thus results cannot be extended to represent all dairy farmers. For that to be the case, participants should be sourced throughout the entire South African agricultural regions in future studies.

Lastly, the research dealt with the difficult subject matter of the usage of a scarce resource, which proved to be a sensitive topic for the participants. This was especially true of the contentious water rights history of the country (Bond and Dugard 2007). The issue was circumvented in the study by extensive explanation to the research participants that the aim of this study was not to incriminate the farmers, or to identify possible unsustainable water usage

practices, but that it lay in the intersection of media use, opinion forming and behaviour change. This was included in the forms of permission of participation.

In terms of the overall research project, only four influences were investigated as links between perceptions and actions. Even though these proved to be influential in the sample, in reality, more possible influences should be investigated.

Conclusion

South Africa is facing growing water scarcity through increased competition and ongoing development. In a study by Ziervogel *et al.* (2014), it was found that the farmers and Farmer's Associations in South Africa are acutely interested in possible adaptation methods. The farmers in the study area are actively seeking ways to adapt to changing environmental, political and social conditions. A need for corporate farming in developing countries was highlighted by Mateo and Ortiz (2012). Some of the already existing adaptations in the study area include diversification of type of farming, buying additional land in an irrigation scheme area for silage, expanding into the tourist industry for extra income and attempting to increase water storage. Such water storage includes the increased capacity of reservoir dams as well as water and soil conservation.

The farmers in this study, whilst being acutely aware of short-term and seasonal climate change, also indicated a sombre awareness of climate change predictions and long-term implications. Adejuwon *et al.* (2008) suggest that farmers do not engage with climate change models and data, relying instead on short-term weather and seasonal climate variations, because they find it difficult to understand and apply the former. However, these farmers realised the adaptations necessary for surviving this predicted future, and expressed concern for the economic impact it would have on the regions agriculture.

This research was successful and met the objectives it set out to achieve. A relationship was found between the agricultural media coverage, specifically with agri-environmental communication, and the farmers' views on adaptations to water-related disasters. Along with this relationship, interpersonal communication and the social norms of the system should be considered in future research. The findings of this project highlighted interpersonal communication and social learning through Farmer's Associations and study groups as the main determinant for new innovations and practices to diffuse in the community. It clearly

established an understanding of the participants' perceptions on water regulations and conservation, and has thoroughly explored various influences on these. Interpersonal networks, formal knowledge and financial considerations proved to be the main determinants of behaviour, followed by agricultural media. This confirms the need for an innovative, multidisciplinary approach to communicating ways to deal with increasing water scarcity.

The interdisciplinary approach of the study between media studies and sustainability science offered a unique insight into the specific research problems, and was successful to the extent that future interdisciplinary studies should be highly encouraged. This is especially true for sustainability science scholarship, and gateways should be defined for exploration into these intricate links between perceptions and pro-ecological behaviour .

What is needed, then, is an attitudinal adjustment towards agriculture. Instead of being viewed as a threat to habitat and resources, agricultural practitioners should motivate the opportunities which agriculture has to improve the ecosystem rather than destroy it (WWF 2008). The solution is to rethink how we approach agri-environmental problems in practice and in research. Every risk which agriculture poses to the environment also offers an opportunity for adaptation (Goldblatt 2010). The key lies in sustainable agricultural practices, which includes organic and conservation agriculture. With further market certification of 'green' and organic products, especially with financial benefit, this type of farming is set to increase. This should be approached through the lens of sustainability science theory and understanding of the social norms and economic considerations of the public. In order to achieve these behavioural changes, the underlying perceptions and social systems have to be examined and understood. These changes, after communication campaign implementation, could bring about improved environmental conditions.

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Appendices

Appendix 1: Semi-structured interview quotations on various themes

Economic value of water

Water has become too expensive to waste.

Water is the limiting factor for expansion.

Can't use too much water because of Eskom.

It's a scarce commodity, and it's very expensive to apply.

Because water is so expensive and scarce, I try to use it as efficiently as possible.

Other problem is the cost of pumping. I think that's why there's more water in the rivers lately, because the people don't just pump without good reason.

Property is actually worth nothing without water papers/rights.

I mean electricity is expensive, which makes water expensive. Economics and water are usually linked. Save water and you also save money, they're linked.

One because it's a scarce commodity, and secondly it's very expensive to apply. So if you waste it, you're losing water, electricity and soil nutrients.

And then, to keep it economically viable for the environment and the stakeholders. For the broader community, for the workers, and for the enterprise itself. And there's a difficult interplay there. The enterprise has to be viable to take care of the environment and the community etc.

Competition for water

And they're going to want our water that we've been allocated. Big clash is going to come in the future, because people also need food. It's already started.

If you're farming today, you've got to be an above average farmer. We've all made huge mistakes in the past.

You go to a water forum meeting during a drought, it's nasty because everyone is just blaming everyone else and the farmers are normally seen as the absolute villains so this is important for your thesis if it hasn't come through yet.

Steep catchment and fast flowing water

From the mountain to the ocean, it's only 20km and so we need to catch the water.

I think the government can build dams for us, there's a lot of water that runs into the ocean that can be blocked.

And the extra water is going to run into the ocean anyway. You won't be able to catch it. Rather spend the money for a pump or another dam. (IAP clearing)

They don't want us to build dams. But when it floods, then all the water ends up in the ocean. Because the mountain is so close to the ocean. It's not that this water would take ages to run down, it rains and 'schloop' it's gone. And that's what the big fight is about. Garden Route agriculture should be studied on its own, not in conjunction with the entire Gouritz catchment.

But there's like a lot of water that goes to sea, when it rains.

The way I see the water situation is: The rains falling there, and it's like 10 kilometres and then it's in the sea. SO, you've got to try and store it." There's a lot of valleys that aren't perennial river courses- that only flow one week a year, where you can put dams up. Then it's not actually going to affect guys lower down. But, with the regulations it's improbable you'll get it.

The other problem, specifically in our area, is the intense slope with which the rivers run. If it rains a lot in the mountains, it's probably two hours and then all of that water is in the ocean. It's like a flash flood, it's just gone.

You can't store the water from the floods, the pumps are not the problem. Dams get full, and the other water just runs away.

Extra water from IAP clearing? Yes but it goes into the Wolwedans dam. Some scientists attribute it to climate change, which it probably is, but it's a reality. It's going to be more volatile.

Because if we don't catch it, it runs off.

And from an incredibly simplistic, very basic point that almost any farmer in this area along the coast would agree to is that: Our rivers are short, steep, fast flowing, don't have enough capacity or flow rate to irrigate from, but they've got more than enough capacity to fill reservoirs and dams and, if that was done and encouraged, there would be more than enough water for almost any eventuality without trying to irrigate out of rivers when things got dry.

Riparian rights paradigm

There's a huge problem with upstream users.

There isn't actually a different way to do things than how the riparian rights work.

We have a historical right to pump out of the river.

There's a lot of valleys that aren't perennial river courses- that only flow one week a year, where you can put dams up. Then it's not actually going to affect guys lower down. But, with the regulations it's improbable you'll get it.

Because, historically, the river runs in little pieces on different peoples land and every person is responsible for his farm without really understanding that it's a system.

But because some farmers have been taking so much water, people and farmers further down don't get any water. They're lucky if they get water.

Changing weather patterns and sever weather events

With the river, it's either feast or famine.

And then obviously with the climate changing, we seem to be getting big lots of rain and then drought spells. Instead of the rain being spread over months, you get the same amount of rain in one hit. So you need storage. And you need irrigation to be able to farm. “

Some scientists attribute it to climate change, which it probably is, but it's a reality. It's going to be more volatile.

Agree that rainfall is changing. Because George used to get rain winter and summer, now you sometimes don't get any in winter or any in summer, so it's totally sporadic.

When the water is there you forget about the dry times, but I've made a note in my mind not to forget that. For me, it's like a gut feel like we're going to get a few more of those.

Distrust of conservation

Conservation from a different perspective: Our farm is next to SanParks boundary and we are not allowed to control the baboons, bush pig and other pests which cause so much damage.

Yes, I am critical of certain things. Conservation being one of them.

Conservation isn't even part of my vocabulary anymore. Because it's coupled to a “don't touch” mindset. Locking out, museum type of conservation. They made the mountains museums.

It has actually caused plants to die etc. I prefer the term Environmental Management.

We get targeted as farmers, from my experience at water forums, the general public doesn't have a clue, and they make assumptions. Government doesn't have a clue, make assumptions. Even these catchment management associations, they generalise. And my experience is that one estuary and one river system isn't the same as the next one. We get bundled into the same thing. Type of water changes, everything changes.

I think we get blanket treated like that. And I don't see it getting any better.

And the problem with the bunny huggers is the don't want nuclear power stations, coal power stations, windmills put up... Because they're sore eyes. But when there's load shedding, they get highly pissed off. When they can't boil a kettle. The bunny huggers are totally unreasonable.

Dam regulation

My dams were empty, but you still had to pay your license. That's how the law works.

We haven't applied to increase dam size. There are farmers here, when we got here 10 years ago, they were already waiting 5-10 years. And they're still waiting.

You can't do anything. You have to apply to increase size of dam/ create dam. You must apply to clean it. You build a dam that's 6m deep. But now there's soil in it. A metre of soil in dam in front- but I can't take it out when the dam is dry. It's unreasonable.

I was registered for the volume of water I got. My problem with Water Rights today is, I pay the same whether I extract the water out of the river or whether I don't have it and I put it in a dam.

Farmers have never built dams that have caused the river to stop flowing, contrasted to the Wolwedans dam that the government built.

I've got the capital cost of having a dam, and the storage, making provision for that. I think it's grossly unfair that you have the same set of rules for a river than you do for dams.

Because I'm completely dependent on rain water in this farm. I've got dams, but the thing is to get permission to make your dams bigger or build more dams is quite the schlep with the environmentalists. We've done it.

Ecosystem protection

It's in everyone's interest to protect water sources because there still needs to be water going through to the ocean for the ecosystem lower down in the river.

If the water at the bottom by the Maalgate river stops flowing, then the chain of communication has to go up to tell the farmers higher up so that they can rectify. So that there is always a little stream for the ecology.

Water has got to run out to the sea.

I realize water has got to run out to the sea.

Doesn't matter what you farm with, as soon as you mess with nature you're looking for trouble. It has to be like how it is in nature.

You need to let nature lead you, so that you can see how to manage it.

What you must bear in mind, is that we're trying to farm with nature and not against nature. That's the key principle. And the resources that you've got, your soil and water: Make sure you're optimizing them and you're maintaining them in a pristine condition.

If anyone is letting pollutants like effluent into their water catchments, they're breaking the law and are compromising a hell of a lot for a hell of a lot of people. Particularly for the people downstream and the ecology.

Government and legislation

The law isn't written for the farmer.

Government isn't on our side. It's a circus at the moment. They don't know what's going on.

EIA can take six years- to approve the enlargement of a dam. 2014 April we cancelled my water license application, that was handed in seven years before that, and we started a new one. If I had to wait for all their approvals, this project would have never come to fruition.

We have 480 legislative pieces that apply to us farmers, impossible know them all.

There's not that many people in Water Affairs that know how things are meant to run, don't understand the realities of farming.

Water Affairs is more into prosecuting and fining me with DWAF than they have to do with the actual job they have to do.

We struggle severely with applications for dams, things like that I think are absolutely outrageous. That you have to apply to build a dam on your own farm, and then you still have to pay tax on the water...

Most of the farmers aren't members of Farmer's Associations because they're negative towards the government.

Everything is stalled. Doesn't just take long. It's a huge problem. It's the biggest determining factor in agriculture in the Western Cape Province, the inefficiency.

Then, also, the Dpt. Of Environmental Affairs, has become a consultation driven process which actually has nothing to do with the environment. The way that processes get handled is timely. There isn't a proper time frame. You get nothing done unless you get an attorney on them, to drive things. Sometimes it feels like the goal of it is more to create jobs for consultants and attorneys than it is to deal with nature itself. And I don't agree with that.

I was registered for 109000 cubes, and the Water Affairs was quite happy to accept my money for all of that. I built a new dam which was 113000 cubes. But didn't do an EIA first. I have since done it. I have been fined. It's their interpretation of the law, but I am not in agreement with it.

The most inefficient government department is Water Affairs. The second worst is Environmental Affairs, actually they're just as bad as each other.

About a year ago, we had a meeting with Dpt. of Water Affairs and had to show them our licenses because they had nothing on system. They haven't even finished with all that backlog. Now they've started policing this area.

Government doesn't have a clue, they make assumptions. Even these catchment management associations, they generalize. And my experience is that one estuary and one river system isn't the same as the next one. We get bundled into the same thing. The type of water changes and everything changes.

Storage capacity as the solution

The solution is more storage dams. But not dams as we see, these big ones. I think we need more off catchment dams so that we can let the normal flow through. Flood water is very important, we have to be able to store it.

Rain patterns have changed. Dams have to be priority number one to store water because the rainfall has changed so drastically.

I think the government can build dams for us, there's a lot of water that runs into the ocean that can be blocked.

They don't want us to build dams. But when it floods, then all the water ends up in the ocean. Because the mountain is so close to the ocean. It's not that this water would take ages to run down, it rains and 'schloop' it's gone. And that's what the big fight is about.

Building new dam took me eight years going through the dam regulation process, then it got turned down.

I don't understanding where the view comes from that farmers have to apply for everything.

I've never applied for a dam, we have the view that you just go ahead, build the dam or clean it or make it bigger, and pay the consequences afterwards. If you get a R50 000 or R100 000 fine, you rather just pay it.

You can't store the water from the floods, the pumps are not the problem. Dams get full, and the other water just runs away.

Our application for a dam took over 10 years. The time period is astronomical.

Catching that water in the high rainfall periods, because most rivers in this area are too small to irrigate out of during normal flow times, because it's such a small stream. But when it is raining it's like the Zambesi. It's Feast or famine.

And from an incredibly simplistic, very basic point that almost any farmer in this area along the coast would agree to is that: Our rivers are short, steep, fast flowing, don't have enough capacity or flow rate to irrigate from, but they've got more than enough capacity to fill reservoirs and dams and, if that was done and encouraged, there would be more than enough water for almost any eventuality without trying to irrigate out of rivers when things got dry.

We want to store more water as a safeguard. Also, it's a means of protecting the downstream users. The public just sees us as wanting more.

That's why I'm going the biological, conservation agriculture route, because I want to increase the storage capacity of my soil. When it rains, the hummus layer can hold the water. If I could have more water, I could expand my carrying capacity.

Reliance on religion

Without God, you cannot farm.

First knees, then experts.

You have to believe in God, otherwise you can't farm.

God told us to work the soil and look after it, but somewhere one has to draw a line. But it's here where the ruling is the problem, what does it mean?

Ruling nature, that's a difficult one. We are supposed to, because we got brains to be able to make certain decisions. To rule means to make sure that they don't go extinct either. Conservation included.

We have to rule over nature, it says so in the Bible.

We have to rule, but actually, God is in control. But he put us there to do it

Experimental farm, study groups and experts

We go to the Agricolos Pastures day every year and to the experimental farm.

You build up a knowledge base, especially because I'm younger, it's easier to want to learn things. The older guys are sort of: This happened. This is what you have to do. I respect that they've got experience, but I also first want to give it a go. I'm not just going to do what they say I must do. I've got a good family friend that works at the Experimental farm, so we go there a lot.

We go to lectures that they present, and they present new papers of research that they do there. There are plenty people there to ask advice: on animal husbandry, nutrition, pastures.

I changed my whole pasture management system after going to the experimental farm to ask advice about it.

When need more info: Go to people who have more experience of it than you do. Fellow farmers or vets or the Experimental Farm. When you have problems you go to the Experimental Farm.

But, I like to learn. So I often go seek information- Experimental farm included.

Also, talking to Experimental Farm about running a workshop on debt counselling for employees. Did research. I don't go to them for information because they specialise in pastures. But they have done a bit of social research which I'm interested in.

Study group- one of most important sources. "To be efficient" was our slogan for the study group when the milk price was down.

I get information from Associations.

If it's nutritional advice and pasture advice, we go to the Experimental farm. We've got a good relationship with the Department of Agriculture.

Outeniqua Farmers Association, Outeniqua Dairy Study Group and the MPO Milk Producers Organisation are very jacked up. They've got quite a broad scope. So if there's something important, it comes through them.

If you need specialist advice you have other people to go to, experts.

Outeniqua Dairy Study Group for pasture information, and experts from seed companies.

I believe the experts are experts for a reason. I went on a course (Graham Sate) about soil conservation and biological farming.

I go to congresses. And information days at the experimental farm and there are study groups. One tries, because there's knowledge everywhere. You take a bit from everywhere and you change accordingly.

We got to the best experts available, internationally. We are also very involved with the Experimental farm, with all their programs and research etc.

We go to the best consultants, overseas included.

George experimental farm is probably the best one there is one. We use that. But that's more for pastures. And we would consult them for anything we couldn't really handle. I think their dairy section and pasture section is excellent.

We go to the experimental farm. We go to lectures that they present, and they present new papers of research that they do there. There are plenty people there to ask advice: on animal husbandry, nutrition, pastures. There's plenty of knowledge out there, you've just got to know who to use.

The experimental farm in George is awesome. There's a guy there, a pasture guru. If we want to know anything, they've already tested it there.

Being part of a study group makes a huge difference. The people give ideas and say we did this and we did that but they don't want to give figures for some or other reason.

Interpersonal communication

If you know a farmer with a lot of knowledge you call him. And you know who to call in which terrain. We know who is the most able in different fields.

When it gets dry, if the water at the bottom by the Maalgate by the tar road stop flowing, then the chain of communication has to go up to tell the farmers higher up so that they can rectify. So that we work together so there is always a little stream for the ecology.

Especially the older guys. They've had a lot of experience growing things and they know rainfall and when to plant and when not to plant. In that way I'm also new to it. I've never planted extra stuff.

You figured out who is good with what.

You go to people who have more experience of it than you do. Trust some not others. But overall everyone in the area is actually very good at helping each other. Not too much envy or trying to cheat each other.

Before I started again with sheep, I drove over to him and asked his advice. Even though I grew up with sheep, it's been many years since then. I know he's a very practical man, and he does things in simple ways, that's why I went to him.

I talk to farmers as well, and other people I know. And I know who to trust.

If you know a farmer with a lot of knowledge you call him. And you know who to call in which terrain. Who is the most able in different fields.

Within the Blueberry Association we have Grower Days where we all share information.

I've learnt from my dad and fellow farmers.

Also, I have a famer friend who I've known for years. We sat and discussed things a lot. He's got a lot of knowledge and I ask him a lot. He helped me with strategies during the drought.

I like Geology- teach it to myself. I also try to lecture, but only to the other farmers. It's my passion, the soil. I make compost. If your soil isn't right, then you have a huge problem. If your soil is pristine, you use less water, too.

Know which farmers to go to for what information.

We will sometimes call a meeting on the river. Phone all the farmers and we get together and then discuss it.

Know who to go to for different advice.

The old people said: A farmer talks. If there were to be an attack on my farm, it wouldn't be an hour before the entire George knows. News spreads fast.

Remember the stuff is a lot different to what I was used to on the previous farm. So the first three years we just watched how the other farmers were doing it.

We are very open for other farmers to chat to us, from the other study group and we also go to other farmers.

When we're at the Farmer's association we talk to each other about things. Ask how they do things. And trust that info.

The dairy industry, unlike many industries, is uncompetitive, because everyone is selling a uniform product. Standard product. So there's no reason to hide trade secrets. Everyone wants everyone else to succeed as well. Getting good tips and avoiding pitfalls from fellow farmers is quite commonplace.

And the farmers in this area, everyone supports each other, helps each other. Nobody wants to see someone else struggle. Because all the farmers in this area are all old settler farmers. Children are friends etc.

We get together and we have meetings in connection with water. We discuss fairly regularly what issues and stuff like that we have.

But overall everyone in the area is actually very good at helping each other. Not too much envy or trying to cheat each other.

Negative perceptions about the media

It's just all negative, news is negative. It's sensation feeding into anxiety.

I don't read a newspaper anymore, I haven't read one for 3 years. I refuse.

Often half the stuff is not written by people to be read by people. They need to be read and understood by the citizens, that's why you need spin doctors which could change the perceptions of farmers. The public shouldn't only understand, but should be make it that they are sensitive to their food source.

It dampens one's mind the statements the media make against the farmers.

I do look at new developments and things like that. But you won't necessarily just go ahead and implement. But you take note of it. I also don't believe everything that it says there. I chat to people first who I think know more about it or that have tried it before.

Importance of adaptation

A farmer that stagnates goes backwards.

It's everything. If you don't have water you can't do anything.

What frustrates me personally at this stage is: globally, we have to get more technologically efficient. Global population increases, resources aren't. And to do that, you need to be more energy efficient and there needs to be investment into that to protect the environment. But the current processes make it impossible.

If you're farming today, you've got to be an above average farmer. We've all made huge mistakes in the past.

Invasive Alien Plant management

It's too expensive. And the extra water is going to run into the ocean anyway. You won't be able to catch it. Rather spend the money for a pump or another dam.

I'm not clearing only because I have to, I'm clearing because I want to.

Our dad raised us to know that Invasive plants are bad, and they have to be removed.

We live in a very volatile country, so farmers are scared of letting people onto their farm to clear.

I've cleaned a hell of a lot of bush. I've replanted bush by doing it the wrong way. Heinrich Neethling came to do a course here, for clearing bush and that.

And we find that, for wattle, the best thing at this stage, if you've got financial constraints, is to ring bark everything. One thing we make a big mistake in agriculture, is we want instant results. Farming is not a quick fix. It all runs in cycles. It's got a process. And, even the bush clearing's got a process.

Economy of scale

I have to utilize the 7ha of sloped land I have on my farm, where I can't grow pastures. That's why I have beef cattle now. You have to use every single hectare of land, because you pay for it. This is where economies of scale comes in. I have to expand everything in order to make money.

When I started farming, it wasn't nearly as complicated a business as it is now. Now, it's a business. You have to enlarge your farm without being able to buy more land, but you reach your maximum capacity of cattle.

Appendix 2: NEP scale quotations on various themes

Question 6: The earth has plenty of natural resources if we just learn how to develop them.

Not if it means fracking, no.

Depends on what sort of natural resources. If you're talking about fossil fuels, disagree 100% completely. But wind, sun, solar, water energy sources, renewable side I agree 100%.

Interesting question. Coal can be used up. Water, if we dam properly look after it properly and avoid soil erosion and mismanagement, then it's agree. So it depends which resource. Solar energy, wind energy, waver energy, then I strongly agree. Then you go to natural gas and fracking, then I strongly disagree.

Question 7: Plants and animals have as much right as humans to exist.

Because when I think about it, I think about the bugweed for example. And other Invasives. That's why I don't strongly agree.

No, I don't know. Because then you see our rivers with all the Black wattle.

Question 12: Humans were meant to rule over the rest of nature.

Yes, I agree completely because the Bible says we are supposed to rule. But ruling also needs to be thought about, what does it mean? I think it includes conservation. Then it's alright. Otherwise it isn't.

I agree, but it's here where the ruling is the problem. What does it mean? It has to be responsible.

Yes, but not to screw up. You need to let nature lead you, so that you can see how to manage it.

This is a difficult one. Because we are supposed to, because we've got brains to be able to make certain decisions, which the rest of nature can't. But how should we rule? To rule means to make sure that they don't go extinct either. Conservation included.

Yes, because it says so in the Bible.

Actually, God is in control. But he put us here to rule for Him.

People aren't meant to rule over nature. They're meant to rule over the animal kingdom, not nature.

Appendix 3: Media quotations on various themes

Reliance on religion

George Herald

Deur al die moedeloosheid en laagtepunte heen vanjaar waar hulle te bang was om na die weervoorspelling te kyk en letterlik van dag tot dag geboer het, het hy vasgehou aan 'n goddelike belofte. (Dis Krismis op Kiewietsvlei)

Through all the despair and lows throughout the year, where they were afraid to watch the weather forecast and literally farmed from day to day, he held onto a divine promise . (It's Christmas on Kiewietsvlei)

A prayer meeting for rain was held in the Herald community yesterday. "We are farmers and we are still positive, knowing things will change, but we need help! (Natural disaster unfolding)

Dit is nietemin wonderlik om te sien hoedat die Here besig is om die droogte te breek... Eers die sagter reën om die harde droë aarde sag te maak, en dan vertrou

Nevertheless, it is wonderful to see the Lord working to break the drought ... First the softer rain to make the hard, dry ground soft, and we

ons gaan Hy die groter reën stuur wat die damme sal volmaak. (Gebedsdiens: dankie en asseblief)	trust He will send bigger rain, to fill the dams. (Prayer Service : Thank you and please)
Namens die boeregemeenskap wil ek my dank uitspreek vir die gebede wat vir ons opgaan. (Gelowiges bid vir boere)	On behalf of the farming community, I want to thank you for the prayers that go up for us. (Believers pray for farmers)
If it does not rain soon we are in trouble. It is for this reason that I thought we must take this matter through prayer to a higher authority, our Lord Jesus Christ... I appeal to the people of George to join us in prayer. (Prayer for rain)	
Daar raak ek toe so intens bewus van God soos nog nooit in my lewe nie. Dit was asof Hy deur die skouspel spesiaal vir my wou se: "Moenie bekommerd wees oor die droogte nie. Ek sien dit, Ek weet daarvan, wees rustig, Ek is in beheer."	I was so intensely aware of God, like never before in my life. It was as if he wanted to say: "Do not worry about the drought. I see it, I know it, be still, I'm in charge."
Landbou Weekblad	
God is ongelooflik. Vertrou op hom in die geloof... Ons het gebid, gehuil, gesing en ons lewe weer aan God opgedra... ons vertrou in Hom... Ons het ook vir ons Regering gebid. (Angus gesels- God bring reën)	God is unbelievable. Trust him in the faith... We prayed, sang and delivered our lives to God... we trust in Him... We also prayed for government. (Angus chats- God brings rain)
Meer as 14 000 mense van oor die hele Suid-Kaap en verder het die byeenkoms in die Outeniqua-stadion op die dorp bygewoon om om reën vir die deur droogte geteisterde gebied te bid. (Angus Buchan bid vir reën)	More than 14 000 people gathered from across the Southern Cape in the Outeniqua-stadium to pray for the rain through the drought stricken area (Angus Buchan prays for rain)
Nou bid die dorpenaars die hardste vir reën. Ek weet te veel reën bring skade, maar 'n mens moet altyd dankbaar wees, want dit kom van Bo. (Droogte knel nog elders)	Now the townspeople pray the hardest for rain. I know too much rain brings damage, but you always have to be grateful, because it comes from above. (Drought stunting others)
Die voorsitter van die boerevereniging Langkloof, sê boere in dié omgewing "is op hul knieë weens die droogte". (Boere is op hul knieë)	The chairman of the farmers' association Langkloof, says the farmers in the area "are on their knees because of the drought." (Farmers are on their knees)
Dit maak nie saak wat jy op die oomblik beleef nie – of dit nou 'n kwaai droogte, verwoestende brande, ekonomiese rampspoed of selfs politieke druk is, onthou een ding: As God vir ons is, kan geen mens teen ons staande bly nie (Romeine 8:31). God seën julle. Hou aan boer vir Hom. Behou jou integriteit en opregtheid en, bowenal, hou Jesus Christus op die voorpunt van jou boerdery, dan sal jy nie misluk nie. (Die Beloofde Land)	It does not matter what you are experiencing at the moment - whether it's a severe drought, devastating fires, economic calamity or even political pressure, remember one thing: If God is for us, no one can be against us (Romans 8:31). God bless you. Keep farming for him. Maintain your integrity and sincerity and, above all, keep Jesus Christ on the forefront of your farm, you will not fail. (The promised land)

Changing rainfall patterns

George Herald

The weather patterns are becoming unpredictable and this change is not for the better. Our seasons are more erratic. (Back to normal- for now)

It is expected that future rain will come in the form of major rainfall or flood events. (Aquifer stretches from Lamberts to PE)

The unusually dry spell experienced by George during the past winter is expected to be followed up by heavy rains similar to last year when floods ravaged... the Southern Cape. (Flood warning- end of dry spell)

Current climate change predictions suggest a change in rainfall patterns for the area. More intense rainfall events (floods), increased run-off (water that is not absorbed by the soil) and a reduction in ground water result in less water available for run-of-river. (Garden Route- Warned about water shortages in 2007)

Climatologists have predicted that the eastern sections of the Western Cape will gradually become more arid. (Climate change- Prepare for a drier George).

Here along the Garden Route we have, since 2006, experienced heavy rains and floods interspersed with long dry periods. (Climate change- Prepare for a drier George).

Water and agricultural management methods will have to be adapted fast and drastically if these changes in rainfall patterns are a result of climate change. (Drought intensifies)

Erratic spread of rainfall has been the cause of agricultural droughts over the past four years. Irregular downpours occur, with dry periods in between and some flood rain that pushes up the year average. It looks good statistically, but the rain pattern fails to replenish groundwater capacity and storage dams. (Drought intensifies)

Voorheen hoef 'n dam net drie maande se water gehou het, want dit het meer gereeld greeen. Met die veranderende reënpatrone moet ons nou damme he wat ses tot nege maande se water hou. (Boere in stryd om oorlewing)	Previously a dam only had to hold three months of water, because it rained more often. With changing rainfall patterns we now need to have dams that hold six to nine months' worth of water.
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Long-time residents of George speculate that rainfall patterns have indeed changed and they are finding themselves in a much drier environment than they can remember. (Water a serious issue)

Judging on the current weather conditions, it seems as if predictions of dryer patterns are coming true and we will need additional storage capacity for George. (Disaster area declared)

Landbou Weekblad

My plaas tussen Riversdal en Barrydale het twee jaar gelede laas reën gesien, en nou't daar al 260mm in twee dae geval. (Suid-Kaap, Karoo spoel weg)	My farm between Riversdale and Barrydale last saw rain two years ago, and now 260mm has fallen in two days. (Southern- Cape- Karoo rinses away)
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'n Landboukundige droogte gaan oor die verspreiding van reën. Ons reënval was van die somer van 2007 tot	An agricultural drought is about the distribution of rain. Our rainfall was, from summer of 2007
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<p>die lente van 2008 sowat 1 160 mm. Dit is 460 mm meer as die gemiddelde. Hoe kan jy sê dit is droog as dit 1 160 mm gereën het? Dit is droog as gevolg van die verandering in reënvalpatrone. Oor die laaste 34 maande het ons in 20 maande ondergemiddelde reënval gehad. Dit is dus 59 % onder die langtermyn-gemiddelde- (Leer lesse uit droogte)</p>	<p>until the spring of 2008 about 1160mm. It is 460mm more than the average. How can you say it is dry if it has rained 1160mm? It's dry as a result of the change in rainfall patterns. Over the last 34 months we have had 20 months below the average rainfall. This is 59% below long term average. (Learn lessons from drought)</p>
<p>Botha sê die afgelope vier jaar beleef die Suid-Kaap gereeld landboudroogtes. Die jaarlikse reënval vir 2008 op die plaas was 592 mm, 158 mm laer as die langtermyn-gemiddelde, maar dit word nie as een van die droogste jare beskou nie. Die reënvalverspreiding vertel egter 'n ander storie, naamlik ses maande van ondergemiddelde reën, vyf maande met gemiddelde reënval en 'n maand waarin vloedreën voorgekom het. (Bestuur weiding goed na droogte).</p>	<p>Botha says that the last four years the Southern Cape experienced regular agricultural droughts. The annual rainfall for 2008 on the farm was 592mm, 158mm lower than the long-term average, but it is not considered one of the driest years. The rainfall, however, tells a different story. Five months of below average rainfall, five months with average rainfall and a month of flooding have occurred. (Manage grazing well after drought).</p>

Steep catchment and fast flowing water

George Herald

Whenever it rains, 90 to 95% of the water ends up in the sea. (More prayers for rain)

Nearer to the coast we need more storage capacity as it takes only hours for rainwater to run off to the sea. Only regular, soft rain that is spread over a number of months will improve the situation. (Drought intensifies)

Landbou Weekblad

George se reënwater loop binne ses tot tien uur van die berg af tot in die see. Gevolglik is boere se onttrekkingstyd baie kort. Sowat 450 besproeiingsdamme in die distrik lê droog; heelwat ander het minder as 20 % water. (Leer lesse uit droogte)

George rainwater runs off the mountain into the sea within six to ten hours. Consequently, the farmer's withdrawal time is very short. About 450 irrigation dams in the district are dry; many others have less than 20% water. (Learn lessons from drought).

Wat ons uit hierdie droogte geleer het, is die bestuur en opgaar van water. Ons moet opgaarkapasiteit skep. Daar is tans baie reënwater wat opgeberg kan word wat see toe loop. (Leer lesse uit droogte).

What we learned from this drought is the management and storage of water. We need to create storage capacity. There is currently a lot of rainwater that can be stored that runs into the sea. (Learn lessons from drought).

“Die Suid-Kaap is amper die enigste deel in die land wat nie 'n staatswater-skema het nie, maar die boere is bereid om self die water op te gaar. Gee net vir ons toestemming. Hoekom word ons beperk om op te gaar, terwyl daar in goeie reëntye amper 90 % van die water wegliep toe?” meen mnr. Stephan Gericke,

The Southern Cape is almost the only part in the country which does not have a government water scheme, but the farmers are willing to store the water themselves. Just give us permission. Why are we limited with storage capacity, while during

voorsitter van George se landbouvereniging. (Leer lesse uit droogte)	good rainfall almost 90% of the water runs away into the sea? (Learn lessons from drought)
Die Suid-Kaapse gronde kan nie naastenby so baie reën op 'n slag opneem nie. Die meeste daarvan loop binne ure see toe. "Hoewel die reënval hoog is, is die verspreiding daarvan 'n groot probleem," sê dr. Philip Botha, 'n spesialis-landbou-wetenskaplike by die Outeniqua-proefplaas by George. (Wees gereed vir wanneer reën val)	"Southern Cape soils cannot take and store nearly as much rain at a time. Most of it runs into the sea within hours. Although the rainfall is high, the distribution thereof is a major problem." said Dr. Philip Botha, a specialist agricultural scientist at the Outeniqua research farm at George. (Be prepared for when rain falls)

Storage capacity as solution to severe weather events

George Herald

It may appear that there will be longer periods of drought, and more intensive rains and even flooding. This in fact confirms the need for dams to be built so that runoff can be contained during heavy rains and stored for longer periods. It strengthens the argument for dams." (Water a serious issue)

The raising of the overflow of the dam will immensely increase the capacity of the Garden Route Dam. "It is a very cost effective way to ensure additional water security." (Waste water recycling plant launched next week)

The environmental impact study into the raising of the Garden Route Dam spillway to increase the storage volume in the dam, has also commenced. (Waste to water)

The rivers lie all around our district, but we don't have storage infrastructure. Whenever it rains, 90 to 95% of the water ends up in the sea. Farmers should also be encouraged by the state to build dams. (More prayers for rain)

Gericke feels strongly about increasing water storage capacity by building more dams, however, legislation makes it extremely difficult for farmers to obtain approvals. (Drought intensifies)

"Voorheen hoef 'n dam net drie maande se water gehou het, want dit het meer gereeld greeën. Met die veranderende reënpatrone moet ons nou damme he wat ses tot nege maande se water hou." (Boere in stryd om oorlewing)	Previously a dam only had to hold three months' water, because it rained more often. With the changing rainfall patterns we now have to have dams that hold water for six to nine months. (Farmers struggling to survive)
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Judging on the current weather conditions, it seems as if predictions of dryer patterns are coming true and we will need additional storage capacity for George. (Disaster area declared)

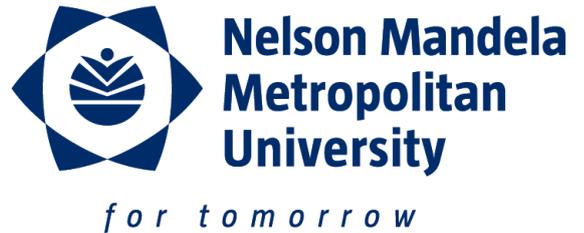
Such problems develop during droughts because farmers are prohibited to build enough dams. (One of the worst droughts)

Government should also build more dams. More dams will allow us to collect enough water during floods and rainy periods and our situation can be much more favourable. (one of the worst droughts)

Landbou Weekblad

<p>Wat ons uit hierdie droogte geleer het, is die bestuur en opgaar van water. Ons moet opgaarkapasiteit skep. Daar is tans baie reënwater wat opgeberg kan word wat see toe loop. (Leer lesse uit droogte).</p>	<p>What we learned from this drought is the management and storage of water. We need to create storage capacity. There is currently a lot of rainwater that can be stored that runs into the sea. (Learn lessons from drought).</p>
<p>Een van die groot bekommernisse vir toekomstige droogtes in die Eden-gebied is die gebrek aan wateropgaarkapasiteit. (Leer lesse uit droogte).</p>	<p>One of the biggest concerns for future droughts in the Eden-area is the lack of storage capacity. (Learn lessons from drought).</p>
<p>“Die Suid-Kaap is amper die enigste deel in die land wat nie ’n staatswater-skema het nie, maar die boere is bereid om self die water op te gaar. Gee net vir ons toestemming. Hoekom word ons beperk om op te gaar, terwyl daar in goeie reëntye amper 90 % van die water wegliep see toe?” meen mnr. Stephan Gericke, voorsitter van George se landbouvereniging. (Leer lesse uit droogte)</p>	<p>The Southern Cape is almost the only part in the country which does not have a government water scheme, but the farmers are willing to store the water themselves. Just give us permission. Why are we limited with storage capacity, while during good rainfall almost 90% of the water runs away into the sea? (Learn lessons from drought)</p>
<p>Die staat kan ’n enkele opgaardam vir al daardie riviere bou... “Ons wil al hierdie goed – van opgaargeriewe tot die bestuur van vinnig lopende riviere – saam met die plaaslike owerhede doen. Ons wil nie hê dit moet slegs vir die landbou gedoen word nie. Die res van die gemeenskap in die streek moet ook voordeel trek,” sê Gericke. (Leer lesse uit droogte)</p>	<p>The state can build a single reservoir for all those rivers ... "We want to do all these things – from storage facilities to the management of fast running rivers -together with the local authorities. We do not want it to be done only for agriculture. The rest of the community in the region should also benefit," said Gericke. (Learning lessons from drought)</p>

Appendix 4: Ethics approval



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SOUTH CAMPUS

FACULTY OF ARTS

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Noxolo.mngonyama@nmmu.ac.za

Ref: H/14/ART/JMS-005

14 November 2014

Ms D M Buckle
31 Newcombe Avenue
Miramar
PORT ELIZABETH
6070

Dear Ms Buckle

LINKING COMMUNICATION AND KNOWLEDGE TO PERCEPTIONS AND CONCEPTIONS OF WATER CONSERVATION OF THE FARMERS IN THE EDEN DISTRICT, SOUTH AFRICA

Your above-entitled application for ethics approval served at the FPGSC Higher Degrees sub-committee of the Faculty of Arts Faculty Postgraduate Studies Committee.

We take pleasure in informing you that the application was approved by the Committee.

The Ethics clearance reference number is **H/14/ART/JMS-005**, and is valid for three years, from 05 NOVEMBER 2014 – 05 NOVEMBER 2017. Please inform the FPGSC, via your supervisor, if any changes (particularly in the methodology) occur during this time. An annual affirmation to the effect that the protocols in use are still those for which approval was granted, will be required from you. You will be reminded timeously of this responsibility.

We wish you well with the project.

Yours sincerely
Mrs N Mngonyama
FACULTY ADMINISTRATOR

Appendix 5: English questionnaire

New Ecological Paradigm Scale (Dunlap 2000)		Strongly agree	Agree	Unsure	Disagree	Strongly disagree
1	We are approaching the limit of the number of people the earth can support.	5	4	3	2	1
2	Humans have the right to modify the natural environment to suit their needs.	1	2	3	4	5
3	When humans interfere with nature, it often produces disastrous consequences	5	4	3	2	1
4	Human ingenuity will insure that we do not make the earth unliveable.	1	2	3	4	5
5	Humans are severely abusing the earth.	5	4	3	2	1
6	The earth has plenty of natural resources if we just learn how to develop them.	1	2	3	4	5
7	Plants and animals have as much right as humans to exist.	5	4	3	2	1
8	The balance of nature is strong enough to cope with the impacts of modern industrial nations.	1	2	3	4	5
9	Despite our special abilities, humans are still subject to the laws of nature.	5	4	3	2	1
10	The so-called "ecological crisis" facing humankind has been greatly exaggerated.	1	2	3	4	5
11	The earth is like a spaceship with very limited room and resources.	5	4	3	2	1
12	Humans were meant to rule over the rest of nature.	1	2	3	4	5
13	The balance of nature is very delicate and easily upset.	5	4	3	2	1
14	Humans will eventually learn enough about how nature works to be able to control it.	1	2	3	4	5
15	If things continue on their present course, we will soon experience a major environmental catastrophe.	5	4	3	2	1

Demographic information					
Age		Race		Gender	F / M
Home Language		Marital Status			
Highest level of education					
Agricultural education					
Where have you travelled for professional purposes (Locally and internationally)?					
Which organisations do you belong to?					
Farming-related					
Non-farming-related					

Thank you!

Appendix 6: Afrikaans questionnaire

Nuwe Ekologiese Paradigma Skaal (Dunlap 2000)		Stem heeltemal saam	Stem saam	Onseker	Verskil	Verskil ten sterkste
1	Ons nader die limiet van die aantal mense wat die aarde kan ondersteun.	5	4	3	2	1
2	Mense het die reg om die natuurlike omgewing te verander om hulle behoeftes te pas.	1	2	3	4	5
3	Wanneer mense inmeng met natuur, het dit dikwels rampspoedige gevolge.	5	4	3	2	1
4	Menslike vindingrykheid sal verseker dat ons nie die aarde onleefbaar maak nie.	1	2	3	4	5
5	Mense is besig om die aarde ernstig te misbruik .	5	4	3	2	1
6	Die aarde het baie natuurlike hulpbronne, ons moet net leer hoe om hulle te ontwikkel/gebruik.	1	2	3	4	5
7	Plante en diere het net soveel reg as mens om te bestaan.	5	4	3	2	1
8	Die balans van die natuur is sterk genoeg om die impak van moderne industriële nasies te hanteer.	1	2	3	4	5
9	Ten spyte van ons spesiale vermoëns is mense nogsteeds onderhewig aan die wette van die natuur.	5	4	3	2	1
10	Die sogenaamde "ekologiese krisis" wat mensdom in die gesig staar is aansienlik/grootliks oordrewe.	1	2	3	4	5
11	Die aarde is soos 'n ruimteskip met baie beperkte ruimte en hulpbronne.	5	4	3	2	1
12	Mense is bedoel om oor die res van die natuur te heers.	1	2	3	4	5
13	Die balans van die natuur is baie delikaat en maklik ontsteld.	5	4	3	2	1
14	Mense sal uiteindelik genoeg weet oor hoe die natuur werk om in staat te wees om dit te leer beheer.	1	2	3	4	5
15	As dinge voortgaan in die huidige rigting, sal ons gou 'n groot natuurramp ervaar.	5	4	3	2	1

Demografiese inligting					
Ouderdom		Ras		Geslag	V / M
Huistaal		Huwelikstatus			
Hoogste vlak van opleiding					
Landbou-opleiding					
Waar het jy al vir professionele doeleindes gereis (plaaslik en internasionaal)?					
Watter organisasies behoort jy aan?					
Boerdery – verwante					
Nie- boerdery – verwante					

Baie dankie!

Appendix 7: English Interview Schedule

Section A: General

1. Before we start, do you have any questions?
2. Can you tell me what your normal day looks like, for me to understand your realities?
3. Your farming history? (since birth etc.) Family history? Size of farm?
4. Commercial farming & subsistence farming?

(Dairy, Ostrich, Fruit, Sheep, Fish, Hops, Chicken, Vegetables, Viticulture, Beef)

Section B: Farming

1. When faced with an issue/ problem on the farm, what is your first step to solving it?
(Probe: Do you look for additional information? How do you get information?)
2. Do you talk to fellow farmers when you have concerns and need information?
(Probe: Why/ Why not?) And about farming innovations etc.?
3. Do you have any interest in alternative farming practices? (If yes, which? How did you find out about these? Which farming innovations have you tried?
If no, are you 100% satisfied with the way your farm is run?)
4. How do regulations affect your farming? (Probe: Which regulations do you have? How does the government affect your farming?)
5. Any farming knowledge that has been passed down through generations? How does it influence you? How have things changed?

Section C: Water and farming

1. What does water mean to you as a farmer?
2. On a scale of 1 to 5; how efficient would you rate your water use? 1 being least efficient; 5 being most.

Could you comment on that?

Possible improvements for water efficiency?

3. Do you try to conserve water?
(If yes, what do you do to conserve it?)
4. And how is river conservation handled in your farming community? (What do you do to conserve the river?)
5. And the bigger picture, how do the farmers protect the catchment area? (What do you do to conserve the catchment?)
6. How conservation-minded would you describe yourself?
7. How does that affect your practices?

8. What has been your biggest challenge regarding water and farming?

Section D: Water management

1. Who do you think should be responsible for protecting the water sources?

(Why?)

And managing it? (Why?)

2. How does water availability influence your farming practices?

(Probe: availability / quality / reliability; How?)

3. What do you use water for, specifically?

(Irrigation? Etc. Are you able to do so effectively with your allocated amount of water?)

4. What do you remember about the drought back in 2009/2010? (Anything, literally) (Media coverage)

5. How do you keep track of any changes in water legislation and regulations?

6. What's your view on Invasive Alien Species? (Trees, Plants, Species).

7. Do you clear IAP? Know of other farmers who clear?

Section E: Farming and the media

1. Do you think the media influences your farming practices at all? Elaborate?

2. Do you read any newspapers regularly? GH? Landbou weekblad? (If yes, which? Local? National? International? If no, any particular reason?)

3. Do you remember which newspapers and radio stations you listened to as a child?

4. Are there any programs on television that you love watching? (Probe: 50/50, 7deLaan, National Geographic, Discovery)

Section F: Media usage

1. Do you look for additional information regarding your farming concerns in general? (Probe: industry, oil & gas extraction, urbanisation, National Parks, water use controls. Where do you look? Online?) What information would you be interested in?

2. Do you have all the information you need as a farmer?

Oral information: "I'm going to give you subjects and you say yes or no according to if you're interested in articles about it. The reason this isn't in a questionnaire is so that we can discuss your answers so that we can understand what you're looking for when you seek information." (Probe for all: If they say yes: Where?)

- Anything related to farming, if so where?
- Improved farming efficiency

- Sustainable farming practices and innovations
- Water use and restrictions
- Water science and purification processes
- Water Conservation
- Alien Species management

Thank you!

Do you have any feedback?

Appendix 8: Afrikaans Interview Schedule

Seksie A: Algemeen

1. Voor ons begin, het jy enige vrae?
2. Kan jy my deur jou normale dag vat, sodat ek jou realiteite kan verstaan?
3. Jou boerdery geskiedenis? Familie geskiedenis? Grootte van jou plaas?
4. Kommersiële boerdery & bestaansboerdery?
(Suiwel, Volstruis, Vrugte, Skape, Vis, Hoep, Hoender , groente, Wingerd , Bees)

Seksie B: Boerdery

1. Wanneer daar 'n probleem of krisis op jou plaas is, wat is jou eerste stap om dit op te los ?
(Ondersoek : Gaan soek jy vir meer inligting? Hoe/Waar?)
2. Praat jy met medeboere wanneer jy probleme het op die plaas en meer inligting nodig het?
Vertrou jy hulle advies?
En oor nuwe tegnologieë en innovasies? (Ondersoek: Hoekom? / Hoekom nie?)
3. Het jy enige belangstelling in alternatiewe boerderypraktyke ? (Indien ja, watter? Hoe het jy oor hulle uit gevind?
Indien nie, is jy 100% tevrede is met die manier waarop jou plaas loop?)
4. Hoe beïnvloed regulasies jou boerdery? (Ondersoek: Watter regulasies het jy? Hoe beïnvloed die regering jou boerdery?)
5. Enige boere kennis wat deur die generasies aan jou oorgedra is? Hoe beïnvloed dit jou? Hoe het dit dinge verander?

Seksie C: Water en boerdery

1. Wat beteken water vir jou as 'n boer ?
2. Op 'n skaal van 1 tot 5; hoe doeltreffend sou jy se is jou water gebruik? 1 die minste doeltreffende; 5 is so doeltreffend as moontlik.
Kan jy kommentaar lewer op dit?
Moontlike verbeteringe om jou water meer doeltreffend te gebruik?
3. Probeer jy om jou water te bewaar? Spaarsamig gebruik? (Indien ja, wat doen jy om dit te bewaar?)

4. En hoe word rivier bewaring hanteer in jou boerdery gemeenskap? (Wat doen jy om die rivier te bewaar?)
5. En die groter prentjie, hoe dink jy beskerm die boere die hele opvanggebied? (Wat doen jy om die opvanggebied te bewaar?)
7. Vind jy bewaring 'n moeilike kwessie? Bewaring boerdery? Bewaring in die algemeen? Het jy 'n probleem daarmee?
8. Wat is jou grootste uitdaging ten opsigte van water en boerdery?

Seksie D: Water bestuur

1. Wie dink jy moet verantwoordelik wees vir die beskerming van die waterbronne? (Hoekom?) En die bestuur daarvan? (Hoekom?)
2. Wat is jou standpunt oor indringerspesies?
3. Verwyder jy jou IAP? Weet jy van ander boere wat hulle indringers uithaal? As boeregemeenskap, redelik verantwoordelik?
4. Hoe beïnvloed die beskikbaarheid van water jou boerderypraktyke? (Ondersoek: kwaliteit / stabiliteit. Hoe?)
5. Waarvoor spesifiek gebruik jy water? (Besproeiing? Ens. Kan jy dit effektief doen met jou hoeveelheid water?)
6. Wat onthou jy van die droogte in 2009/2010 ? (Enigeiets, letterlik) (Media dekking)
7. Hoe vind jy uit oor enige verandering in water wetgewing en regulasies?

Seksie E: Boerdery en die media

1. Dink jy die media beïnvloed jou boerderypraktyke enigsins? Hoekom/nie?
Is jy geïnteresseerd in inligting wat jy deur die media kry? Vertrou jy dit? Van waar?
2. Lees jy enige koerante of ander publikasies gereeld? GH? Landbou Weekblad? (Indien ja, watter? Indien nie, enige spesifieke rede?)
3. Kan jy onthou watter koerante jy gelees het en radiostasies waarna jy geluister het in die verlede en as 'n kind?
4. Is daar enige programme op televisie wat jy graag kyk? Enige boerdery verwante programme? (Ondersoek: 50/50, 7deLaan, National Geographic, Discovery)

Seksie F: Media gebruik

- 1) Soek jy vir aanvullende inligting oor jou boerdery in die algemeen? (Ondersoek. Industrie, olie en gas ontginning, verstedeliking, Nasionale Parke, water te gebruik kontrole Waar soek jy op die internet?) Watter inligting sou jy in belang stel?
- 2) Sou jy se jy het al die inligting wat jy nodig het as 'n boer? (Water & boerdery)) Of is jy altyd oop vir nuwe navorsing ens.?

Mondelike informasie: "Ek gaan 'n paar onderwerpe noem, dan se asb. vir my of jy sal belang stel in inligting daarvoor. Soos as jy deur die koerant blaai en jy kom op 'n artikel daarvoor af."

Drie opsies, stel nie belang nie, stel belang, en soek aktief vir inligting daarvoor.

- Enigiets verwant aan boerdery
- Hoe om boerdery doeltreffendheid
- Volhoubare boerderypraktyke en innovasies
- Watergebruik en beperkings
- Water wetenskap en suiweringsprosesse
- Water bewaring
- Uitheemse Spesies bestuur

Dankie!

Het jy enige terugvoer?

Appendix 9: Informed consent form

RESEARCHER'S DETAILS	
Title of the research project	Media and communication influences on farmers' views of water conservation in the Garden Route, South Africa
Reference number	H/14/ART/JMS-005
Principal investigator	D Buckle
Address	9 Windheuwel, Saasveld Rd, NMMU George Campus
Contact telephone number (private numbers not advisable)	0721231180

A. <u>DECLARATION BY OR ON BEHALF OF PARTICIPANT</u>			<u>Initial</u>
I, the participant and the undersigned			
ID number			
A.1 HEREBY CONFIRM AS FOLLOWS:			<u>Initial</u>
I, the participant, was invited to participate in the above-mentioned research project			
that is being undertaken by	D Buckle		
from	Department of Journalism, Media and Philosophy		
of the Nelson Mandela Metropolitan University.			
THE FOLLOWING ASPECTS HAVE BEEN EXPLAINED TO ME, THE PARTICIPANT:			<u>Initial</u>
2.1	Aim:	The investigator is studying Media Studies The information will be used to/for their Thesis	
2.2	Procedures:	I understand that I am participating in a questionnaire and interview to form a part of the data that will be used in the research project	
2.3	Risks:	None	
2.4	Possible benefits:	As a result of my participation in this study, The Knysna Farmers Association will receive a copy of the thesis upon completion. Upon request, digital copies can be made available to participants, as well.	
2.5	Confidentiality:	My identity will not be revealed in any discussion, description or scientific publications by the investigators.	
2.6	Access to findings:	Any new information or benefit that develops during the course of the study will be shared as follows: Through email/ presentation at the Knysna Farmer's Association	
2.6	Voluntary participation / refusal / discontinuation:	My participation is voluntary	YES NO
		My decision whether or not to participate will in no way affect my present or future care / employment / lifestyle	TRUE FALSE

3. THE INFORMATION ABOVE WAS EXPLAINED TO ME/THE PARTICIPANT BY:							
D Buckle							
in	Afrikaans		English		Xhosa		Other
and I am in command of this language, or it was satisfactorily translated to me by							
(name of translator)							
I was given the opportunity to ask questions and all these questions were answered satisfactorily.							
4.	No pressure was exerted on me to consent to participation and I understand that I may withdraw at any stage without penalisation.						
5.	Participation in this study will not result in any additional cost to myself.						

Initial

A.2 I HEREBY VOLUNTARILY CONSENT TO PARTICIPATE IN THE ABOVE-MENTIONED PROJECT	
Signed/confirmed at	on 20
Signature or right thumb print of participant	Signature of witness:
	Full name of witness:

B. IMPORTANT MESSAGE TO PATIENT/REPRESENTATIVE OF PARTICIPANT	
Dear participant	
Thank you for your/the participant's participation in this study. Should, at any time during the study:	
<ul style="list-style-type: none"> - an emergency arise as a result of the research, or - you require any further information with regard to the study, or - the following occur 	
Kindly contact	Thea Buckle
at telephone number	0721231180