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The influence of environmental change on the provision of cultural ecosystem services in selected rural villages, Limpopo Province.

by

Khomotso Mokono

(1482618)

Dissertation

Submitted in fulfillment of the requirements for the degree.

Master of Science

In

Animal, Plant, and Environmental Science

In the Faculty of Science, University of the Witwatersrand, Johannesburg, South Africa

Supervisor: Prof. Wayne Twine

March 2023

Declaration

Johannesburg, March 2023

I, Khomotso Ramokone Johanna Mokono, hereby declare that this dissertation is my own, unaided work. It is being submitted for a Master of Science degree at the University of the Witwatersrand. This dissertation has not been submitted before for any degree or examination in any other university.

Date: March 2023

Name: Khomotso Ramokone Johanna Mokono

Abstract

Rural communities in communal areas in South Africa are vulnerable to significant environmental change, due to their heavy dependence on the local environment. The influence of local environmental change on the provision of ecosystem services (ES) has been well studied, but less attention has been paid to cultural ecosystem services (CES than the other categories of ES (provisioning, regulating, and supporting)) in the literature. This study fills this gap by focussing on the influence of environmental change on CES in rural communities. The study documents local environmental changes perceived by local communities, how these were perceived to impact the provision of CES, and how these perceptions differ across socio-demographic factors. Data were collected using key informant interviews (20) and survey questionnaires interviews (n=100). Survey respondents were stratified by village, gender, age group, and farmer type. The key findings were that residents identified a great variety of CES provided by the natural environment, including resources important in ceremonies, and as significant places for culturally important practices. These also included ES that would usually be classed as provisioning (e.g., wild foods) and supporting (e.g., grazing for livestock) services that had particularly important cultural value in addition to contributing to livelihoods. Furthermore, the residents identified significant changes to climate, soil, plants, animals, and water bodies, which were driven by local and external drivers. The most important finding was that the perceived influences of environmental change on the provision of cultural ecosystem services were mostly the changes influenced by climate. The village in which the respondents resided had a greater influence on the perception of CES and environmental change than other socio-demographic factors. This study provides valuable information and insight about local communities' perceptions of cultural ecosystem services, and how they might be affected by environmental change.

Keywords: environmental change, cultural practices, cultural ecosystem services, and socio-demography.

2 Corinthians 12:9

And he said unto me, my grace is sufficient for thee, for my power is made perfect in weakness. Most gladly therefore will I rather glory in my infirmities, that the power of Christ may rest upon me.

Not by might, nor by power, but by the spirit of God and grace upon my Life to have reached thus far “Ebenezer”.

Glory To God, in the Name of the Father, Son, and Holy spirit,
AMEN!

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Abbreviations

CBM	: Community based monitoring
CBNRM	: Community based natural resources managements.
CES	: Cultural Ecosystem Services
ES	: Ecosystem Services
GHG	: Greenhouse gases
IPCC	: Intergovernmental panel on climate change
NTFP	: Non-timber forest products
SES	: Social ecological system
SPSS	: Statistical package for the social science
TEK	: Traditional ecological knowledge

Glossary

Deke	: Thatching grass (*Hyparrhenia hirta (L.) Stapf)*
Dimake	: *Arachis hypogaea L*
Dinawa	: Ground nuts *(Phaseolus vulgaris)*
Dinhlwa	: Chicatana ant (*Atta mexicana*)
Ditloo	: Bambara ground nut (*Vigna subterranean*)
Go phahla	: Cultural ritual for speaking with ancestors.
Hlophi/ tlhopi	: Mixture of mealie meal and wild melon (*Citrullus lanatus*)
Lerotse	: Wild melon (Citrullus lanatus)
Mabilo	: Wild medlar (*Vangueria infausta*,)
Magege	: Termites (Macrotermes spp)
Mahlatswa	: *Englerophytum* spp
Malomanama	: Creeping blepharis (*Cassia abbreviate*)
Marula	: *Sclerocarya birrea*
Mmupudu	: Redmilk fruit (*Mimusops zeyheri*)

CHAPTER 1: INTRODUCTION

1.1 Background

South Africa has been experiencing significant land use and land cover changes since the promulgation of the Native Land Act of 1913, in response to the wider range of cultural, social, and environmental influences and politics (Hoffman, 2014). This Act successively divided the land into separate areas reserved for different race groups (Hoffman, 2014). The creation of the ethnically divided Apartheid homelands in the 1950s and massive forced removals onto even smaller parcels of land resulted in only 13% of the land surface of South Africa being allocated to the rural black population, exerting further pressure on the land and resulting in environmental degradation (Pienaar & von Fintel, 2014). Although homelands ceased to exist after the end of Apartheid in 1994 when they were incorporated into the new provinces, these areas remained degraded and overcrowded (Hoffman, 2014). Rural areas in South Africa remain home to millions of people (Hajdu et al., 2020). These areas have undergone substantial local environmental change due to large and growing settlements, conversion of rangeland to arable land and heavily utilised communal rangelands (Alcamo et al., 2005; Anthony & Bellinger, 2007). These environmental changes have resulted in a decline in soil structure and loss of vegetation cover, severe soil erosion, veld deterioration and bush encroachment (Anthony & Bellinger, 2007). Changes to the local environment occur as a direct result of clearing or abandoned agricultural land, overgrazing, and intensive harvesting of communal natural resources (Alcamo et al., 2005). Indirect drivers include communal tenure, weak governance, over-population and inefficient resource use (Giannecchini et al., 2007; Findlay & Twine, 2018).

Local environmental change and pressures in rural communal areas are set against the backdrop of global climate change (Kumar & Das, 2014). Currently, scientists are certain that increases in global temperatures are caused by the increased concentrations of greenhouse gases (GHGs) in the atmosphere due to anthropogenic industrial activities (IPCC, 2018). Global climate change has resulted in the frequent occurrence of extreme weather events in recent

decades (Shongwe et al., 2009). Climate change in South Africa is expected to result in high temperatures, more irregular rainfall patterns and frequent extreme weather events such as droughts and floods (Tadross et al., 2011; Harvey et al., 2018; IPCC, 2018). Although climate change is a global phenomenon, it is at the local level that its impacts are felt, and from where responses to climate change are seen and made evident (Fereja, 2017; Nash et al, 2019). In the former homelands, climate change exacerbates land degradation and together with various social processes aggravate soil erosion, loss of vegetation cover and species habitat (Scholes, 2009). These impacts are highlighted when droughts occur, enhancing periods of overgrazing, and floods, which wash away topsoil (Ma et al., 2018). Additionally, droughts are expected to increase the likelihood of poor crop yields, crop failure and livestock mortality in former homelands (Tadross et al., 2011; Harvey et al., 2018; IPCC, 2018).

Environmental changes impact the provision of ecosystem services (Kronenberg, 2014; Cheng, et al., 2019) by altering the function and structure of ecological systems (Abd Elbasit, 2019; Elwell, 2020). Ecosystem services are defined as the benefits or goods which support and maintain human well-being due to the dynamics, properties and functioning of ecosystems (Abd Elbasit, 2019). These services are categorised into four main types: provisioning, regulating, supporting and cultural (MEA, 2005). Provisioning services include the provision of water, fuel, medicine and food. These services are possibly much easier to evaluate and quantify economically, as such they have been examined in most previous studies (MEA, 2005; Abd Elbasit, 2019). Regulating services control ecological processes and include the purification of water and control of floods (Milcu et al., 2013). Supporting services maintain the diversity, function and structure of the ecosystems. Cultural services include spiritual and aesthetic experiences, a sense of belonging, cultural heritage, and recreation (Milcu et al., 2013). Cultural services are difficult to quantify and identify (Abd Elbasit, 2019). However, they offer a valuable contribution to people's well-being (Mowat & Rhodes, 2020).

Cultural Ecosystem Services (CES) are particularly important to the rural communities in South Africa (Daniel et al., 2012; Elwell, 2020; Mowat &

Rhodes, 2020). For example, the communities in Ciskei and Transkei former homelands perceive the thicket vegetation (*isihlathi*) as a sacred site where they connect with their ancestors (Cocks et al., 2012). There are also indigenous species, such as the *marula* tree (*Sclerocarya birrea*), which have particular cultural significance. *Marula* fruits are used by many ethnic groups across its range to make traditional beer which is used for cultural ceremonies and rituals such as *ho phahla* (Shackleton et al., 2007; Sigwela et al., 2017). Compared to other ecosystem services, cultural ecosystem services are given less attention in the literature, particularly within an African context (Cocks et al., 2012; Mowat & Rhodes, 2020). It is essential to fill this research gap as rural communities have a deep and close relationship with the local natural environment (Mowat & Rhodes, 2020). Unfortunately, when poor policy decisions are made, it further exposes already vulnerable communities to even greater risk (Mowat & Rhodes, 2020).

1.2 Rationale

Environmental change has raised serious concerns throughout the world, including in South Africa (Anthony & Bellinger, 2007; Ma et al., 2018). For the past decades, South Africa has been experiencing changes to the natural environment (Cock & Wiersum, 2003; Anthony & Bellinger, 2007; Chan et al., 2012). These changes include climate change, land cover and land use change, which are influenced by anthropogenic activities and natural factors (Anthony & Bellinger, 2007). These changes have been well studied but the knock-on effects and influences of these changes on society are less well studied. In particular, the influence of environmental change on the provision of CES for rural communities is poorly understood (Cock & Wiersum, 2003, Anthony & Bellinger, 2007; Chan et al., 2012). This is due to the often intangible aspects of CES (the nonmaterial benefits people obtain from ecosystems) (Cabana, 2020; Mowat & Rhodes, 2020). Moreover, although the importance of ecosystem services for livelihoods is well-established in the literature, the nature and value of CES are less well-established (Cocks et al., 2012). Environmental change has the potential to reduce the efficiency in the provision of ecosystem services, including cultural ecosystem services (Kronenberg,

2014). For Instance, land transformation results in the loss of culturally important adult *marula* trees (Shackleton & Shackleton, 2004).

In order to understand the influences of environmental change on the provision of CES, it is important to understand local communities' perceptions of these. These perceptions and knowledge are likely to be influenced by a range of socio-economic factors such as the village of residence (The village in which participants reside), occupation, age and gender (Mensah et al., 2017). Perceptions may differ between villages within a region due to differences in cultural norms and experiences, differences in village size and resource demand relative to the local natural resources, and as well as varying ecological conditions such as vegetation type, topography and soil type (Mensah et al., 2017). Understanding local perceptions of CES, environmental change, and how these changes impact CES will minimise the knowledge gap on the link between societies, culture and environment in the former homeland areas, and on the poorly understood cultural impacts of environmental change in these communities. Given the above, this MSc research project investigated the perceived past and present CES provided by local ecosystems in five rural communities, the environmental changes experienced by these communities, their perceived causes, and the perceived influence of environmental changes on the provision of cultural ecosystem services.

1.3 Aim, objectives, and research questions.

Aim

The aim of the study was to investigate the perceived impacts of environmental change on the provision of cultural ecosystem services, and how these perceptions differ by age, gender, farmer type and village in selected rural villages of the Limpopo Province.

Objectives and key questions

1. To investigate the local perceptions on past and present cultural ecosystem services derived from the local environment by the rural communities, and how these vary by socio-demographic factors.
    a) What are the perceived past and present cultural ecosystem services derived from the local environment by the rural communities?
    b) How socio-demographic factors influence how these cultural ecosystem services are perceived?
2. To determine local perceptions of the local environmental change, the causes, and the impacts on cultural ecosystem services, and how these vary by socio-demographic factors.
    a) What are the local perceptions of how and why their local environment has changed, the causes, and the impacts on CES?
    b) How do local perceptions of environmental change, causes and impacts on cultural ecosystem services vary by socio-demographic factor?

1.4 Dissertation structure and overview

This dissertation consists of five chapters, outlined as follows: Chapter 1 provides a general introduction, background and rationale of the study, followed by the aims, objectives and key questions of the study, and the literature review. Chapter 2 describes the study sites and methodology used in the study. Chapter 3 focuses on the perceived past and present cultural ecosystem services derived from the local environment by the rural communities, and assesses how age, gender, farmer type and the village of residence influence how CES are valued. Chapter 4 focuses on the local perceptions of how and why the local environment has changed, and the impacts of the changes on CES; and how these vary by age, gender, farmer type and the village of residence. Chapter 5 provides an overall discussion, study limits, conclusions and recommendations. Chapters 1 and Chapter 2 (Methodology) are written as stand-alone research chapters, and each chapter has its reference list.

1.5 Literature review

1.5.1 Environmental perceptions and how they are influenced by socio-economic and socio-demographic factors.

Rural communities are particularly exposed to the impacts of environmental change, as they depend heavily on local natural resources to meet their daily needs and to acquire income (Shackleton & Shackleton 2000, 2004; Hunter et al., 2010). As such, studies have shown that most rural areas in South Africa are vulnerable to environmental scarcity and resource over-exploitation, caused by socioeconomic and demographic factors (Shackleton & Shackleton 2000, 2004; Hunter et al. 2010). Livestock husbandry, farming, trade and consumption of natural resources are the main land-based activities in rural communities. These activities may have significant impacts on natural resources such as medicinal plants, fuelwood, and water (Hunter et al., 2010). Although millions of households in rural communities depend on the natural environment for their well-being, residents' perceptions of the environment is less known compared to urban residents (Hunter et al., 2010).

One study demonstrated that younger and more educated individuals tend to have stronger environmental concerns compared to their counterparts (Marshal, et al., 2005). A study on gender differences in environmental concern demonstrated simple differences between women and men, with women showing stronger environmental concern (Hunter et al. 2010). Masterson et al. (2017) stated that the sense of belonging to the place is associated with identity elements. Additionally, Chen et al. (2014) examined the powerful influence of 'place' within natural resource politics. This author suggests such politics are as much about stakeholders' perceptions of place meanings as they are about competition over the allocation and distribution of scarce resources. Additionally, Cheng et al. (2003) acknowledge that people's perceptions of place are typically excluded from natural resource decision- making.

Understanding local perceptions of environmental change is important. Local perceptions and knowledge of environmental change are important in making management decisions relating to the management of natural resources (Pyhälä et al., 2016). Knowledge of local perceptions can help to improve

understanding of environmental changes and their impacts on residents in different settings. For example, differences between local perceptions of change demonstrate the potential contribution in identifying new elements of changes in the environment (Hunter et al., 2010). Moreover, local perceptions may well influence their behaviour regarding planning actions and management plans (Pyhälä et al., 2016). Local perceptions are thus ideal in any initiatives aiming for sustainable climate change adaptation and mitigation and natural resource management (Pyhälä et al., 2016). However, these perceptions are important and are poorly understood in rural societies.

1.5.2 Natural resources and rural livelihoods

Rural livelihoods are diverse, multiple and dynamic, and are greatly differentiated by social identity with unequal and greatly variable outcomes depending on gender, age and other factors (Cousins, 1999). Livelihoods in rural communities are primarily land-based and consist of arable agriculture, harvesting of natural resources and animal husbandry which are all practiced on communal rangelands (Anthony & Bellinger, 2007). The most well-studied aspect of ecosystem services provided by communal lands are provisioning services including the non-timber forest products (NTFPs) such as wild spinach, edible fruits, fuelwood, wooden utensils, weaving material, building material and medicinal plants, and supporting services including soil for agriculture, grazing and browse for livestock (Shackleton & Shackleton, 2004).

Former homelands are home to approximately 4.79 million households (Pienaar & von Fintel, 2014), who still depend heavily on the communal land and its natural resources for their livelihoods (Shackleton & Shackleton, 2004; Giannecchini et al., 2007; Hamann et al., 2016). This variety of natural resources harvested from communal lands is utilised for direct use and trade in both local and distant markets (Cousins, 1999; Shackleton & Shackleton, 2004). Natural resources often act as a safety net in poverty because they provide free or cheap domestic products such as food, cooking energy, medicines, and they are also used to generate income (Twine, 2013; Shackleton & Shackleton, 2004).

Approximately 200-300 plant species are used by rural households in South Africa (Shackleton, 2001; Wiersum et al., 2006). The most used resources are wild herbs (93–100%), indigenous fuelwood and fencing wood (between 70–100%) and wild fruits (72–100%) (Wiersum et al, 2006). Fuelwood is used as a source of energy; rural communities rely on fuelwood for cooking, heating water and keeping themselves warm during winter (Shackleton et al, 2007; Matsika et al. 2012). These natural resources are harvested from communal rangelands around villages (Shackleton, 2001). Additionally, rangelands also support domestic livestock (Cousins, 1999; Fereja, 2017). Approximately 30% of the former homelands in South Africa are agricultural households, with 14.3% of households owning cattle (David, 2017*).*

The landscapes in rural communities have largely been shaped by discriminatory Apartheid policies that placed most of the land in the hands of white commercial farmers and undermined peasant production amongst black farmers in the homelands (Kepe & Tessaro, 2014). However, despite this history, farming remains a significant source of food security among black rural communities (Shackleton & Luckert, 2005). Although extensive arable production is declining and either shifting to more intensive cultivation of home gardens or being abandoned altogether (Shackleton et al. 2019). Nevertheless, rural communities in parts of South Africa such as Limpopo province, still place great importance on growing maize and traditional vegetables (Mpandeli et al., 2005; De Cock et al., 2013).

Rural communities have regulations that limit or prohibit the harvesting of certain natural resources such as fuelwood (Shackleton, 1993; Matsika et al. 2012). However, the regulations are no longer effective as most people do not comply with them because most of the regulations have not been approved to have legal effect in compliance with South African court regulations compliance. As such leaders would also not be able to enforce compliance in their communities (Olivier et al., 2010). Community-based involvement in natural resources management is a common approach used in managing the local environment and includes Community Based Monitoring (CBM), Traditional Ecological Knowledge (TEK), and Community Based Natural Resources

Management (CBNRM) (Shackleton, 1993; Cousins, 1999; Musavengane & Simatele, 2016). However, resource governance in communal areas is often ineffective due to the shortage of resources relative to the need and the weakening of traditional resource governance structures due to cultural and political change (Giannecchini et al., 2007; Matsika et al., 2012; Findlay & Twine, 2018). This results in a phenomenon known as the “tragedy of the commons”, in which individuals utilise natural resources according to their own self-interest and behave contrary to the common good of all users by depleting the shared resources through their collective action (Boonzaier et al., 1990), for example overharvesting of resources, and illegal cutting of culturally important indigenous trees such as *Sclerocarya birrea* (*marula*) (Kirkland et al., 2007).

Community involvement is recommended in most rural communities for its effectiveness in managing the environment and natural resources (Musavengane & Simatele, 2016). Rural communities are currently encouraged to participate and be involved in their local development projects and give their opinion, knowledge (preferably indigenous or traditional) and perceptions in matters that affect their current and future natural environment, society, and economy (De Cock et al., 2013; Kepe, 2014).

1.5.3 Importance of ecosystem services to people

Four categories of ecosystem services are provisioning (such as non-timber forest products, fresh water, and fish), regulating (such as climate regulation, water purification, and pollination), supporting (such as species habitat, soil formation), and cultural services (such as tourism, sense of place, and recreation) (MEA, 2005). Rural communities around the world form dynamic relationships and interactions with their surroundings, which they rely on as a source of tangible products and services (Mensah, 2017). The importance of ecosystem services to these communities is valuable for cultural valuation because these services exist if these populations benefit from them (Mensah, 2017). In addition, their social perceptions towards the importance of ecosystem services are crucial to identify the most important and valuable ecosystem services at a local scale, and the potential trade-offs between

ecosystem services (Abd Elbasit, et al. 2019; Cabana, 2020; Mowat & Rhodes, 2020).

The capacity of an ecosystem to supply a specific ecosystem service may not indicate the actual production or consumption of that ecosystem service, hence a landscape may not always ensure optimal utilisation (Abd Elbasit et al. 2019). Benefits may be distributed differently among a group of beneficiaries depending on their access to the resources and the importance they place on their efficient management (Mensah, 2017). There is mounting evidence that access to a particular ecosystem service and use of that service would be strongly influenced by a wide range of ecological factors including ecological ethics (moral principles governing the human attitude towards the environment, and rules of conduct for environmental care and preservation), ecological knowledge, spatial and environmental factors, and social factor including demographic factors (Abd Elbasit et al., 2019; Cabana et al., 2020; Mowat & Rhodes, 2020). For instance, the rate at which people visit a free or recreational site can reduce due to a long distance to that site. Therefore, adequate investigation of these factors could also improve the understanding of the complex interactions between people and the environment (Mensah, 2017; Cabana et al., 2020; Mowat & Rhodes, 2020).

Many of nature's contributions to people (NCP) are critical for human health, and their decline threatens the quality of living (Daz, 2015). The contributions of nature to human well-being within social-ecological systems have been widely studied using a variety of conceptual frameworks (Daz, 2015). Several social-ecological approaches and conceptual frameworks, including the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), have emerged in recent decades, illustrating the interconnections between social and natural processes that direct the delivery of benefits from nature to people and support the functioning of social-ecological systems (Millennium Ecosystem Assessment, 2005). The IPBES framework emphasises the role of people in providing nature's contributions to people by recognising the role of anthropogenic assets in achieving a high quality of life (Díaz, 2015). However, there is a growing need to communicate effectively how both people and nature

contribute to quality of life (Steffen et al. 2015). According to Steffen et al. (2015), understanding complex interactions between nature and society remains a challenge for informing sustainable development.

The complex and dynamic relationships between people and ecosystems have made it necessary to conduct additional research on the services provided, and the field of ecosystem services has seen a significant amount of research in recent decades (Steffen et al. 2015). However, scientists, landscape managers, and policymakers continue to disagree on the idea (Mensah, 2017). The emergence of numerous global projects, like the Millennium Ecosystem Assessment (MEA), the Economics of Ecosystems and Biodiversity (TEEB), and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), are manifestations of the ongoing discussion (IPBES, 2018). The majority of the efforts in ecosystem services evaluation have been focused on the ability of ecosystems to deliver ecosystem services and their economic valuation, even though ecosystem services are increasingly being used to inform and assist management decisions at the landscape level (Mensah, 2017).

1.5.4 Provision and use of cultural ecosystem services in rural communities.

Culture interacts with nature in many socio-ecological settings (Cheng et al., 2019). For instance, landscapes have a significant influence on the people's local identity, which enhances the human-nature relationship (Cheng et al., 2019). Human culture, social interaction, heritage value, religion and knowledge system and related amenity services have always been shaped and influenced by the condition and type of the ecosystem in which culture is based, and vice versa culture shapes nature through the selection of plants and animals and the reworking of the landscapes (Tengberg et al., 2012; Verschuuren et al., 2018). Additionally, there is mutual feedback between culture and the natural environment, in which a shift in one often leads to a change in the other (Verschuuren et al., 2018). The use of natural resources may create diverse cultural landscapes with aesthetic, ecological and economic

value (Cocks et al., 2012). For example, the communities in Ciskei and Transkei former homelands perceive the thicket vegetation *(isihlathi*) as a sacred place where they can communicate with their ancestors (Cocks et al., 2012). Cultural ecosystem services are the intangible benefits people acquire from ecosystems and have a direct effect on their quality of life (Sigwela, 2017). Cultural ecosystem services are pointed out by most authors as important in fulfilling psychological needs such as self-actualisation, belonging and esteem (Wu, 2013). Cultural ecosystem services are essential in a wide range of settings and their importance to human well-being is acknowledged (Sottini, 2019). There are thirteen (13) types of cultural ecosystem services identified by the Millennium Ecosystem Assessment (MEA, 2005), including spiritual experiences, religious values, cultural diversity, education values, knowledge systems, inspiration, social relations, cultural heritage values, aesthetic values, sense of place, mental health, ecotourism and recreation. CES has an indirect influence on mental and emotional wellbeing, and its influence is often subjective (Milcu et al., 2013). How ecosystem services are valued is influenced by socio-economic factors such as age, gender, and experience (Mensah et al., 2017).

Landscapes are acknowledged to provide CES (Anthony & Bellinger, 2007). CES based on landscape aesthetics (the enjoyment and pleasure felt through the observation of environmental scenery) are mostly acknowledged by people who value scenic beauty, while cultural ecosystem services such as a sense of place are acknowledged by people who have an attachment to a particular place, typically it is complemented by a sense of belonging (Anthony & Bellinger, 2007). Landscape units, particularly forests, mountains, and water bodies such as rivers and dams, were found to be extensively used in meeting community needs, across a range of natural resource uses including maintaining socio-cultural norms (Anthony & Bellinger, 2007). Landscape aesthetics, for example, scenic drives and game drives are commonly known and consistently included in cultural ecosystem services (Daniel et al., 2012). Aesthetic services are based on the appreciation of natural scenery; aesthetic values in rural areas are linked with the amount of open space in forested and agricultural land use or land cover types and mountains (Cocks & Wiersum,

2003; Chan et al., 2012). These conceptualisations highlight scenic beauty (Chan et al., 2012). The concepts of biocultural diversity and cultural landscapes have both emerged to give recognition to the co-evolution of the interaction of biological and cultural diversity (Cocks & Wiersum., 2003; Cocks et al., 2018). For example, some plant species have shown great significance for religious practices within rural communities (Cocks et al., 2012). These species have cultural values, for instance, most ritual burning incense are derived from native vegetation obtained from the local ecosystems (Cocks, 2006). Additionally, other plant species are harvested in order to maintain a *kraal*, which is a sacred host of traditional rituals and other cultural practices (Cocks & Wiersum, 2003).

Cultural heritage is another aspect that is influenced and shaped by cultural ecosystem services (Daniel et al., 2012). Cultural heritage is important for cultural sustainability and cultural identity within rural communities (Daniel et al., 2012). The local environment including landscapes and natural resources is linked with the identity of the individual, society or community, and cultural activities (Tengberg et al., 2012). CES usually focuses on the non-tangible cultural benefits and values provided by ecosystems, but many provisioning services (such as wild foods, and medicine) and supporting services (e.g., agricultural production, grazing that enables livestock farming) have strong cultural meaning and value (Tengberg et al., 2012). Cultural activities and natural resources are strongly linked (Rankoana, 2016). For instance, the brewing of traditional beer made from *marula* fruits, the production of traditional crops and livestock, which are used for cultural activities and rituals, the celebration of the first-fruit rituals, communal labour, hunting and fishing. Therefore, these resources play an important role in cultural activities and events (Rankoana, 2016). Most rural communities are dependent on natural resources for their livelihoods and cultural practices (Elwell et al., 2020). This provides shared experiences across the generations as well as settings for communal interactions significant to cultural ties, for example, cultural activities such as annual dances which are performed at landscapes such as open spaces, in order to celebrate and come together as a community (Daniel et al., 2012; Tengberg et al., 2012).

The spiritual and religious significance is another category of cultural ecosystem services (de Groot, 2006). Interest in religious and spiritual significance and value attributed to a certain aspect of the natural environment has been growing (Daniel et al., 2012; de Groot, 2006). Conservationists and diverse religious groups have tried to reinforce the link between environmental conservation and religion to promote the concept of environmental stewardship (de Groot, 2006). Natural features such as mountains and rivers are marked as sacred areas for religious practices; these sacred areas are marked by religious symbols such as crosses or flags on holy places along pilgrimage routes and mountain summits (Daniel et al, 2012). Mountains have a unique power to awaken a sense of the sacred as Bernbaum (2006, p. 304) states: “Their clouds, soaring summit and thunder that swirl about their peaks, the life-giving water from rain that flow from their heights, these and other appearances instil them with a feeling of sanctity and mystery’’ (Bernbaum, 2009, p.304). Mountains are important in some African cultures as a site for traditional male initiation schools (Sedibe, 2019). They are marked as a sacred site to which only traditional leaders or healers have access (Sedibe, 2019).

Different perceptions of CES exist in various rural communities. The former Ciskei and Transkei homelands in Eastern Cape Province, exemplify communities that value CES (Murata, 2021). Most people in these former homelands are isiXhosa-speaking people of Cape Nguni descent (Murata, 2021). Thicket vegetation, known locally as *ihlathi lesiXhosa* (meaning Xhosa forest), is perceived to be a sacred place where the ancestors communicate with their living descendants through messengers (*izithunywa*) in the form of mammals, birds, insects or even the wind (Cocks et al., 2012). Additionally, certain birds are believed to be representatives of the ancestors: for example, swallows (*iinkonjane)* and wagtails (*iicelo*), when frequently seen around the home, nesting or entering the house, were reported to bring good luck and blessings from the ancestors (Cocks et al., 2012). Trapping birds and hunting small game with dogs are common activities in rural communities and are traditional sports for boys and young men (Cocks et al., 2012; Murata, 2021).

Communities in the Gazankulu former homeland adjacent to the western border of the Kruger National Park in the Greater Giyani and Thulamela municipalities of Limpopo Province are another example of communities that values CES (Anthony & Bellinger, 2007). This former homeland is in the savanna biome, and most residents speak Xitsonga (Anthony & Bellinger, 2007). *Marula* (*Sclerocarya birrea*) is the most highly valued tree species in the region (Anthony & Bellinger, 2007). This *marula* fruit is valued for its juice which is fermented to make *marula* beer. This beer has long been brewed by rural households and is associated with several cultural traditions such as an offering that is given to ancestors as a symbol of thanksgiving (Shackleton & Shackleton, 2004; Cocks, 2006; Anthony & Bellinger, 2007). Additionally, during cultural celebrations and rituals this beer is also often consumed (Cousins, 1999; Cocks, 2006).

1.5.5 Trends and drivers of environmental change in communal areas

Almost one-third of the world`s land surface is classified as dryland, comprised of hyperarid, semi-arid and dry sub-humid areas, and a substantial proportion of this is thought to be in various states of degradation (Meadows & Hoffman, 2002). Currently, degradation of the earth's land surface through anthropogenic activities is negatively impacting the well-being of at least 3.2 billion people, leading the planet to a sixth mass species extinction, and costing more than 10 percent of the annual global gross product in loss of biodiversity and ecosystem services (Meadows & Hoffman, 2002; IPBES, 2018). The study of environmental change is increasingly discussed because its effects and presence continue to grow (Pyhala et al., 2016) and is altering the future of the earth and its occupants (Jones & Brittona, 2019). South Africa has experienced substantial environmental change especially land degradation in the former homelands (IPBES, 2018; Scheiter et al., 2018). Approximately 38% of South Africa's population lives in ecologically degraded areas (Sigwela, 2017). Many parts of the former homeland areas of South Africa are experiencing environmental scarcity and are increasingly vulnerable to overharvesting of natural resources, deforestation and overgrazing (Anthony & Bellinger, 2007).

The savanna biome covers more than one-third of South Africa and is home to 9.2 million people living in rural communities (O`Connor et al., 2014). The savanna biome covers 70% of the former homelands (Shackleton et al., 2001). The apartheid-era resettlement programs, in which 75% of the black population was allocated 13% of the land, contributed to the degradation of the savanna biome in black homelands due to unsustainable agricultural development (O`Connor et al., 2014). Hence, the loss of large trees has resulted from the excessive fuelwood harvesting driven by the energy demand of a growing population (Kirkland et al, 2007). The most common change in the former homelands is the increase in bushes and shrubs in the vegetation cover as a result of the phenomenon known as bush encroachment (Hoffman, 2014). This phenomenon occurs because of the increasing number of tall shrubs and trees at the expense of the grass due to overgrazing and the exclusion of fire (Hoffman, 2014). Impacts of bush encroachment are related to a reduction in grass cover.

Overgrazing is a common environmental trend in former homelands, resulting from increased number of livestock and less grazing land (O`Connor et al., 2014). Overgrazing causes a decline in vegetation cover and loss of palatable pasture, which exposes the topsoil to water and wind erosion (Shackleton et al., 2001). Soil erosion results in the loss of nutrients by volatilisation (Mudongo, 2019). Salinisation, desertification, soil erosion and other land degradation associated with intensive deforestation and overgrazing reduce the quality of future agricultural productivity and land resources (Marland et al., 2003). Environmental perceptions of trends and drivers of environmental change like those reviewed above, are shaped by factors such as age, gender, wealth status, and location (Hunter et al., 2010).

Local environmental change in the former homelands is indirectly driven by socio-economic factors such as poverty and overpopulation, which requires more shelter or housing, food, energy for cooking, grazing for livestock, etc. (Anthony & Bellinger, 2007; Bouahima et al., 2015); and anthropogenic activities such as deforestation, overharvesting of natural resources, pollution, unsustainable use of communal rangelands and farmland (Nwankwoala, 2015;

Ma et al., 2018). These anthropogenic activities cause changes to the ecosystem which in turn influences the provision of ecosystem services (Cooper et al., 2002).

Overharvesting of natural resources in rural areas occurs as a result of the over-dependence of rural communities on natural resources for their daily consumption of domestic products (Shackleton et al., 1993; Cousins, 1999). A study by Shackleton, et al. (2005) examined population profiles of five essential tree species used as non-timber forest products (NTFPs) in the semiarid Lowveld of South Africa. Furthermore, the study contrasted the population densities of the five tree species, including *Sclerocarya birrea,* in 2003 with data from 1992. In 1992, the population density was 83.9 stems ha^{-1} whereas by 2003 it was 42.4 stems ha^{-1}. This is approximately 50% decline. There was a clear indication in the study area that the current use of the five tree species is high, and unsustainable (Shackleton et al., 2005).

Overharvesting of resources is to satisfy both subsistence and commercial demands for numerous purposes including food, water, medicine, and fuelwood (Anthony & Bellenger 2007; Thondhlana et al., 2012). The reliance on fuelwood as a source of energy in most rural communities places a great deal of harvesting pressure on the resource, which in turn exacerbates deforestation, which causes a decline in vegetation cover (Shackleton, 2001; Matsika et al., 2012). Additionally, the removal of trees loosens the topsoil, hence making the topsoil vulnerable to soil erosion (Scholes, 2009). Many animal and plant species are lost due to the loss of habitat in degraded ecosystems (Scholes, 2009). Harvesting of phragmites reeds for roofing is another common practice in rural communities (Cousins, 1999; Cocks, 2006). These reeds are overharvested for both domestic purposes and economic purposes to either supplement income for low-income households or to form the sole income in other households (Cousins, 1999; Cocks, 2006). Thus, this results in the overharvesting of this plant species as it is sold to the local markets and external markets (Shackleton et al., 2007). Overharvesting alters the natural environment and leads to loss of habitat (Shackleton et al., 2007). Overgrazing in communal rangelands is a common practice in rural communities

(Shackleton, 2001). Overgrazing in the communal rangelands is due to the high numbers of livestock and is supported by limited communal rangelands (Shackleton & Cousins, 2001).

The former homelands experiences change in land use or land cover (Cousins, 1999). These land use or cover changes have impacted essential ecosystem services, which have long-term and wide-ranging consequences, which indirectly affect ecosystem services such as biodiversity and water provision (Cousin, 1999; Shackleton et al., 2007). Change in vegetation structure and functioning lead to loss of biodiversity and soil erosion (Matsika et al., 2013; Twine & Holdo, 2016).

Bush encroachment has occurred over a large area of the former homelands (Cousins, 1999; Shackleton et al., 2007). Bush encroachment has been recognised in South Africa since the late ninetieth century (O`Connor et al., 2014). Encroachment is most rapid in communal tenure and is a common cause of land cover change in communal areas. There are several managements of bush encroachment. For instance, fire suppresses bush growth by killing and reducing the abundance of encroaching woody species (O`Connor et al., 2014). However, rainfall interacts with fire and increases the growth rate of woody plants. Effects of drought such as high mortality rates of livestock and other herbivores also exacerbate bush encroachment as this allows more rapid growth of woody plants (Shackleton et al., 2007).

Land conversion is a form of land use/cover changes in rural communities (Cousin, 1999). Land conversion causes changes to the environment to fit the needs of the local communities, thus causing severe effects, which are becoming worse as the problem of human overpopulation continues (Bouahim et al., 2015). Land conversion such as forest to agriculture reduces the quantity of land available for timber and food production (Shackleton, 2001). Land cover changes have impacts on the function, composition and structure of the ecosystem. Land use change affects the provision of ecosystem services (Chen, 2014). The changes in land use cause natural resources such as water, soil, plant species and timbers to be destroyed, altered or damaged. Furthermore, it results in the degradation of land, water and air (Chen, 2014).

1.5.6 Climate change

1.5.6.1 Trends in climate change

The climate is characterised by humidity, winds, mean air temperature, precipitation, and frequency of extreme weather events over a lengthy period of time (Mbokodo, 2017). Climate change occurs as a result of human activity or due to natural variability (Grimm et al., 2013; IPCC, 2018). Anthropogenic activities such as cutting down trees and excessive carbon dioxide emissions play an important role in altering global probabilities of the occurrence and intensity of both weather and climate extremes (Cooper et al., 2002). The increase in extreme weather events includes storms, floods and droughts in recent decades (Shongwe et al., 2009; IPCC, 2018). Emissions of greenhouse gases (GHGs), which are defined as gases in the atmosphere that influence the earth`s energy balance, are observed to be increasing throughout the world (Cooper et al., 2002; IPCC, 2018). Deforestation, agriculture and other land use changes contribute to the emission of GHGs. These GHGs cause climate change by trapping heat. Additionally, increased wildfires and extreme weather are effects of climate change caused by increased GHGs emissions (Cooper et al., 2002).

Although climate change is a global phenomenon, its effects and presence are evident and felt differently at the local scale. Africa is one of the most vulnerable continents to climate change because of multiple stresses and low adaptive capacity (Mbokodo, 2017). Africa is one of the lowest contributors to greenhouse gas emissions, yet key development sectors have already experienced widespread losses and damages attributable to human-induced climate change, including reduced food production, biodiversity loss, water shortages, loss of lives and reduced economic growth (IPCC, 2022). In rural Africa, poor and female-headed households face greater livelihood risks from climate hazards. In urban areas, growing informal settlements without basic services increase the vulnerability of large populations to climate hazards, especially women, children, and the elderly (IPCC, 2022). Hence, South Africa is no exception. The South African climate is semi-arid (a region that receives

precipitation at rates below possible evapotranspiration), and this area is prone to the occurrence of droughts and floods (Meadows, 2006). The main concerns are increased water stress and a reduction in agriculture, affecting food security and worsening malnutrition (Mbokodo, 2017). During the last five decades, the mean average temperature in South Africa has increased to 1.5 times the observed global average of 0.65ºC (IPCC, 2018).

Limpopo Province is particularly vulnerable to climate change, as not only extreme climate events are expected but the low adaptive capacity of the province is impacting the resilience of fragile communities and ecosystems (Mbokodo, 2017). Temperatures in Limpopo Province are projected to increase drastically, reaching levels never observed before in the recorded climate of the region (DEA, 2013). Limpopo's municipalities are also in a highly vulnerable situation, particularly in zones corresponding to former homeland areas (Meadows & Hoffmann, 2002; Mbokodo, 2017). The former homelands have approximately 9.8 % of South Africa`s population, with 80% living in rural areas; additionally, the area is under-resourced (StatsSA, 2019). Many local communities are projected to experience the impacts of hotter and drier conditions, face more droughts and unfortunately more severe and frequent floods (Kepe & Tessaro, 2014).

1.5.6.2 Impacts of climate change on rural communities

Climate change is accountable for declines in natural resources, and it threatens people with food insecurity and water scarcity (Kumar and Das, 2014; Shimrei, 2016). Impacts of climate change on rural communities include extreme temperatures, droughts and floods, which result in changes to ecosystem (Fereja, 2017). Climate change is superimposed on a suite of other stresses impacting local livelihoods and human well-being (Shackleton & Luckert, 2015). Droughts led to water scarcity, famine, loss of biodiversity, loss of livestock and wildlife and general suffering of people living in affected areas (Cooper et al., 2002). Additionally, long term drought led to disease and mass migration (Cooper et al., 2002). Ecosystem services are adversely affected by droughts, as plants and animals depend on water for efficient growth and

survival (Scholes, 2009). Moreover, intense droughts threaten crops` survival (Grimm et al., 2013).

Frequent droughts reduce the capacity of rangelands to support wildlife and livestock and significantly reduce biodiversity (Chamier et al., 2012). In rural communities of the former homelands of Ciskei, overgrazing and browsing by domestic livestock have transformed the thicket biome into an open karroid dwarf shrubland (Cocks et al., 2012). This transformation was accompanied by the loss of succulent species, which reproduce with difficulty in the hotter and more arid micro-climate that results from this transformation (Cocks et al., 2012). Agricultural changes such as excessive input of organic fertilisers (animal excreta) as a result of droughts have taken place in most of South Africa`s rural communities over the past decades (Shackleton & Luckert, 2015).

Extreme temperatures increase soil temperatures which can be detrimental to some plant and animal species (Grimm et al., 2013). Hence, extreme heat can also impact the indigenous vegetation by entering through leaf stomata and burning the plant tissues during the photosynthesis process (Peters et al., 2011). Climate change has increased the extent of insect outbreaks through a combination of elevated plant drought stress, greater insect over-winter survival, and shortened insect development and reproduction cycles (Grimm et al., 2013). Climate-change-induced shifts in plant species distributions are changing the characteristics of biomes, altering structure and ecosystem functioning (Peters et al., 2011). Changes in precipitation regimes are likely to have a particularly strong influence on arid and semi-arid ecosystems and may reverse historical regime shifts, and may lead to desertification (Peters et al., 2011). This affects rural households that depend on natural resources for their livelihood (Peters et al., 2011, Grimm et al., 2013).

Climate change and its threats to rural communities are of concern to most scientists. Studies have shown that these communities are aware of changes in climatic conditions and their impacts on rural livelihoods (Rankoana, 2016). However, the communities' perceptions of climate change are focused on variations in rainfall patterns (scarce rainfall or too much rainfall), and rising temperature trends (Rankoana, 2016). Rural communities are aware that

environmental variability and climate change are responsible for changes in their living conditions such as poverty, increased risks of disease, water and air contamination, floods, depletion of biodiversity, and soil erosion (Kumar and Das, 2014). Furthermore, extreme precipitation events which result in high rates of runoff remove topsoil and vegetation (Scholes, 2009). This removal of topsoil causes a decline in soil structure (soil degradation) which leads to soil erosion and desertification (Barrow, 2001). A decline in vegetation cover (vegetation degradation) changes plant species composition or a loss of certain plant species (Scholes, 2009). These impacts include decrease in nutrient levels in soil, increased soil erosion and lower agricultural production, which has a strong impact on the rural communities as most of them are agricultural farmers (Rankoana, 2016).

Land cover changes at the local level affect microclimatic resources, processes of land degradation, watershed runoff and landscape level biodiversity, sediment loads and soil erosion (Mzuza et al., 2017). These have direct impacts on the livelihoods of local communities (Meadows & Hoffman, 2002). Vegetation cover plays a significant role in influencing climate and weather patterns due to released vapor during photosynthesis. The vapor that is released into the air from the surface energy fluxes can lead to possible cloud formation (Barrow, 2001; Mzuza et al., 2017). However, the intensive removal of native vegetation remains a concern. This induces the invasion of alien species vegetation, which has significant impacts on South Africa`s freshwater and terrestrial ecosystems (Chamier et al., 2012). Alien vegetation increases above ground biomass evapotranspiration, which results in decreased groundwater recharge and surface water runoff (Chamier et al., 2012). Invasive alien species can have large detrimental economic impacts on human wellbeing such as in fisheries, agriculture, grazing and forestry (Shackleton, 2007).

1.6 References

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CHAPTER 2: METHODOLOGY

2.1 Overview of the study approach

This research was conducted in five rural villages in Limpopo Province, South Africa. The villages were chosen because this study complements an ongoing programme of research in these villages by the SALLNET (South African Limpopo Landscape Network) programme. Livelihoods in these villages are mainly land-based and consist of arable agriculture, harvesting of natural resources, and animal husbandry which is all practiced on communal rangelands (Anthony & Bellinger, 2007). The approach of the study was to first conduct key informant interviews with community members who are farmers in the study villages, as well as the community leaders as they have knowledge about the history, environment and culture of the village. and could thus provide insights on locally important cultural ecosystem services and environmental change. The information from the key informant interviews was then used to design a questionnaire that was used to survey local community members in the study villages. A sampling of the survey respondents was stratified by village, farmer type, age group and gender in order t to assess the influence of these socio-demographic factors on the environmental perceptions investigated in the survey. Due to Covid 19, all the interviews were done telephonically except for the key informant interviews in one village (Makushane) as the chief insisted on having the interviews face-face.

2.2 Background of the study area

The study was conducted in five villages within Mopani District Municipality in Limpopo Province, South Africa. The villages were Mafarana and Gavaza in greater Tzaneen municipality; Ga-Selwana and Makushane in Ba-Phalaborwa municipality; Ka-Ndengeza in Greater Giyani municipality (Figure 2.1). Mopani district municipality is situated in the north-eastern part of Limpopo Province and is located between 20º0'S to 24º38'S longitude and 29º52'E to 31º52' E latitude with 31ºE as the central meridian (District Rural Development Plan of Mopani district municipality, 2016). The district covers a total area of 2,001,100 ha including part of the Kruger National Park (District Rural Development Plan

(DRDP) of Mopani District Municipality, 2016). The area receives approximately 612 mm mean annual precipitation (Environmental Management Framework for the Olifants and Letaba river catchment areas, Report, 2009). The Mopani district municipality has a population of 1,159,185, the majority of whom speak northern Sotho (DRDP of Mopani district municipality, 2016). Mopani districts municipality comprises five local municipalities, namely: Ba Phalaborwa, Greater Tzaneen, Maruleng, Greater Letaba and Greater Giyani (DRDP of Mopani district municipality, 2016).

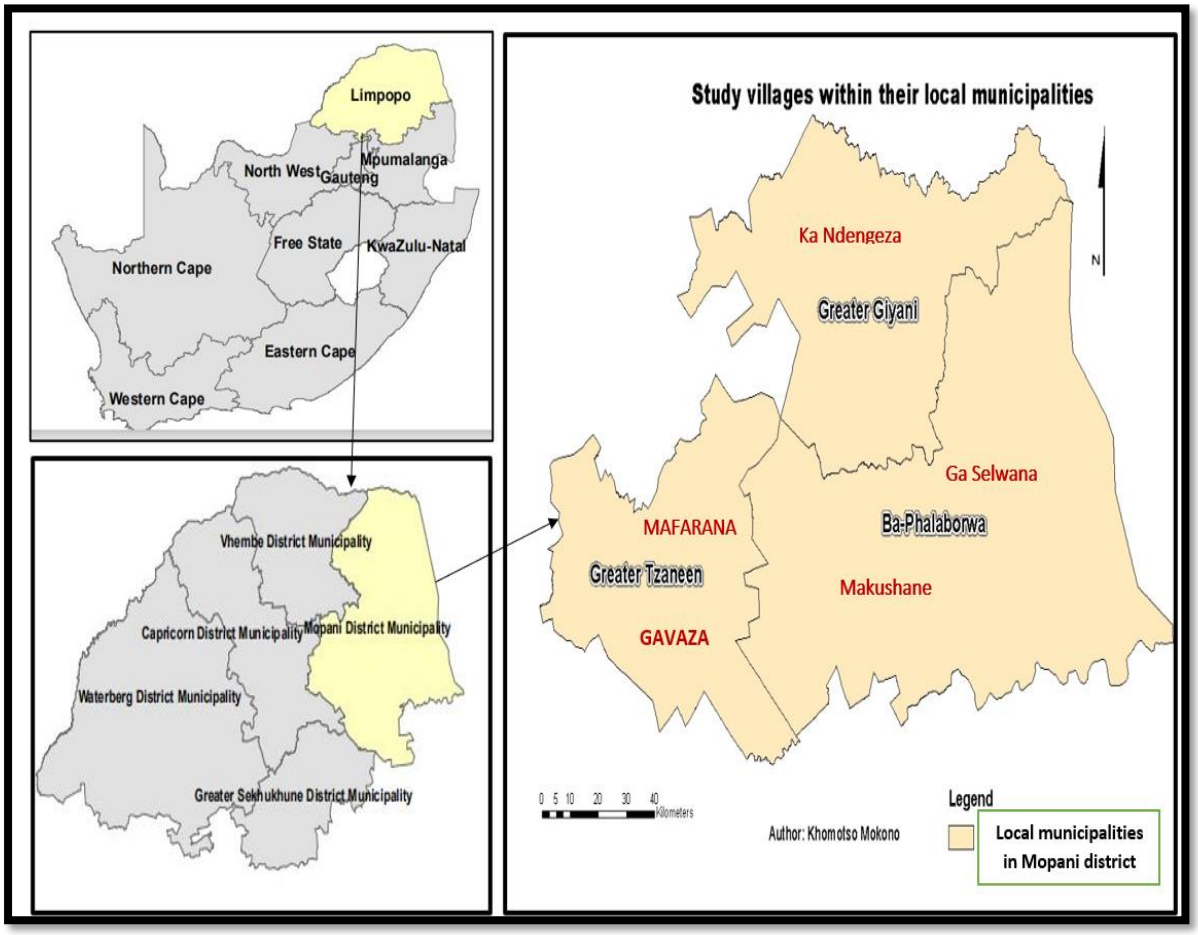

Figure 2.1: Map showing the study site location in Limpopo province, within Mopani district municipality, and the villages within their local municipalities. (Created by the author).

Ba-Phalaborwa municipality is bordered by Greater Tzaneen and Giyani municipality in the north, it includes a portion of Kruger National Park. It forms part of the Greater Limpopo Trans-Frontier Park (DRDP of Mopani District Municipality, 2016). The area has a unique natural environment comprising eco-tourism development and conservation (DRDP of Mopani District Municipality, 2016).

The Greater Tzaneen area comprises a land of 324,260 ha (Stats SA, Community Survey, 2016). It extends from Haenertsburg in the west to Rubbervale in the east. The Greater Tzaneen municipality is characterised by extensive and intensive farming activities (commercial timber, cash crop, tropical and citrus fruit production), with mountainous, inaccessible terrain in the west and south, and uneven topography (gentle slope) to the north and east and areas with exceptional beauty, with considerable intact tourism potential (DRDP of Mopani District Municipality, 2016).

Greater Giyani covers around 417,160 ha (Stats SA, Community Survey, 2016), and it embraces a portion of Kruger National Park. Giyani municipality is next to Thulamela and Makhado municipalities in the north-west, and Mutale Municipality in the north-east, Ba-Phalaborwa in the south, and Greater Tzaneen in the south-west and Greater Letaba Municipality on the west. The municipality has potential for tourism and conservation development due to existing natural heritage sites throughout the area, as well as mining (in some cases, mining sites can become a tourist attraction due to their unique geological features or as historical or cultural landmarks), latent farming schemes, processing of natural products (DRDP of Mopani District Municipality, 2016). The municipality is characterised by a diverse topography, population density and vegetation. Giyani is also the home of the District Municipal offices where the previous administrative offices of Gazankulu homeland were housed (Mopani District Municipality IDP, 2018/19 to 2021/22).

2.3 Data collection

2.3.1 Key informant interviews

Key informant interviews were conducted from February to April 2021, with prominent community members in each village, including traditional leaders (*induna*), village chairperson, community leaders such as community development forums and community project leaders. Five key informants were interviewed per village, totalling 25 respondents. The purpose of the key informant interviews was to get an understanding of the village context and to collect data such as the range of ecosystem services derived, and environmental changes experienced locally, perceived causes of these changes, and their impacts on CES. Semi-structured interviews allowed informants the freedom to express their views on their own terms. A semi-structured interview schedule was used (see Appendix 1). Before proceeding with the key informant interviews, the key interview questions were pre-tested on family members, to test if the questions were clear and easy to be answered within an estimated time. All interviews except for one village (Makushane) were conducted telephonically with at least four key informants standardised by role. The key informant interviews were conducted in English, Sepedi and Xitsonga dependent on which language the interviewee preferred. Key informant interviews took 45-60 minutes.

2.3.2 Survey interviews

Information from the key informant interviews was used to establish the survey questions. A structured questionnaire (see Appendix 2) was used, with mainly closed-ended questions including dichotomous, multiple choice and Likert scale questions. The questions focus on (i) cultural ecosystem services; (ii) environmental changes; (iii) causes of environmental changes; (iv) impacts of environmental changes (v) perceptions of the relationship between cultural ecosystem services and environmental change. Before conducting the survey interviews, the survey was pre-tested with family and friends to determine if the briefness of the questions allows enough time for answering within the allocated timeframe. The purpose of the survey was to collect more detailed data in relation to the study objectives. The survey sample was stratified by gender

(male and female), three age groups (18-34, 35-59, 60+), and type of farmer (subsistence farmer, semi-subsistence livestock farmer, semi-subsistence crop farmer and commercial farmer) in each village (Table 2.1). A total of 100 community members were surveyed with at least 15 people per village. Participants were selected using snowball sampling. Snowball sampling occurs when the research participant recruits other participants for a study (Bernard, 2011). As such the sample group grows like a rolling snowball; as the sample grows or builds up, adequate data are gathered to be useful for research (Bernard, 2011). The dominant language in the study site was Sepedi, which is my home language, a minority speaks Xitsonga; hence a translator was appointed for any interviews which were done in Xitsonga. The survey interviews took 30 minutes to be completed.

Table 2.1 Percent (%) of respondents per categorical factors, village, farmer, age group and gender

Village	%	Farmer	%	Age group	%	Gender	%
Selwana	24	Subsistence	33	18-34	7	Male	42
Mafarana	18	Semi subsistence livestock	23				
Makushane	23	Semi-subsistence crop	25	35-59	61	Female	58
Ndengeza	20	Emerging (commercial)	19	60+	32		
Gavaza	15						
Total	100		100		100		100

2.4 Data processing and analysis

The qualitative data collected in the key informant interviews were analysed using the grounded theory approach, which was created by Glaser and Strauss (1967). Grounded theory turns free flowing text into a set of nominal variables through coding (Bernard, 2011). The following is a summary of how the grounded theory approach was used for analysis. After the key informant interviews, notes of the responses were captured using Microsoft Word. Then the data were organised and coded with Microsoft Word or Excel to turn free flowing text into nominal variables. Finally, I identified thematic patterns

(thematic analysis). Most closed-ended questions in the survey interviews were binary, multiple-choice, or Likert scale questions. Relative frequencies (%) were calculated for categorical responses (such as yes/no, or strongly disagree/disagree/do not know/agree/strongly agree) and central tendency (median, mean and standard deviation) was calculated for numerical variables (such as number of CES mentioned). Before analysis, the validity of the data was tested by determining the range of all the variables to ensure that all the values are within the acceptable range (no outliers) and checked if there were any missing values, as the missing values can affect the validity of the data. Pearson Chi-squared statistic was used, to determine if categorical response variables (e.g., Likert score categories) differed by the specified socio-demographic categories (village, farmer type, age groups or gender), in cases where a high proportion of cells had a count less than five, the Likelihood Ratio was used. The significance level for all statistical analyses was set at $P<0.05$. $P<0.05$ rejected the null hypothesis that there was no significant difference between categories. While Kruskal Wallis is a widely used statistical test for analysing Likert scale data, Pearson's Chi-Squared test is also a legitimate test for such analyses, yielding comparable results. To quote Mircioiu and Atkinson (2017, p10) "We suggest that the use of scores for graphical representation plus Chi-square for analysis of Likert data, which 1) facilitates the visual appreciation of the data and 2) avoids the futile "parametric" versus "non-parametric" debate, assured the best mosaic of statistical tests".

2.5 Protocols and ethics

Ethics clearance was obtained from the University of Witwatersrand non-medical human research ethics committee before commencing with field work (H20 08 24). I managed to complete an online introductory course to research ethics, which I believe has enhanced my knowledge of conducting research in an ethical manner. Arrangements with the chiefs or village leaders of the five villages were scheduled through telephonic communication before commencing with the research. Communication included the introduction and reason for calling, and this was done to ask permission to conduct the research in their area. I also asked for contacts of relevant people that could assist or

guide me as such to familiarise myself with the area. The contacts of such people were shared. I then further asked them to give me contacts of other people who might be interested in participating in the research.

The information sheet was read to respondents, to explain what was expected from them, and when they agreed to be part of the study, I obtained verbal consent which I signed on their behalf. It was clear to each respondent that their participation was voluntary and anonymous. Although the chiefs knew the names of the recommended key informants interviewed, all results, including direct quotes were anonymised so that the respondents could not be identified Respondents were informed that they were allowed not to answer questions they were not comfortable with, and that they could stop the interview anytime. I offered to provide feedback after results have been analysed and conclusions have been made and make sure they understand the results and conclusions.

2.6 References

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CHAPTER 3: PAST AND PRESENT CULTURAL ECOSYSTEM SERVICES DERIVED FROM THE LOCAL ENVIRONMENT BY LOCAL COMMUNITIES

3.1 Introduction

Cultural ecosystem services (CES) are greatly valued by diverse stakeholders such as tourists, traditional healers, and indigenous communities in South Africa (Cocks et al., 2012; Milcu et al., 2013; Mowat & Rhodes, 2020). CES makes an important and valuable contribution to human wellbeing, and rural communities value aspects such as the sense of identity, belonging and worshipping (Sottini, 2019; Mowat & Rhodes, 2020). Cultural events are considered part of CES, as they can provide opportunities for people to connect with cultural heritage, leading to a deeper appreciation of cultural diversity and identity. Additionally, cultural events can provide a sense of belonging, which is an important aspect of CES (MEA, 2005, Maes, et al. 2018). In traditional communities, the land is more than just a productive economic asset, it is important in many cultural practices and rituals, and the often-intangible cultural aspects of individual and community life (Cocks et al., 2012; Klain & Chan, 2012; Cundill et al., 2017). As such, there is a strong relationship between the CES and land (Mowat & Rhodes, 2020). Most traditional communities in South Africa acknowledge that the land has significant cultural importance, suggesting a strong sense of belonging and attachment (Cocks et al., 2012; Sottini, 2019; Mowat & Rhodes, 2020).

The CES benefits utilised by a community depend on their background, condition, situation, culture, and relationship with the land (Cocks et al., 2012; Mensah et al., 2017). Therefore, differences will exist within and between different communities (Mensah et al., 2017). The value assigned to cultural ecosystem services depends on the individual and cultural assessments of their contribution to the wellbeing (Mensah et al., 2017). Differences exist in how these CES are valued by different genders, age groups and cultural practices (Milcu et al., 2013; Mensah et al., 2017; Mowat & Rhodes, 2020).

There is evidence that CES can be a significant motivator for owning, protecting and managing land for a particular amenity-related purpose (Chan et al., 2012; Plieninger et al., 2015). For instance, the residential plots in traditional communities can all be understood as land uses influenced by CES, while many may enjoy the benefits of CES (Chan et al., 2012; Plieninger et al., 2015). Additionally, other evidence suggests that CES, globally, is of more significance and importance to traditional communities (Mowat & Rhodes, 2020). This is especially true where CES relates to important intangible aspects of people's lives, such as a sense of community, place and identity, which has been constructed by a community through living and interacting with the same environment over many generations (Milcu et al., 2013; Mensah et al., 2017; Mowat & Rhodes, 2020).

Cultural ecosystem services make an important and valuable contribution to human well-being, yet present research efforts are lacking. In addition, there is under-representation of studies within an African context. This research gap needs to be filled because traditional communities have a more intimate and profound relationship with the land and poor policy decisions raise the level of risk to these already vulnerable groups (Mowat & Rhodes, 2020).

This chapter aims to investigate the perceived past and present cultural ecosystem services by the local communities and to investigate how they differ by socio-demographic factors (village of residence, farmer type, age group and gender). Documenting the perceived cultural ecosystem services by the local communities is essential in order to create an awareness of CES and how they are important and valued by the local communities among policy and decision-makers in local municipalities and environmental organisations.

3.2 Methods

Details on the survey methods and strategies are given in methodology chapter 2. To achieve the objective of this chapter (investigate the perceived past and present cultural ecosystem services derived from the local environment by the

rural communities, and how these vary by a village of residence, farmer type, age group, and gender) semi-structured interviews were conducted with the key informants (refer here to appendix 1 and 2). Key informant interviews emerged different CES which were used to conduct survey interviews with the communities. The questions were based on the Likert level scale of agreement, likelihood and importance. For agreement, the Likert score 1=strongly disagree, 2=disagree, 3=undecided, 4=agree, and 5=strongly agree. For occurrence, 1=never, 2=rarely, 3=sometimes, 4=frequent, and 5=very frequent. Forthe direction of change, 1=decrease, 2=no change, and 3=increase. The survey interview consisted of 21 questions that focussed on CES, where one question was semi-structured and 20 were structured questions. The semi-structured question aimed at understanding the most valued cultural ecosystem services around the village. The question was phrased as “if you were to move to another village, what would you miss most about the environment around the village”. The remaining 20 structured questions were aimed to identify the perceived past and present cultural ecosystem services, and how they are valued. The median score for each categorical factor (CES) was determined.

To analyse how these varied by age, gender, farmer type, and village, firstly the percentage of each category was calculated since our respondents were not equally selected throughout the villages. Secondly, a Pearson’s Chi-square test was run to test whether two categorical variables differed. SPSS software was used to calculate the median, frequency and Pearson’s Chi-square test. To analyse how these variables differ with different gender, age groups, village of residence and farmer types, Pearson’s Chi square test was used. Village of residence, farmer type, age groups and genders were the independent variables, and the 20 perceived CES were the dependent variables. The percentage of 15 CES which emerged from the question phrased as “if you were to move to another village, what would you miss most about the environment around the village” was calculated.

3.3 Results

3.3.1 Perceived cultural ecosystem services by local communities.

A total of 20 CES emerged from the semi-structured interviews with local key informants (Table 3.1). Only 2 CES were past CES and the remaining 18 were current CES. The CES were categorised as ceremonies, sites for culturally important activities, and natural resources which are used for cultural practices or have cultural importance. Respondents in the survey generally agreed that all CES are important in their culture, with the exception to *Mhlaba day* with the lowest median score value. Conversely respondents moderately agreed that circumcision schools and grasses are important.

Table 3.1: Past and present CES from key informant interviews. The last column reports median scores from the Likert scale with scores 1=strongly disagree, 2=disagree, 3=undecided, 4=agree, and 5=strongly agree. (n=100).

Cultural events	Brief Explanation	Past/ Present CES	Median
Go loma Marula	A cultural event wherein *marula* fruits are harvested and presented to the king, in return the king will officially grant permission to the communities to harvest marula fruits for use. Additionally, this event utilises or benefits from cultural ecosystem services, and helps to enhance and preserve cultural heritage and identity.	Past	4
Mhlaba day	An annual celebration held in memory of the late king Mhlaba. where people do cultural dances, eat traditional food and wear traditional attire made of *mokgopha* (animal skin).	Past	2
Traditional wedding (lobola)	In this event the groom pays the bride price, then the family exchange gifts, and they celebrate with traditional beer made from marula or sorghum maize meal and traditional food. Cattle or sheep are slaughtered for meat as part of the celebration.	Present	4
Marula festival	An annual event held in Limpopo to acknowledge the *marula* fruits. In this ceremony the Marula beer is presented to the audience, and most people	Present	4

	showcase their natural products such as *mopani* worms and traditional attire.		
Cultural events	Brief Explanation	Past/ Present CES	Median
Ho Phahla (ritual)	A ritual performed to communicate with ancestors. Usually done in a sacred place or under a *marula* tree, the traditional beer is sprinkled around during the communication.	Present	4
Traditional healers' graduation	When the trainee traditional healer formally graduates from being a trainee to a practitioner as a traditional healer or *sangoma*. In this ceremony different medicinal plants are given to graduates as a start up for practice.	Present	4
Circumcision school	A cultural school which young males attend as a transformation to manhood. These schools are usually in the mountains or forests.	Present	3
CES sites	Brief Explanation	Past/ Present CES	Median
Cultivated land	Arable land which is plowed and used to grow crops that are used to make traditional meals.	Present	5
Grazing land	Grazed by domesticated livestock, such as cattle, sheep, and goats which are used during ritual practices or have other cultural value.	Present	5
Mountains	Mountain landscapes are culturally important for CES such as a sense of place, and landscape memory, and as sites for practicing rituals, and spirituality, often including therapeutic forests.	Present	4
Water bodies	Most traditional healers collect water from the river for cleansing ceremonies.	Present	4
CES resources	Brief Explanation	Past/ Present CES	Median
Cultivated plants	Domesticated plants that are planted mainly for food. These are important in traditional meals (e.g., *dimaake, timanga, mafela, ditloo, marotse, dinawa)*	Present	5

CES resources	Brief Explanation	Past/ Present CES	Median
Indigenous plants	Undomesticated plants occurring naturally in the surrounding vegetation, many of which have cultural uses or taboos (e.g.,*marula* tree, *mopani* tree, *xirongolo, xibaha, mohwelere, malomanama).*	Present	5
Domestic animals	Livestock that are culturally important. (e.g., Goats, Cattle, Sheep). In most cases used as a meat during ceremonies, and as an offering/sacrifice during cultural practices such as *ho phahla*. Cattle are also important culturally for bride wealth (*lobola*) and as a traditional store of wealth.	Present	4
Morogo	Green leafy vegetables are found throughout southern Africa and are harvested for human consumption as a traditional food. *(e.g., Lerotho, Thepe, Monyaku, Guxe, Cheke)*.	Present	4
Traditional food	Food and dishes that are passed on through generations or which have been consumed for many generations *(e.g., Tihove, Xigugu).*	Present	4
Medicinal plants	Plants that possess therapeutic properties (*e.g., Kgopha, Mokhanare).* used by local communities and traditional healers for medicinal purposes.	Present	4
Edible insects	Insects species which are served as a traditional food. *(e.g., mopani worms, magege).*	Present	4
Wild fruits	Native fruits that grow naturally, not cultivated, e.g., tintoro, *mabilo* Figs, *mahlatswa*, and *mabupudu* used for consumption and they contribute significantly to the rural livelihoods. Wild fruits help to sustain cultural identity.	Present	4
Grasses	(Wild grasses e.g., *deke, xinatsi, banyi, nxenhe, rikatsu*) used for roofing of traditional huts which are used by most traditional healers as a consultation room. Deke is used for making traditional mats.	Present	3

Most of the respondents agreed or strongly agreed (52-100%) that CES is important in their villages for most of the listed CES events, sites, and resources, resulting in a median score of 4 or 5 for most. The greatest consensus was with the grazing land with 30% agreeing and 70% strongly agreeing (Figure 3.1). The exceptions were *Mhlaba* day 63%, circumcision school (35%) and grasses (40%) disagreeing or strongly disagreeing, resulting in median scores of 2 or 3. A small proportion (0-27%) for all the CES was undecided.

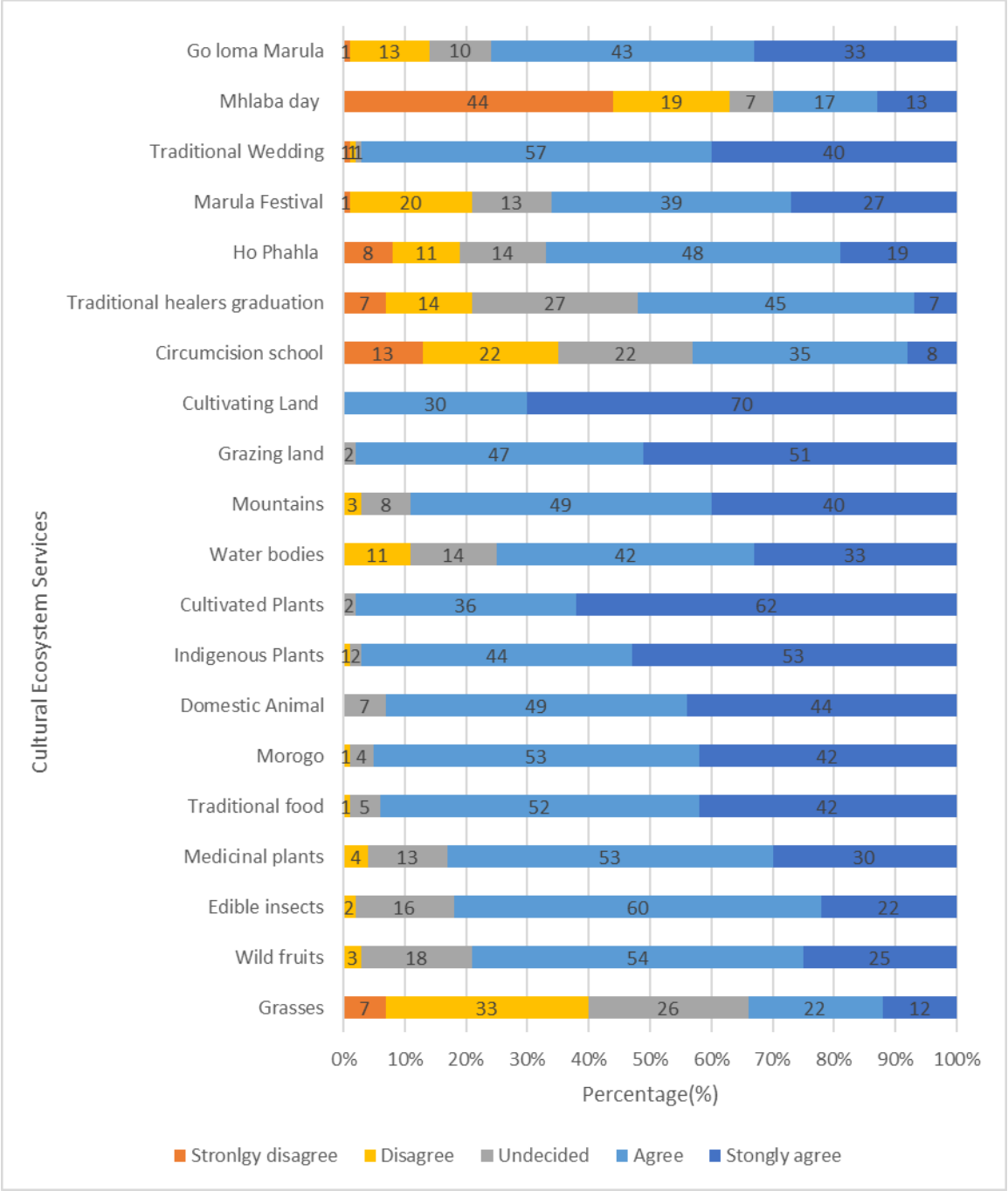

Figure 3. 1: Percentage (%) of the respondents illustrating the Likert score category of agreement on the importance of Cultural Ecosystem Services

When respondents were asked what they would miss most about the local environment if they had to move away, 15 CES emerged from the key informant interviews (Table 3.2). In the survey, respondents were asked which of the 15 they would miss most. A high proportion of the respondents (30%) stated cultivated followed by indigenous trees and fruits (10%). *Marula* tree and fruit were specifically stated by 8%; *mopani* worms, livestock, rivers, and climate

were stated by only 6% of respondents while mountains, medicinal plants, and traditional food were stated by 5% of respondents. The remaining CES was stated by 4% or fewer respondents.

Table 3.2: Percentage (%) of cultural ecosystem services that were mentioned by the local communities, when asked what they would miss about the environment should they move from their village.

CES	**Percent (%)**
Cultivating land	30
Indigenous trees and fruits	10
Marula tree and fruits	8
Mopani tree and worms	6
Livestock	6
Rivers	6
Climate	6
Mountains	5
Traditional food	5
Medicinal plants	5
Serene atmosphere	4
Cultural practices	4
Cultivated crops	3
Grazing lands	1
Natural vegetation	1
Total	100

3.3.2 The influences of socio-demographic factors on the perceived cultural ecosystem services

Significant differences existed between villages for level of agreement on the importance of *go loma Marula* ($p<0.01$), *Mhlaba day* ($p<0.001$), Marula festival ($p<0.001$), *ho phahla* ($p<0.001$), traditional healer`s graduation ($p<0.001$), circumcision school ($p<0.05$), mountains ($p<0.001$), water bodies ($p<0.001$), indigenous plants ($p<0.001$), *morogo* ($p<0.01$), medicinal plants ($p<0.001$), edible insects ($p< 0.01$), wild fruits ($p<0.05$) and grasses ($p< 0.001$) (Table 3.3). *Mhlaba day* ($p<0.001$), *ho phahla* ($p<0.01$), circumcision school ($p<0.05$) and medicinal plants ($p<0.05$) differed significantly between different farmers. *Go loma marula* ($p<0.01$), *ho phahla* ($p<0.01$), medicinal plants ($p<0.05$), edible insects ($p<0.01$) and wild fruits ($p<0.001$) differed significantly between different age groups. Only mountains ($p<0.05$) and medicinal plants ($p<0.05$) differed significantly between gender.

Table 3.3: CES with the chi square p-value for the following social-demographic factors: village (df.16), farming practices (df.12), age group(df.8), and gender(df.4). Illustrating the CES that had significant p value (in bold) (n=100).

Cultural Ecosystem Services	**Village**		**Farmer type**		**Age group**		**Gender**	
	Chi squared	**P value**	**Chi squared**	**P value**	**Chi squared**	**P value**	**Chi squared**	**P value**
Go loma marula	47.73	**<0.01**	13.48	0.335	19.24	**<0.01**	4.67	0.323
Mhlaba day	126.30	**<0.001**	23.70	**<0.01**	5.90	0.653	5.6	0.230
Traditional wedding (lobola)	16.07	0.448	12.09	0.438	8.71	0.368	4.06	0.398
Marula festival	38.80	**<0.001**	7.69	0.335	11.47	0.176	1.27	0.924
Ho Phahla	52.22	**<0.001**	25.34	**<0.01**	20.15	**<0.01**	6.35	0.174
Traditional healers' graduation	62.40	**<0.001**	9.91	0.624	10.71	0.219	2.13	0.711
Circumcision	29.65	**<0.05**	24.52	**<0.05**	8.16	0.418	7.48	0.116
Cultivated land	12.24	4.50	1.48	0.687	1.22	0.645	1.13	0.289

Cultural Ecosystem Services	**Village**		**Farmer type**		**Age group**		**Gender**	
	Chi squared	**P value**	**Chi squared**	**P value**	**Chi squared**	**P value**	**Chi squared**	**P value**
Grazing land	12.07	0.148	3.90	0.690	4.09	0.690	2.33	0.312
Mountains	28.48	**<0.001**	3.67	0.932	6.76	0.932	8.45	**<0.05**
Water bodies	80.99	**<0.001**	16.01	0.067	9.59	0.143	1.55	0.671
Cultivated plants	7.72	0.461	4.24	0.687	2.23	0.645	5.50	0.064
Indigenous plants	32.97	**<0.001**	7.46	0.589	4.75	0.589	4.37	0.225
Domestics animals	10.94	0.205	8.39	0.211	3.51	0.211	0.06	0.973
Morogo	25.16	**<0.01**	9.63	0.377	5.98	0.426	1.28	0.735
Traditional food	17.39	0.136	8.41	0.493	4.67	0.587	2.80	0.423
Medicinal plants	28.43	**<0.001**	19.08	**<0.05**	12.97	**<0.05**	8.51	**<0.05**
Edible insects	25.66	**<0.01**	6.78	0.660	16.63	**<0.01**	1.75	0.625
Wild fruits	23.14	**<0.05**	4.41	0.883	25.49	**<.001**	3.17	0.367
Grasses	38.55	**<0.001**	5.86	0.923	14.10	0.079	3.32	0.506

Focussing on perceptions of cultural ecosystem services that differed significantly within factors (Table 3.3). There was widespread agreement from all the villages (60-92%), with an exception to Mafarana with a fair proportion of 38%, that *go loma marula* is an important ceremony, Gavaza having the greatest consensus with 92% (Figure 3.2). By contrast, Ndengeza had 40% disagreeing. The largest proportion of the respondents in Ndengeza (90%), Makushane and Selwana with an equal proportion of 96% disagreed or strongly disagreed that *Mhlaba* day is important. Conversely, the greatest proportion in Gavaza (87%) and Mafarana (88%) agreed and strongly agreed. Most of the respondents in all villages (50-92%) agreed and strongly agreed that *marula* festival is an important ceremony. A small proportion of 8-28% in all villages, except in Ndengeza disagreed.

The greatest proportion in all villages (55-92%), with the exception of Mafarana (12%) agreed or strongly agreed that *ho phahla* is an important ceremony. Conversely a large proportion in Mafarana (50%) disagreed or strongly disagreed, with 38% undecided.

Most of the respondents in Gavaza (60%), Ndengeza (65%) and Makushane (74%) agreed or strongly agreed that traditional healer's ceremony is important. Conversely the largest proportion in Mafarana (72%) disagreed or strongly disagreed (Figure 3.2). The largest proportion in Selwana (50%) was undecided.

A fair proportion (40-45%) in Gavaza, Ndengeza and Makushane agreed or strongly agreed that circumcision school is an important ceremony. By contrast largest the proportion in Mafarana disagreed or strongly disagreed. Between 16-40% were undecided (Figure 3.2). The greatest proportion of the respondents (75-100%) agreed or strongly agreed that mountains are important. The greatest consensus was with Gavaza having 60% agreeing and 40% strongly agreeing.

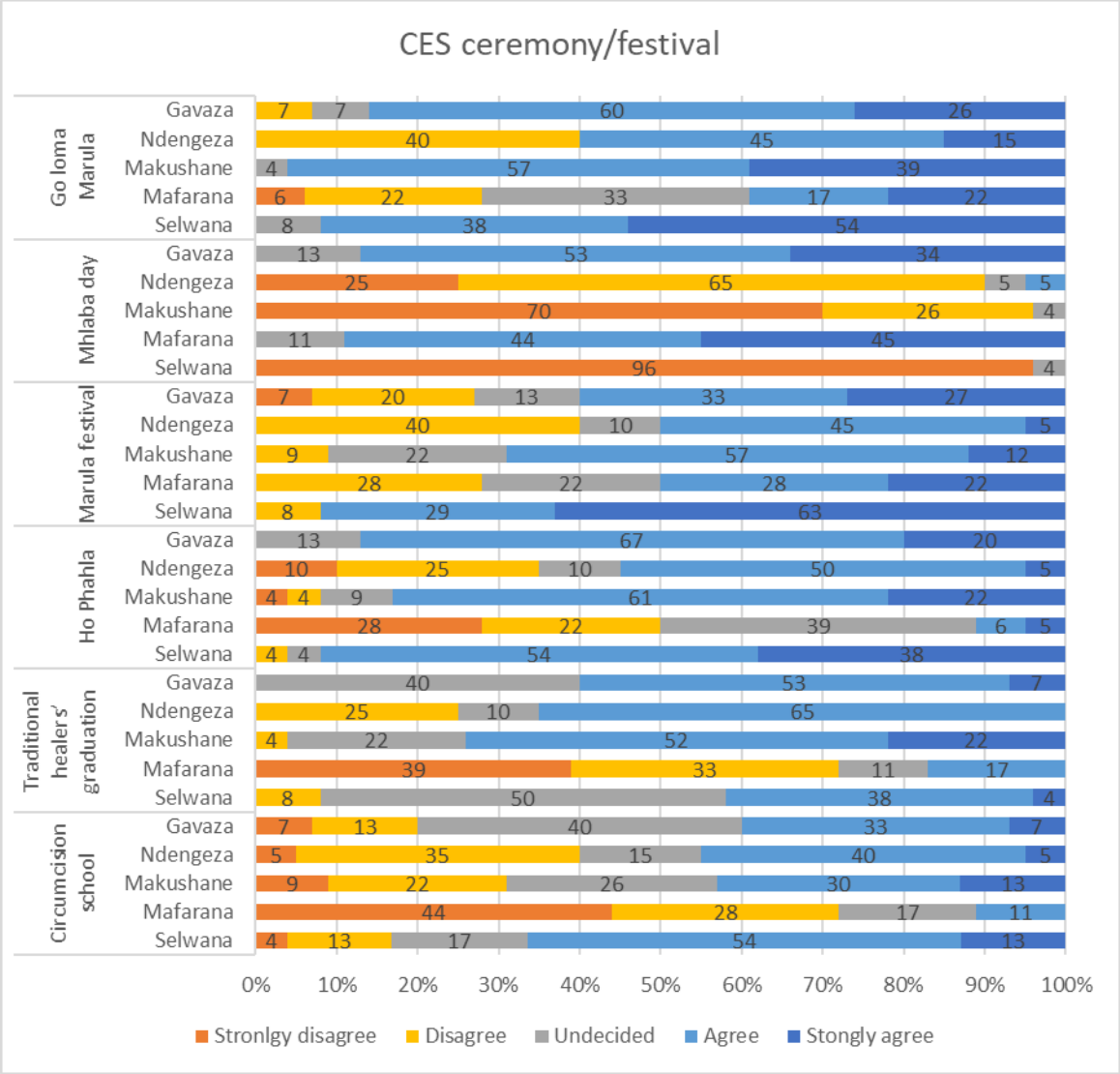

Figure 3. 2: Percent (%) of respondents per Likert category per village for CES ceremonies /festival that differed significantly between villages.

Most of the respondents in all villages (65-100%) agreed or strongly agreed that mountains are important, and less than 26% disagreed (Figure 3.3). Most respondents in all villages (60-100%), except for Gavaza (0%) agreed or strongly agreed that water bodies are important (Figure 3.3). Conversely in Gavaza 47% disagreed, with 53% undecided. The respondents from Mafarana were unanimous (100% strongly agreed) that mountains and water bodies are important.

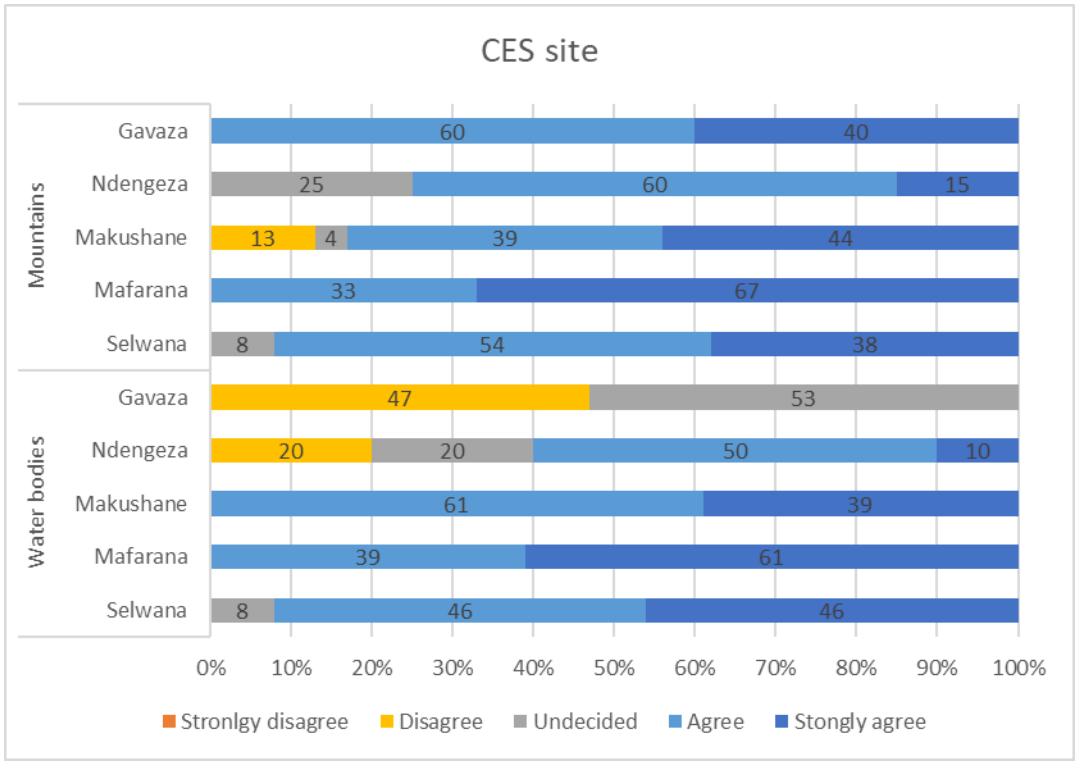

Figure 3. 3: Percent (%) of respondents per Likert category per village for CES sites that differed significantly between villages.

The greatest proportion in all villages (65-100%) agreed or strongly agreed that indigenous plants, *morogo*, medicinal plants, edible insects and wild fruits are important. Conversely less than 13% in all villages disagreed or strongly disagreed. Gavaza had the greatest consensus of the respondents disagreeing or strongly disagreeing that grasses are important in the cultural practices, whereas a fair proportion (30-48%) in other villages, except in Mafarana with only 11% disagreed or strongly disagreed (Figure 3.4). Conversely 73% in Mafarana agreed or strongly agreed. Between (26-30%) in all villages were undecided.

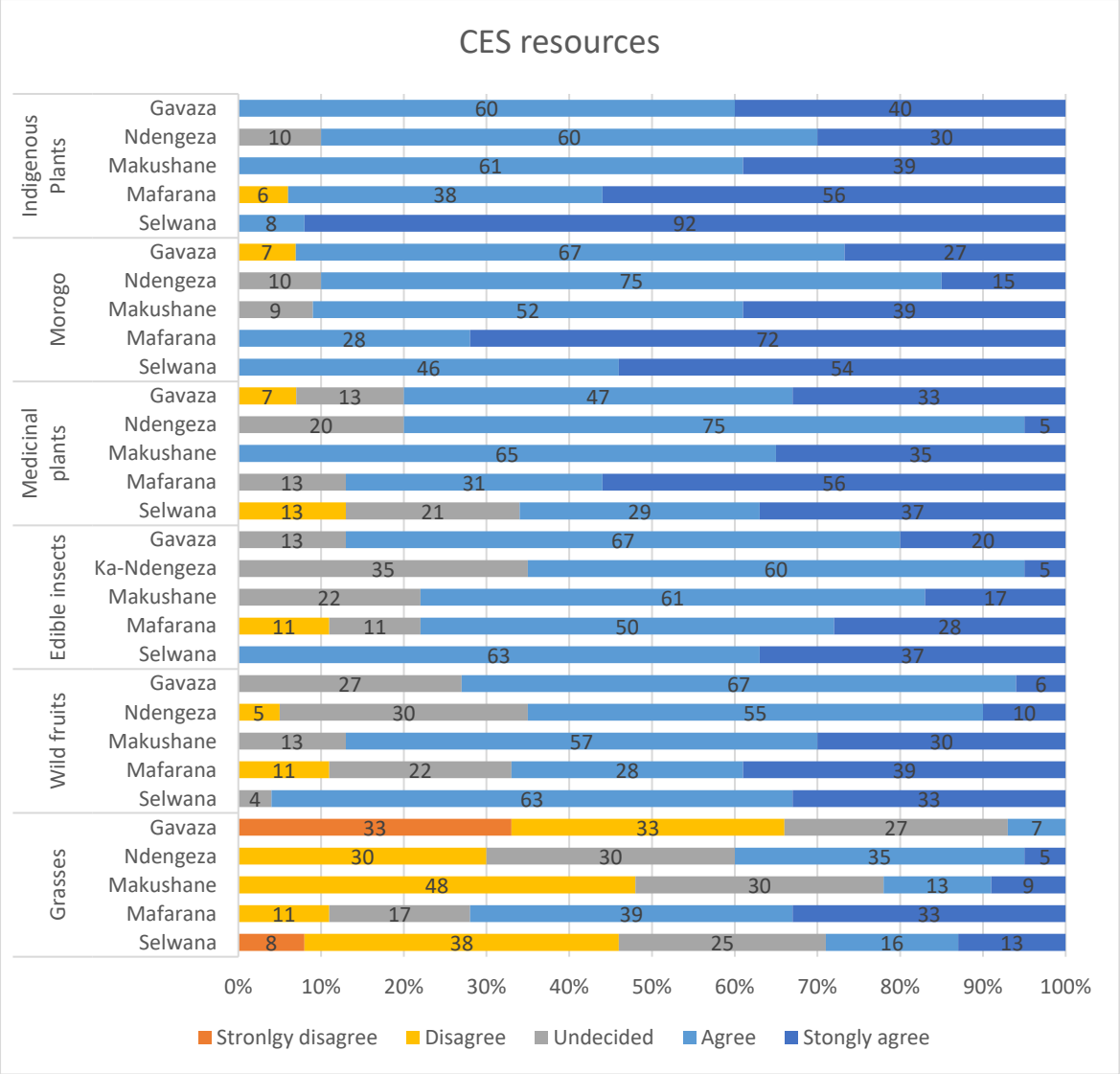

Figure 3. 4: Percent (%) of respondents per Likert category per village for CES resources that differed significantly between villages.

Moving on to farmer type, almost all farmer types (52-90%) except for semi-subsistence farmers disagreed or strongly disagreed that *Mhlaba* day is an important ceremony (Figure 3.5). Commercial farmers had the greatest disagreement of 90%. Most of the commercial farmers (75%) agreed or strongly agreed that circumcision school is an important ceremony. Conversely, most of the semi-subsistence crop farmers (60%) agreed or strongly agreed. A fair proportion of subsistence farmers (33%) was undecided. The greatest proportion of all farmers (76-95%) agreed or strongly agreed that medicinal plants are important. The greatest consensus was with commercial farmers having 58% agreeing and 37% strongly agreeing. Conversely,

only 12% of subsistence farmers disagreed. Less than 22% of all the farmers were undecided.

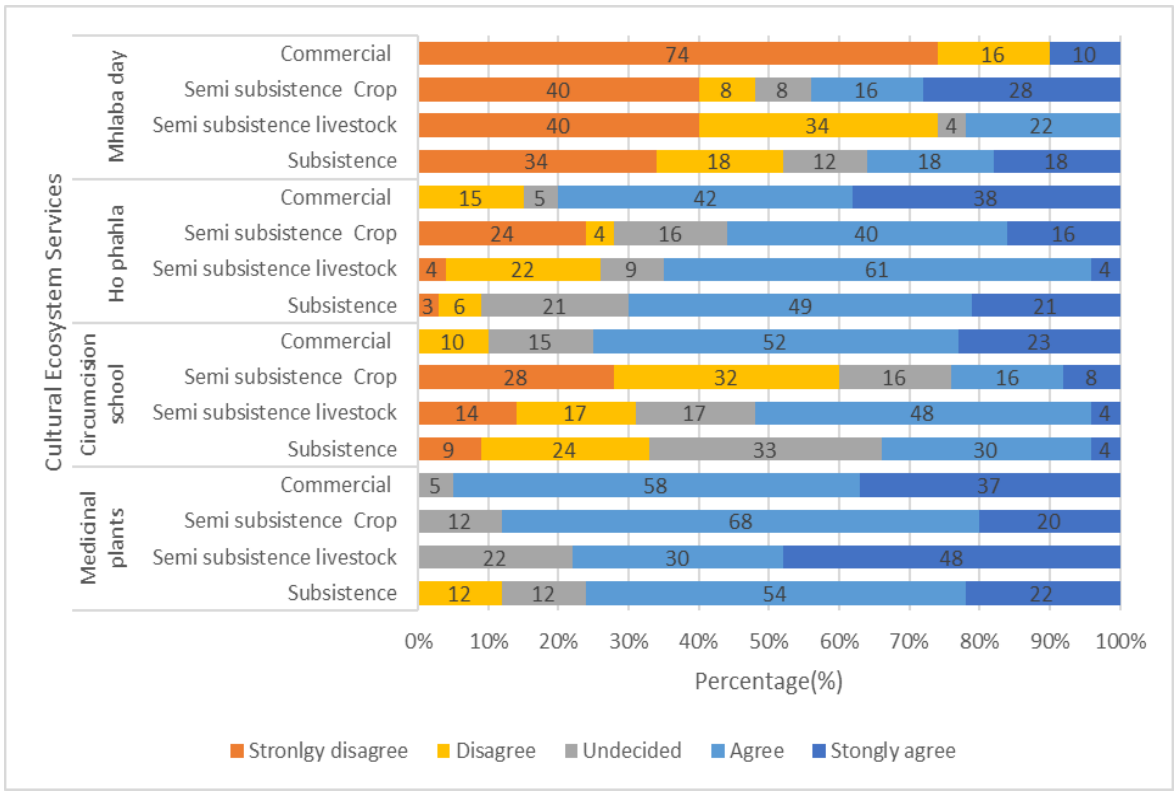

Figure 3. 5: Percent (%) of respondents per Likert category per farmer for CES that differed significantly between farmers.

About 16% of elderly people disagreed that *go loma marula* is important, the middle age group disagreed with only 2%, while the youth did not disagree. Less than 29% were undecided (Figure 3.6). Most of the elderly respondents (78%) agreed or strongly agreed that *ho phahla* is important. By contrast, 29% of youth disagreed, while 43% were undecided (Figure 3.6). A small proportion (3%) of elderly people disagreed at medicinal plants are important, while 5% middle aged respondents disagreed, young people did not disagree. Less than 19% were undecided (Figure 3.6). A larger proportion of all the respondents from all age groups (78-100%) agreed that medicinal plants are important. The greatest consensus was with youth having 28% agreeing and 72% strongly agreeing. The greatest proportion of respondents of middle age with 86% agreed or strongly agreed that wild fruits are important. Conversely, a fair proportion of 34% of the elderly group was undecided. A small proportion of 29% of the youth group disagreed (Figure 3.6).

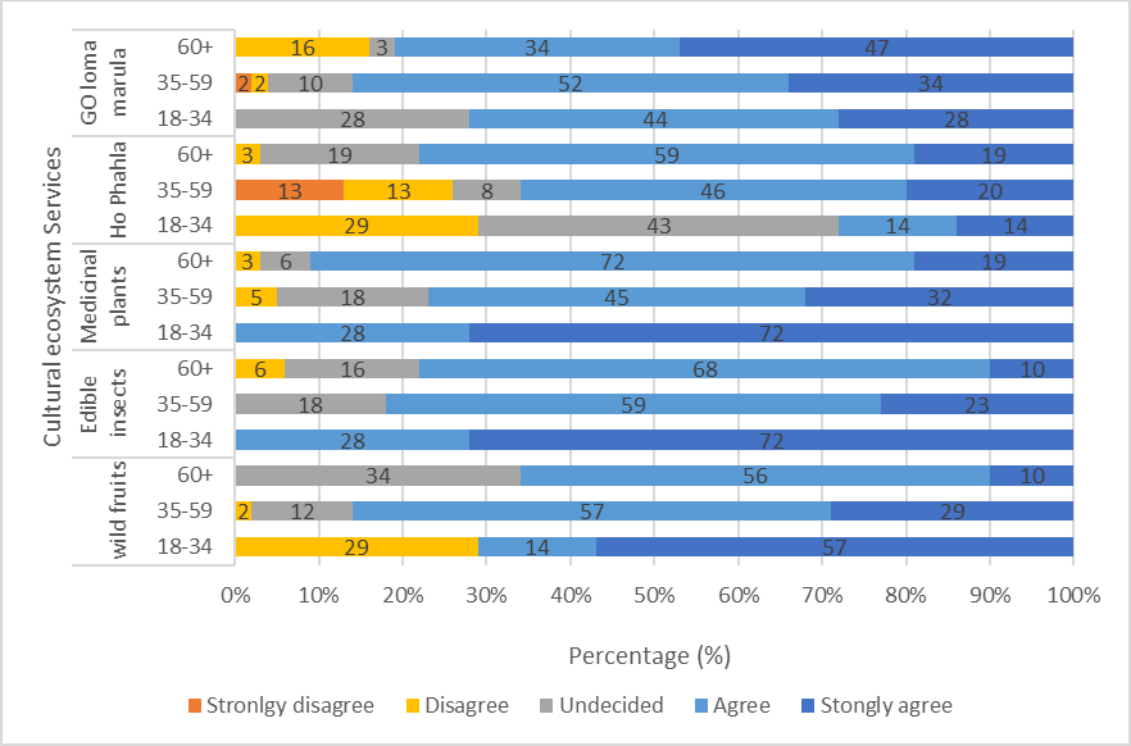

Figure 3. 6: Percent (%) of respondents per Likert category per age group for CES that differed significantly between age group.

Females disagreed with 6% that mountains and medicinal plants are important, while men did not disagree. In contrast, men had a higher agreement that they are important (Figure 3.7).

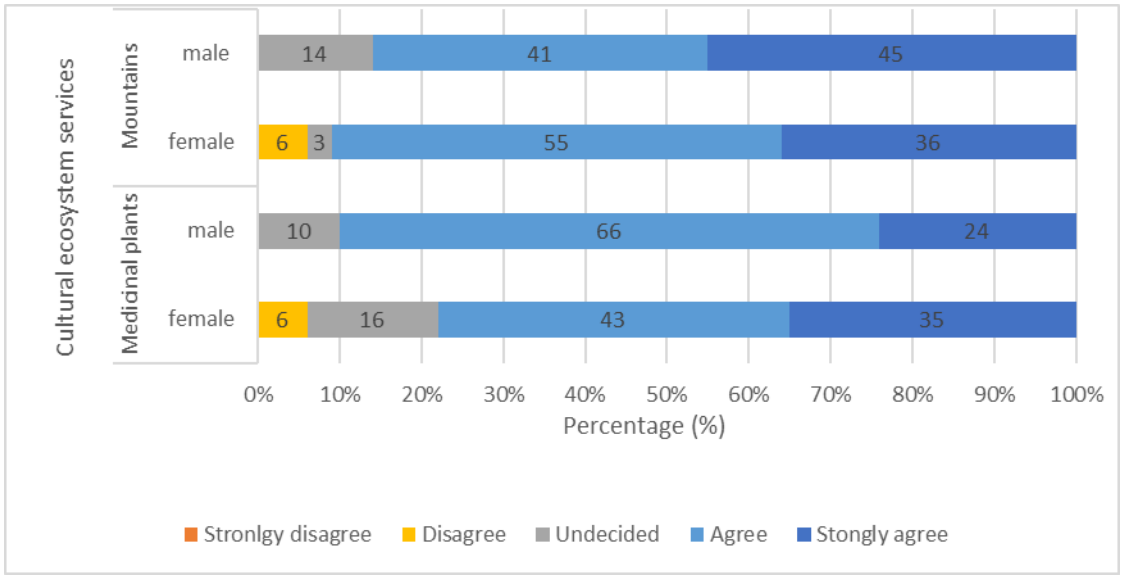

Figure 3. 7: Percent (%) of respondents per Likert category per gender for CES that differed significantly between genders.

3.4 Discussion

The data showed that there were twenty CES perceived by the key informants. From the identified cultural events, namely, *go loma marula* and *Mhlaba* day were no longer practiced. The remaining 18 were mentioned as current CES. The past CES were least valued because most respondents mentioned that they were not familiar with such celebrations or ceremonies. Only Mafarana and Gavaza were familiar with Mhlaba day because the ceremony originated in these villages. The ceremony was held in remembrance of the late King Mhlaba who was the first king of these villages. Indigenous plants, cultivated plants, grazing land, and cultivated land were mostly mentioned and valued by most of the respondents. This was expected because most of the people in these local communities are farmers. It was mentioned that most of them have small gardens in the backyards where they cultivate maize and culturally important vegetables. Moreover, most maize is cultivated in the cultivating fields, a few kilometres outside the villages. It is important to note that respondents did not differentiate between material and non-material culturally important benefits provided by their local environment. This resulted in some services that would typically be classed as provisioning (such as wild foods) or supporting (such as primary production to support culturally valued livestock) being included in the analyses.

Some cultural events were valued by particular members in the society, such as *ho phahla* which was mostly valued by traditional healers and those who believe in the spiritual power of their ancestors. This was expected as *ho phahla* is a ceremony held to acknowledge and communicate with the ancestors (Ngubeni, 2015). Additionally, most respondents mentioned that the reason they do not believe in the spiritual power of ancestors was that they believe in God. Medicinal plants were mostly valued by most respondents. However, a study by Shirungu (2016) indicated that most people who acknowledge medicinal plants are the ones who have knowledge about them and understand how they are used. Hence, it was expected that respondents who are not knowledgeable about medicinal plants will not acknowledge them. Surprisingly, most respondents did acknowledge them. Most respondents mentioned that the reason they do not use most of medicinal plants was because they do not have sufficient information on them, for instance not knowing which plant is used for what and how. They mentioned that they only know of few medicinal plants. In contrast the traditional healers mentioned that they harvest and use medicinal plants because in most cases

they are guided by their ancestors on which herbs to use for a certain sickness or problem. Findings in a study by Ngubeni (2015) showed that some traditional healers are shown certain plants through dreams by ancestors, and such plants are to be collected from the forest. The study further emphasised that plants from the wild are specifically required for rituals, for instance, those done to prevent lightning from striking homes, protecting homes from negative spirits and removal of bad luck (Ngubeni, 2015).

When they were asked what they would miss about their village should they move, most of the respondents mentioned that they would miss the cultivating land and indigenous trees and fruits. This was expected because most of the respondents practice farming, as such cultivating land is very important for their sustenance and cultural practices, as they use cultivated plants to make traditional food. The indigenous trees and fruits were most valued by most of the respondents, and this was also expected because the indigenous fruits form part of heritage and culture.

It was essential to reflect on how these CES differed with socio-demographic factors. A study by Mensah et al. (2017) indicated that there was growing evidence that access to a particular ecosystem service and use of that service would be strongly influenced by a widespread range of social factors including ecological ethics (moral principles governing the human attitude towards the environment, and rules of conduct for environmental care and preservation), ecological knowledge, demographic, spatial and environmental factors. Selwana and Makushane valued most ceremonial CES more than any other villages. This was not surprising as the communities showed deeply rooted cultural traditions. Conversely, respondents in Ndengeza did not value most of the cultural ecosystem services, with the majority disagreeing that most of the CES are important. This was not surprising as during the interactions with them most were not familiar with some of the cultural ceremonies.

Mhlaba day celebration was one of the cultural events which differed significantly between villages, because most of the villages were not familiar with the ceremony. Only Mafarana and Gavaza valued this ceremony because they were familiar with it, they acknowledged the history of *Mhlaba* day. Cultural events such as *Mhlaba* day celebration and *ho phahla* are significant aspects of cultural heritage. These

ceremonies involve elements of medicinal plants, water, and animals which are derived from the ecosystem. CES plays a vital role in ceremonies, linking people to their local environment and cultural heritage (Maes, et al. 2018). *Ho phahla* differed significantly between villages. Makushane and Gavaza valued *ho phahla* more than other villages, this was not surprising as most of the respondents from these villages mentioned that they believe in ancestors, and they do ancestral practices and rituals such as asking for protection and luck from the ancestors. “When things do not go well, we prepare *marula* beer, and go to a sacred place and communicate with our ancestors, after things will be well with us” said one of the traditional healers from Makushane. In Selwana and Mafarana most people mentioned that they are Christians, and they do not believe in ancestors. “*ho phahla* is demonic” said one respondent from Mafarana. However, it was unexpected as they have demonstrated a great acknowledgement on the cultural practices.

The importance of natural features (water bodies and mountains) differed between villages, depending on whether they occurred locally. For instance, in Gavaza and Ndengeza, most disagreed they are important, and they mentioned that they do not have rivers and mountains near to them. In contrast Makushane, Mafarana and Selwana valued these features because they have either one or both locally.

Agreement on medicinal plants and Mhlaba day differed significantly between farmers. Subsistence and semi-subsistence crop farmers had higher agreement on the importance of Mhlaba day than other farmers. This was not surprising, because Siphesihle and Lelethu (2020) mentioned that subsistence agriculture plays a fundamental role in the provision of culturally important crops. It was reflected that medicinal plants are also differed significantly between farmers. Subsistence farmers were the only ones to disagree, although the disagreement was based on a small proportion it was surprising that subsistence farmers disagreed as one could expect subsistence farmers to acknowledge medicinal plants. Another study by Ndou et al., (2019) investigated the medicinal plants value-chain in South Africa, their study highlighted that most medicinal plants are traded as such it was not surprising that commercial farmers agreed as they might be traded to different stakeholders including the traditional healers and nearby communities, because medicinal plant use has not

declined among African people because of the deeply rooted cultural associations and belief in the existence of ancestors (Mbongwa, 2018).

There was a significant difference in how *ho phahla* was valued between the age group. The findings showed that most of the people age 60+ valued *ho phahla* more than any other age group. This was expected as it is known that *ho phahla* is a spiritual practice that required one to be spiritually connected to the ancestors in all senses, including psychologically and emotionally (Ngubeni, 2015; Ndlovu, 2016; Chilisa, 2017). Studies by Ngubeni (2015) and Ndlovu (2016) indicated that most youth are not spiritually connected to the ancestors because they only perceived it as an activity or hobby which is practiced by older people. “Even if some try to participate, they will not be as spiritually connected as the elders because *ba shilafetse* (meaning they are spiritually unclean), they are occupied with lots of activities, which are also limitation contributors to their spiritual understanding of ancestors” said one elderly respondent. *Go loma marula* differed significantly between age groups. Findings showed that elderly people valued these practices more than other age groups. The older people indicated that this practice was no longer as effective as it used to be, because most people, especially the youngest generation, do not completely understand the purpose of the practice. The purpose of this ceremony is to present the *marula* fruits to the king in order to be granted permission to start harvesting the marula fruits. However, it was indicated that once the *marula* or *mopani* worms are ready to be harvest, they harvest them even before the permission was granted. Additionally, the elderly indicated that it has become a norm to harvest *marula* fruits before permission is granted. As such this ceremony was deemed unnecessary.

There was no significant difference in how indigenous plants are valued between the age groups. However, the results showed that the youngest generation valued the indigenous plants. The youngest generation indicated that the indigenous plants provide stewardship of natural heritage, and enhance sense of place, they form part of what makes a region unique. Most of the indigenous plants that they focused on was *marula* plant and *mopani* plant. The *marula* trees are culturally, economically, and ecological valued significant species in South African savanna (Shackleton and Shackleton, 2004; Shackleton et al., 2007). *Marula* trees play a significant role in ecosystem functioning and create economic and cultural value for local communities

(Shackleton, et al., 2000, Shackleton et al., 2002). *Marula* fruit are used and brewed to make *marula* beer, which can be shared amongst the residents during the cultural gatherings and ceremonies (Shackleton, 2004). *Marula* sites are used for cultural ceremonies, such as *ho phahla* (communicating with the ancestors). The bark of this tree is used as traditional medicine to treat stomach illnesses (Shackleton, 2001). The fruits are also used to make juice and jam, while kernels are added to a variety of traditional dishes or are consumed (Shackleton and Shackleton, 2005). The *marula* oil is used by the Venda tribe as a traditional way to preserve meat. The oil is applied on the meat, and this method of preservation has been used by different generations (Nwonwu, 2006). The *marula* tree, thus, has a broad value based on its multiple uses, making it a multi-use common property resource in communal lands and an important source of non-timber forest products (NTFPs) across the savanna (Shackleton et al., 2005). The increasing resource demands, along with many large tree fuelwood options being reduced in the landscape, have worsened the harvesting of *marula* tree for fuelwood (Shackleton et al., 2005; Matsika et al., 2012, Mograbi et al., 2015). The elderly (60+) indicated that these plants especially the *marula* fruits are essential for their CES, as *marula* beer is mostly used during *ho phahla*.

Mountains and medicinal plants differed significantly between genders. This was expected as circumcision schools are mostly on the mountains, and more males valued mountains due to the circumcision school or initiation school than females. Men indicated that they value circumcision school as it assists them during the transformation from boyhood to the manhood. Females disagreed with a smaller proportion than men that medicinal plants are important, whereas greater proportion agreed. This was expected as one study have reported that in rural communities women are the primary caregivers, as such they are more likely than men to use medicinal plants (Torres et al. 2016).

3.5 Conclusion

This study investigated the perceived past and present CES and how they are valued. The variety of CES provided by the local environment could be classified in terms of resources for ceremonies, sites for culturally important activities, and provision of natural resources for culturally important uses. Most of the listed CES are still valued by the communities. This study also reflected how socio-demographic factors influenced how CES were valued. Most of the CES were valued mostly by the elderly people. Perceptions varied more by village than other socio-demographic factors, as such this has shown that a place of residence has an influence on how people value the CES. It can be concluded that local context is a very important determinant of CES and how they are valued regardless of type of farmer, age group or gender. Hence this is important as local cultural values can be used to promote sustainable use of natural environment. Community involvement is recommended in most rural communities for its effectiveness in managing the environment and natural resources (Shackleton et al.,2005).

The findings in this study could assist the traditional leaders, healers and community members to understand the cultural ecosystem services and the perceptions around them in their communities. Understanding the CES will encourage the communities to give their opinion, knowledge (preferably indigenous or traditional) and perceptions in matters that affect their natural environment and their culture (Donnges, 2003, Kepe, 2014). Additionally, a better understanding of CES and perceptions around them may be used to create awareness on the importance of CES and guide the traditional leaders on the cultural practices that the communities value the most and ones that are less valued, and the reason behind this. As such this can assist the traditional leaders and the communities in working together to effectively strategise on restoring, improving, and sustaining the cultural practices. Understanding the importance of cultural ecosystem services to wellbeing constitutes a critical first step in efforts to safeguard what matters most to people (Elwell et al., 2020). Furthermore, the findings are important to highlight the importance of incorporating consideration of local CES in environmental management initiatives and environmental impact assessments by government, NGOs, and consultants.

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CHAPTER 4: LOCAL PERCEPTIONS ON LOCAL ENVIRONMENTAL CHANGE, CAUSES AND IMPACTS

4.1 Introduction

Studies have shown that South Africa, particularly in the rural communities, is experiencing environmental change, and climate change induced challenges (Anthony & Bellinger, 2007; Chan et al., 2012). These challenges include extreme weather events (droughts, extreme temperatures, and floods), land cover and land use changes, which are influenced by anthropogenic and natural activities (Cocks & Wiersum, 2003). These extreme related weather events have had a negative impact on rural productivity affecting rural dwellers (Acharya & Panda (2013). Studies have shown that the most critical environmental problems in rural communities are due to the settings because natural resources are essential to income and providing for daily needs (Shackleton & Shackleton 2000, 2004; Hunter et al. 2010). Natural resources are sometimes purposefully harvested for cultural practices (Coopoosamy and Naidoo, 2012). It has been shown that the rural communities experience environmental scarcity and are increasingly vulnerable to resource over-exploitation, driven largely by socio-economic and demographic factors (Shackleton and Shackleton 2000, 2004; Hunter et al. 2010). Furthermore, a study by Unganai (2009) observed that climate induced weather events have resulted in many natural disasters in rural communities and have contributed to increased food and water insecurities in many parts of the country. The study observed that the heavy dependence on climate-sensitive economic sectors, such as agricultural productivity makes South Africa vulnerable to any changes in climate (Unganai, 2009).

It is a concern that climate change continues to exert significant hardship on many rural communities in South Africa (Anderson et al., 2007). Although climate change remains a concern in South Africa and globally, little is known about how perceptions on climate change vary between individuals (Acharya and Panda 2013). Local communities' perceptions of ongoing climate change, its causes and its effects are sometimes different from contemporary scientific findings on the subject (Anderson et al., 2007). Few studies observed that community members are aware that the climate is changing through their observations of rising temperature, droughts, and unreliable rainfall (Anderson et al., 2007; Acharya & Panda 2013). Most rural communities

perceived that the variations in temperature and rainfall variability negatively affect the natural resource-based livelihoods (Anderson et al., 2007). These environmental perceptions determine how communities formulate strategies to cope with the changes in the short term and to adapt to more long-term shifts (Makhado et al., 2009). There is a perception that land-based livelihoods strategies in communal areas make insignificant contributions to overall wellbeing (Makhado et al., 2009). However, environmental perceptions within a community may vary by factors such as gender. For example, Rankoana (2016) found modest distinctions between men and women, with women showing higher levels of environmental concern and behavioural adjustments relative to men.

The major threat due to climate change and land use and cover in the Limpopo Province is the loss of ecosystems on which humans depend for their livelihoods (Anderson et al., 2007). Landcover and land use changes includes overharvesting, overgrazing, deforestation (Anderson et al., 2007). Development, overharvesting, and human population increase have a direct impact on ecosystem service and indirect impacts on CES, for instance, a substantial decline in many wild medicinal plant populations, which results in traditional healers to travel long distances to obtain the required plant material for treatment (Coopoosamy and Naidoo, 2012; Mbongwa, 2018). Furthermore, the reliance on fuelwood as a source of energy in most rural communities places a great deal of harvesting pressure on fuelwood, which in turn exacerbates deforestation, which causes a decline in vegetation cover, which results in many animal and plant species being lost due to the loss of habitat in degraded ecosystems (Shackleton, 2001; Scholes, 2009; Matsika et al., 2012).

Climate change affects cultural ecosystem services and the well-being of people mainly through its impacts on spirituality and cultural identity, aesthetics, and recreation (Palomo, 2017). The impact includes biodiversity loss which has resulted in the decreased number of local tourists and a decline in most wild plants which are important for cultural practices and rituals (Coopoosamy and Naidoo, 2012; Palomo, 2017; Mbongwa, 2018). Climate change also impacts on the cultural landscapes which are the centres of cultural values and contribute to the identity of communities, as features of the environment are often associated with the identity of an individual, a community, or a society. They provide experiences shared across generations, as well

as settings for communal interactions important to cultural ties (Daniel et al., 2012). Cultural resources are also impacted by climate change. Impacts such as floods and severe winds have the potential to damage standing structures (cultural sites) such as *kraal,* which is a sacred host of traditional rituals and other cultural practices (Cocks & Wiersum, 2003).

This chapter reflects on the environmental change experienced by local communities. It also highlights the perceived causes of environmental change and the impacts of these changes on cultural ecosystem services (CES). Additionally, it further examines how the perception about environmental change differs by socio-demographic factors. Although the local natural environment is central to the well-being of millions of households in rural regions of developing countries, there is limited knowledge on the residents' environmental perceptions and concerns in such areas (Hunter et al. 2010, Yao et al., 2022). As such it was important to investigate on the perceived environmental changes, its causes, and its impacts on the CES in selected rural communities. Additionally, this is significant as is urged by Hunter et al., (2010) that the local environmental perceptions are of significance and should be taken into consideration during decision-making.

4.2 Methods

Aspects of local environmental change including the landscape and climate, change in the rainy season, and occurrence of extreme climatic events, causes of environmental change, and impacts of environmental change on CES were explored in key informant interviews. Likert scores were then used in a questionnaire to explore individual perceptions of these in the survey of 100 respondents. The Likert categories were of environmental change, environmental causes, occurrence, and likelihood. For the detailed meanings of the Likert categories of change, agreement, occurrence of change and seasonal variation refer to Table 4.1. In order to identify the most perceived environmental changes, extreme climatic events, seasonal variations and causes the median score for each categorical variable was calculated. To understand how the changes and causes differed between villages, farmers, age group and gender, the Pearson Chi-squared test was used.

Table 4. 1 Aspects of environmental change, indicating Likert category and score.

Categories	**Likert category**	**Likert score**
Environmental change	Direction of change	1 = decrease
		2 = no change
		3 = increases
Environmental causes	Agreement	1 = strongly disagree
		2 = disagree
		3 = neither or undecided
		4 = agree
		5 = strongly agree
Changes in rainy season	Direction of change	1 = earlier
		2 = same or no change
		3 = later
Occurrence of the extreme climatic	Likelihood	1 = never
		2 = rarely
		3 = sometimes
		4 = frequent
		5 = very frequent
Causes of environmental change	Agreement	1 = strongly disagree
		2 = disagree
		3 = neither or undecided
		4 = agree
		5 = strongly agree
Impacts of environmental change	Agreement	1 = strongly disagree
		2 = disagree
		3 = neither or undecided
		4 = agree
		5 = strongly agree

4.3 Results

4.3.1 Local perception on environment changes

Ten types of environmental changes emerged from the key informant interviews. The environmental changes were categorised into changes to soil, animals, plants, water, and climate (Table 4.2) Eight of them were based on the perceived direction of change while soil erosion and bush encroachment were based on the level of agreement. During the key informant interviews, some respondents mentioned that they do not experience soil erosion and bush encroachment while others said they did. Hence, I investigated whether the community members experienced soil erosion and bush encroachment or not. Respondents generally agreed that there had been a decrease in soil fertility, livestock mortality, abundance of locally important animals, quality of grazing land, abundance of locally important plants, amount of water in rivers, and quality of water in rivers. By contrast most respondents agreed that there has been experiencing climate change. Most of the respondents agreed that they experience soil erosion and bush encroachment.

Table 4.2: Aspects of environmental change, indicating the median Likert score.

Environmental changes	**Category**	**Variable type***	**Median**
Soil fertility	soil	Direction	1
Livestock mortality	animal	Direction	1
abundance of the important animals	animal	Direction	1
Quality of grazing land	plants	Direction	1
abundance of local important plants	plants	Direction	1
Amount of water in rivers	water	Direction	1
Quality of water in rivers	water	Direction	1
Climate change	climate	Direction	3
Soil erosion	soil	Agreement	4
Bush encroachment	plants	Agreement	4

* For direction of change Likert score 1=decrease. 2=stay the same and 3=increase. For agreement of change Likert score 1=strongly disagree, 2=disagree, 3=neither, 4=agree, and 5=strongly agree.

Most of the respondents said that there has been a decrease in soil fertility (51%), and the respondents mentioned that they must now use fertiliser in order to maintain crop productivity. There has been a decrease in livestock mortality (57%), but the

respondents perceived that the number of livestock have decreased as they were forced to sell due to the stealing of livestock around the area. Additionally, there has been a decrease in the abundance of the local important animals (60%), quality of grazing land (58%), abundance of important plants (68%), due to the overgrazing and deforestation, amount of water in rivers (67%) and quality of water in rivers (70%) (Figure 4.1). Conversely most of the respondents stated that there has been an increase in climatic change. Conversely a fair proportion of the respondents reported no change in soil fertility , livestock mortality , abundance of important animals, grazing land, the abundance of important plants , amount of water in rivers and quality of water in rivers (Figure 4.1).

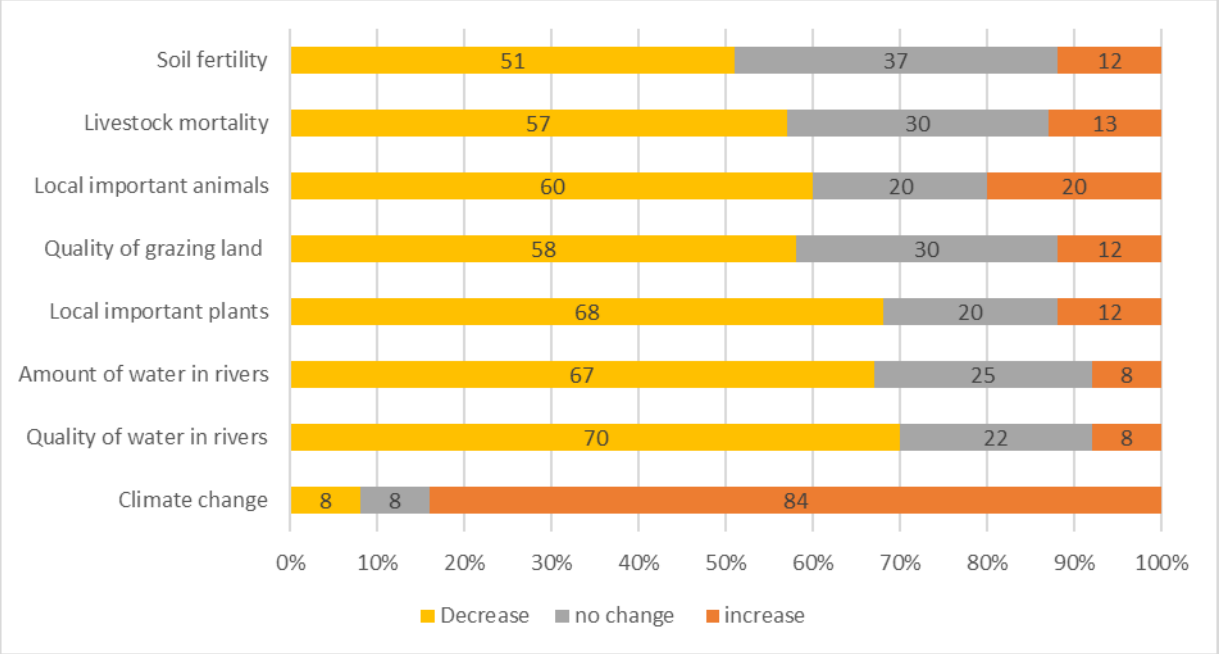

Figure 4.1: Percentage (%) of the respondent Likert scores for the direction of change for different environmental change aspects.

Most of respondents agreed that they experience soil erosion (56%) and bush encroachment (63%), and a small proportion (20%) and (23%) respectively were undecided. Only 1% disagreed for both (Figure 4.2).

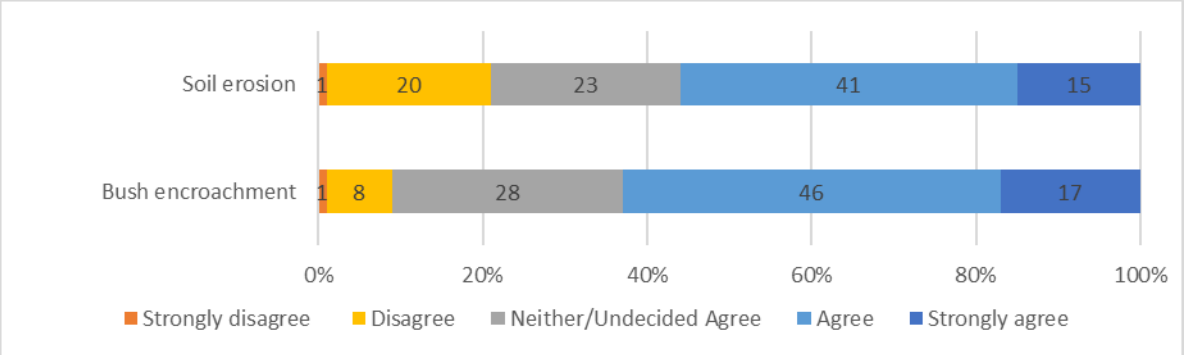

Figure 4.2: Percentage (%) of the respondent Likert scores for agreement on the different environmental change aspects.

In terms of climate change, two factors (start of rainy season and end of rainy season) emerged from key informants' interviews (Table 4.3). Nearly equal proportions of respondents reported earlier (43%) and later (41%) start of the rainy season, with 16% reporting no change (Figure 4.3). By contrast the large majority (67%) of respondents reported a later end of the rainy reason, although 25% reported an earlier end. Only 8% reported no change in the end of the rainy season.

Table 4.3: Variation in rainy season indicating the median Likert score.

Changes in rainy season	**category**	**Median**
Start of rainy season	climate	2
End of rainy season	climate	3

*1=earlier. 2=no change and 3=later

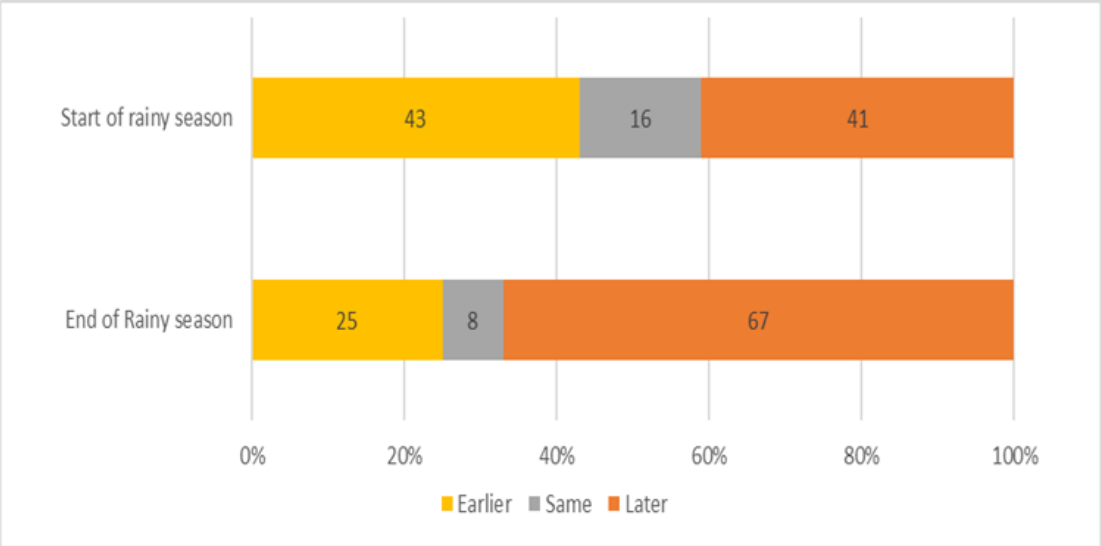

Figure 4.3: Percentage of the respondents showing Likert score of variation in rainy season for the past 10 years.

Five extreme climatic events emerged from key informant interviews (Table 4.4). A large proportion of the respondents reported rare occurrence of floods (61%), severe winds (50%) and low temperatures (68%), and a fair proportion indicated droughts occur rarely (42%). Conversely, most of the respondents reported frequent (46%) and very frequent (42%) occurrences of high temperatures (Figure 4.4). Except for floods (24%), less than 11% of respondents reported climatic extremes as never occurring. For drought and severe winds, a fair proportion of respondents (37% and 35% consecutively) reported sometimes.

Table 4.4: Occurrence of the extreme climatic events, indicating the median Likert score.

Occurrence of the extreme climatic events	**Category**	**Median**
Floods (Too much rain)	climate	2
Drought (Lack of rain)	climate	2
Severe winds	climate	2
Low temperature	climate	2
High temperature	climate	4

*1=never. 2=rarely and 3=sometimes, 4=frequent, and 5=very frequent.

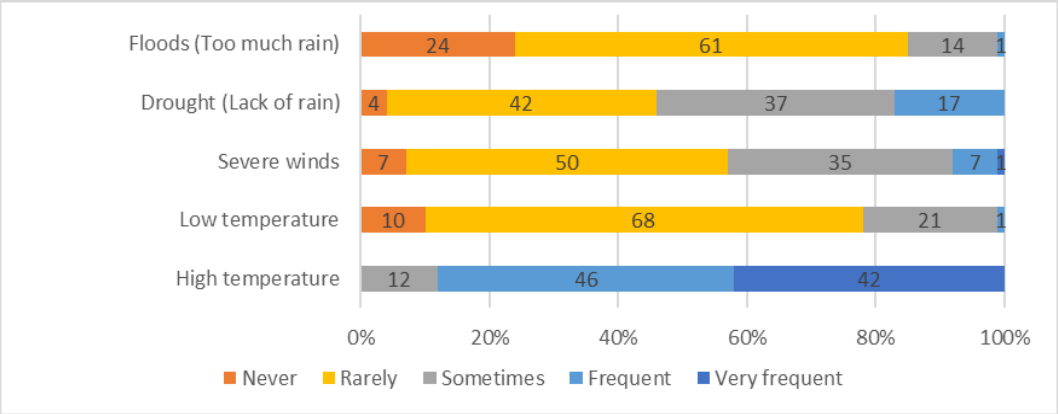

Figure 4.4: Percent (%) of respondents per Likert category showing the occurrence of the extreme climatic events.

4.3.2 Local perception on causes of environmental change

Seven causes of environmental change emerged from the key informant interview. There was general agreement that residential development, wildfires, deforestation, overgrazing, overharvesting and littering are the main causes of environmental change with the exception of air pollution (Table 4.5). These causes result in a decrease in most important plants such as *marula*, *mopani* trees and other indigenous plants. Overgrazing and overharvesting result in decreases in medicinal plants, soil erosion and decrease in soil fertility, increase in climate change, and a decrease in the amount and quality of water in rivers consecutively.

Table 4.5: Causes of environmental change indicating the median Likert score.

Causes	**Category**	**Median**
Residential development	development	4
Wildfires	land	4
Deforestation	plants	4
Overgrazing	plants	4
Overharvesting	plants	4
Air pollution	pollution	2
Littering	pollution	4

*1=strongly disagree, 2=disagree, 3=neither, 4= agree, and 5= strongly agree.

There was widespread agreement (65-79%) for all the causes of change except for pollution, with which only 10% agreed or strongly agreed (Figure 4.5). The greatest consensus was around residential development as a driver of change, with 55% agreeing and 24% strongly agreeing. The respondents mentioned that it is possible that the areas will be twice the size they are now in the next decade. Conversely, greatest disagreement was around air pollution as a cause of change, with 83% disagreeing or strongly disagreeing. Less than 22% of the respondents were undecided.

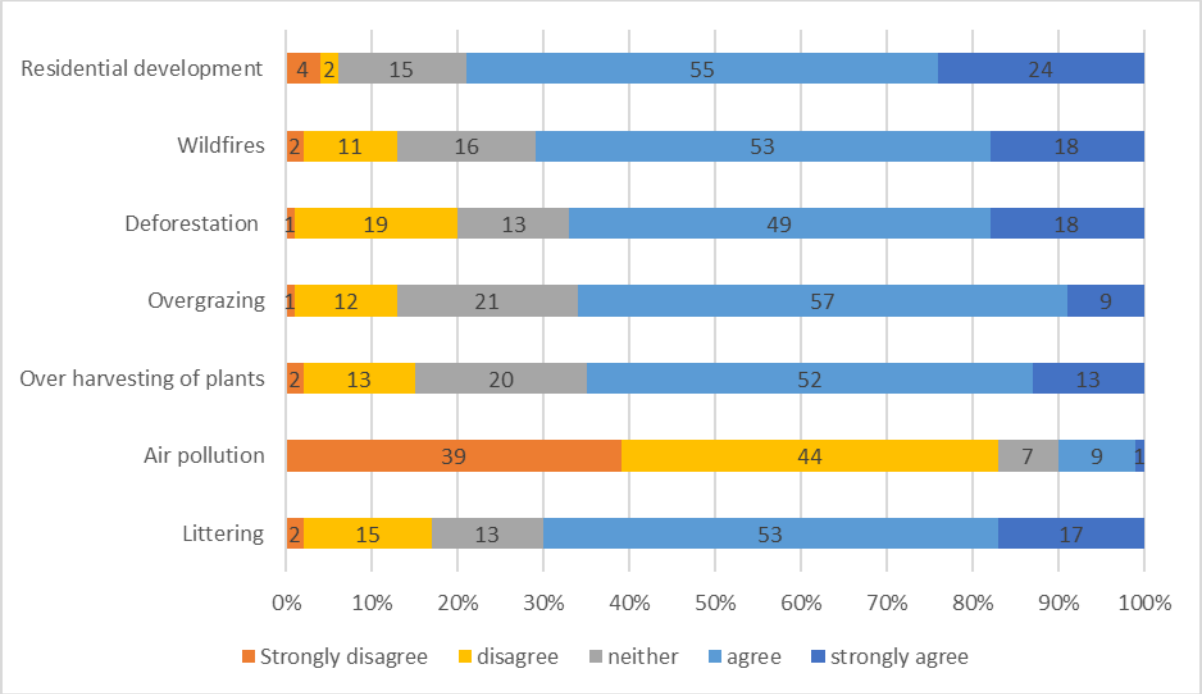

Figure 4.5: Percentage of the respondents illustrating the Likert score of agreement on environmental changes they experience.

4.3.3 Local perception on the impacts of the environmental change on the provision of cultural ecosystem services

Focusing on the local perception of the impacts of environmental change. four perceptions of environmental impacts on the provision of CES emerged from the key informant interviews (Table 4.6).

Table 4.6: Impacts of environmental change on the provision of CES indicating median Likert.

Impacts of environmental change	**Median**
Reduction in the availability of the most important livestock for our cultural practices.	4
Reduction in the availability of the most important wild animals for our cultural practices.	4
Decrease in the availability of *marula* tree and *mopani* trees influences our cultural practices	4
Extreme temperatures influence cultivated crops which are used to make traditional food.	4

*1=strongly disagree, 2=disagree, 3=neither, 4=agree, and 5=strongly agree.

There was a high level of agreement on all of these among survey respondents. There was a widespread agreement for all the perceived impacts of environmental change on the provision of cultural ecosystem services (81-85%). Less than 6% disagreed or strongly disagreed. Conversely, at least 13% were undecided (Figure 4.6).

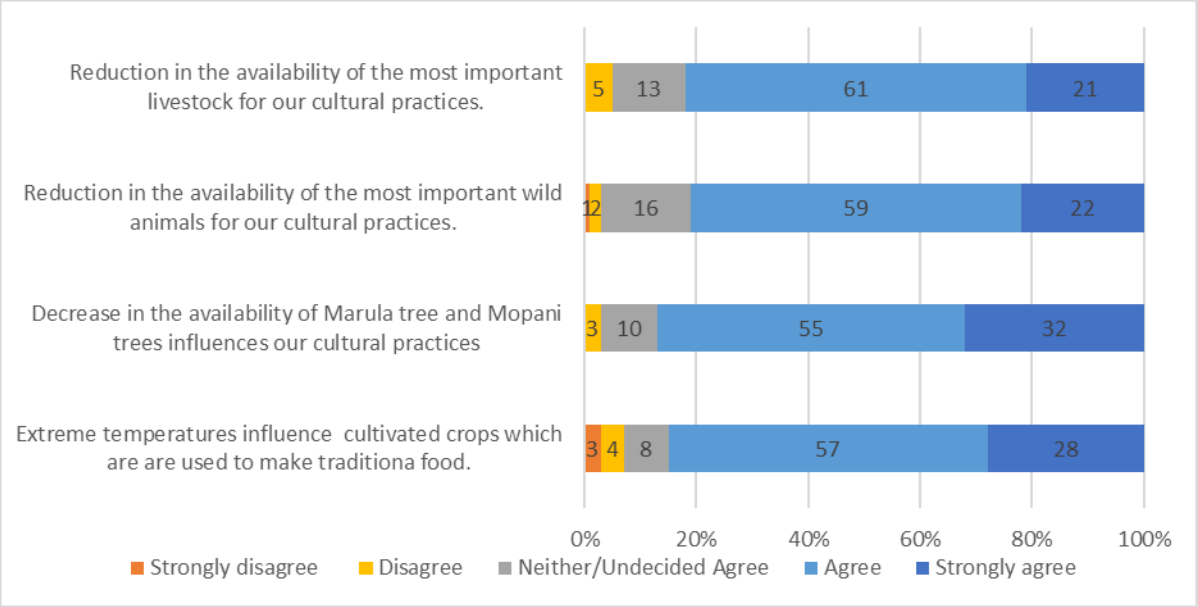

Figure 4.6: Percentage (%) of the respondent illustrating the Likert score on different perceptions of environmental changes on the provision of CES.

4.3.4 The influence of socio-demographic factors on perceptions of environmental change

Table 4.7 summarises the results of statistical analyses of variation in perception scores by socio-demographic factor per an aspect of environmental change. Perceptions of livestock mortality ($p<0.05$), quality of water in rivers ($p<0.01$), amount of water in river, ($p<0.001$) and end of rainy season ($p<0.05$) differed significantly between villages. Abundance of local important plants ($p<0.05$) differed significantly between farmer type. Livestock mortality ($p<0.01$) and climate change ($p<0.05$) differed significantly between age groups. Livestock mortality ($p<0.05$), bush encroachment ($p<0.05$), quality of water in rivers ($p<0.05$), start of rainy season ($p<0.05$) and drought ($p<0.05$) differed significantly between genders.

Table 4.7: Environmental changes with the Chi square P-value for the following social-demographic factors: village (df.16), farming practices (df.12), age group (df.8), and gender (df.4), illustrating the cultural ecosystem services that had significant p value (in bold). (n=100).

Environmental changes aspects	**Villages**		**Farmers**		**Age group**		**Gender**	
	Chi squared	**P-value**	**Chi squared**	**P-value**	**Chi squared**	**P-value**	**Chi squared**	**P-value**
Soil fertility	10.468	0.234	3.939	0.685	3.213	0.523	0.465	0.793
Soil erosion	14.958	0.528	10.320	0.588	6.993	0.537	6.824	0.145
Livestock mortality	15.810	**<0.05**	11.411	0.076	13.178	**<0.01**	6.608	**<0.05**
Local important animal	10.734	0.217	3.064	0.801	1.263	0.868	3.210	0.210
Quality of grazing land	11.543	0.173	9.769	0.135	2.803	0.591	2.458	0.293
Local important plants	5.968	0.651	12.457	**<0.05**	2.650	0.618	0.367	0.832
Bush encroachment	20.291	0.207	12.443	0.411	9.412	0.309	9.921	**<0.05**
Quality of water in rivers	19.217	**<0.01**	7.226	0.300	2.556	0.635	6.041	**<0.05**
Amount of water in rivers	36.775	**<0.001**	10.368	0.322	7.390	0.286	5.679	0.128
Climate change	16.476	0.420	12.411	0.413	16.016	**<0.05**	7.331	0.119
End of rainy season	18.024	**<0.05**	2.970	0.813	2.564	0.633	0.558	0.757

Environmental changes aspects	Villages		Farmers		Age group		Gender	
	Chi squared	P-value	Chi squared	P-value	Chi squared	P-value	Chi squared	P-value
Start of rainy season	7.788	0.454	9.446	0.150	4.108	0.392	7.586	**<0.05**
Floods	8.309	0.761	6.629	0.676	6.198	0.401	3.809	0.283
Drought	19.263	0.082	5.748	0.765	9.511	0.147	4.610	**<0.05**
Severe winds	23.769	0.095	12.666	0.394	9.091	0.335	1.830	0.767
Low temperature	16.245	0.180	14.095	0.119	9.274	0.159	1.777	0.620
High temperature	11.390	0.181	10.991	0.089	5.503	0.239	2.088	0.352

Focussing on the influence of village of residence on perceptions of the aspects of environmental change that differed significantly between villages, there was widespread agreement in all the villages (56-67%) except Ndengeza (35%) that there has been a decrease in livestock mortality (Figure 4.7). Conversely, a fair proportion mentioned an increase in livestock mortality in Makushane (26%) and Ndengeza (20%). Between 33-45% from all villages except Makushane 9% and Gavaza 20% reported no change. Most of the respondents from all the villages (65-93%), except for Selwana with 46%, reported a decrease in quality of river water. Gavaza had the highest proportion of 93% of respondents indicating a decrease in water quality. Less than 17% of respondents from any of the villages reported an increase in quality while a fair proportion in Selwana (37%) reported no change. Ndengeza had equal proportions of respondents reporting a decrease and increase. Less than 34% reported increase in all villages except in Ndengeza, while a small proportion (14-28%) reported no change.

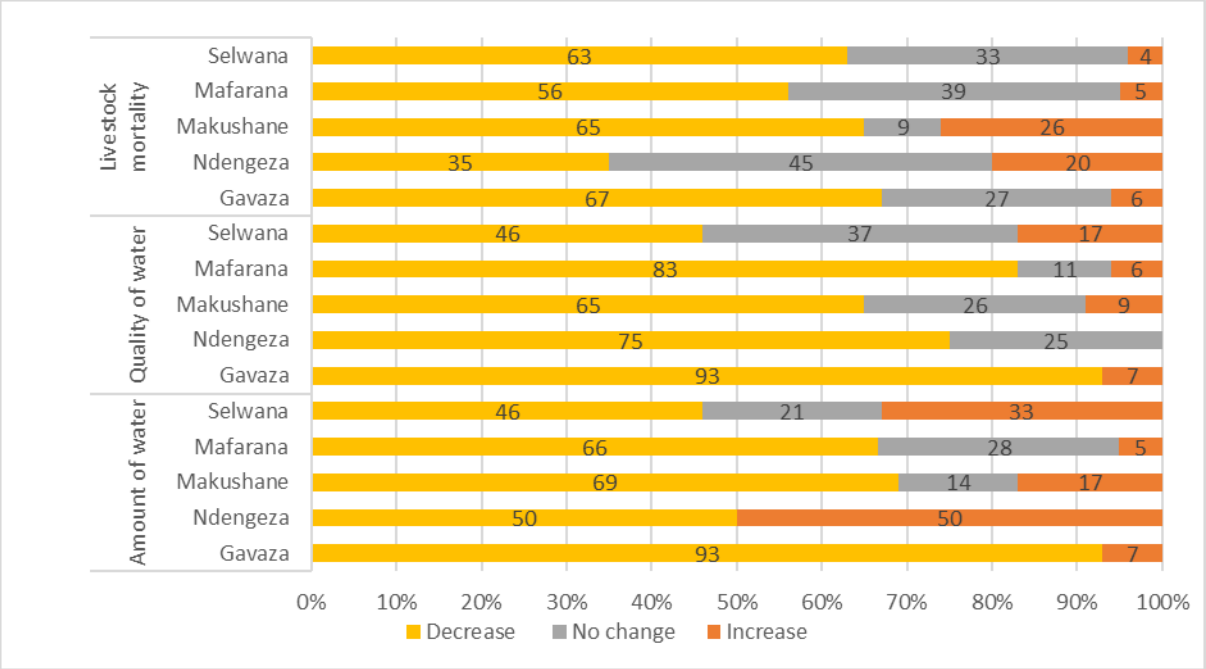

Figure 4.7: Percent (%) of respondents per Likert category per village for environmental changes that differed significantly between villages.

Concerning perceptions of climatic change, most respondents from Selwana (58%) and Makushane (57%) reported an earlier end to the rainy season (Figure 4.8). By contrast a large majority in Ndengeza (70%) reported a later end of rainy season. Opinions were less conclusive in Mafarana and Gavaza.

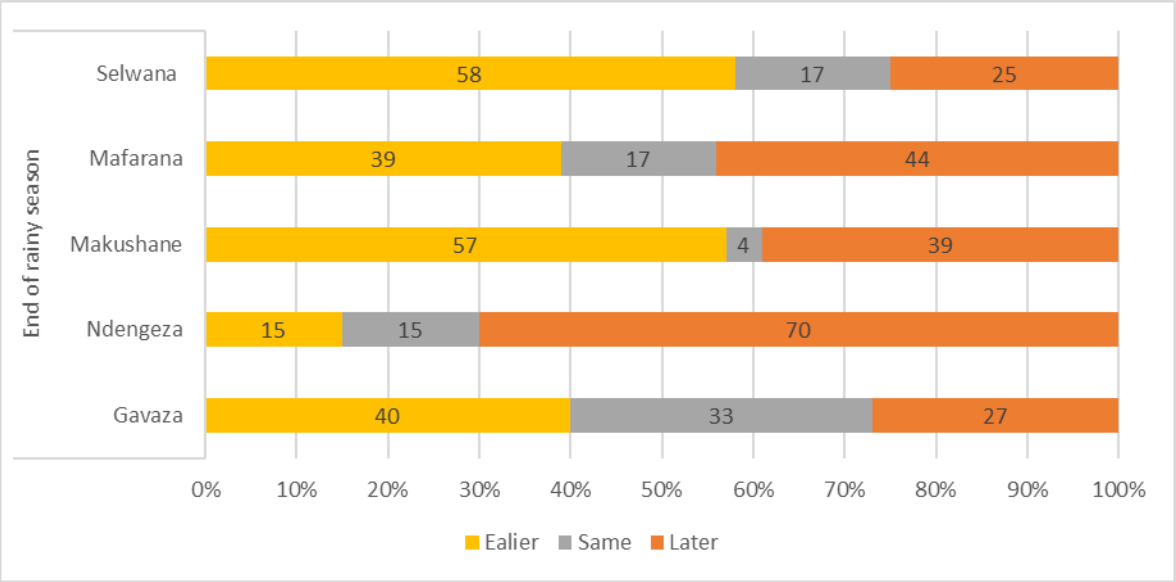

Figure 4.8: Percent (%) of respondents per Likert category per village for changes in the rainy season that differed significantly between villages.

Farmer type only influenced perceptions on change in abundance of important local plant species. Although most respondents in all farmer categories reported a decrease in abundance of local important plants, this was highest among semi-subsistence crop farmers (84%) and lowest among semi-subsistence livestock farmers (52%) (Figure 4.9).

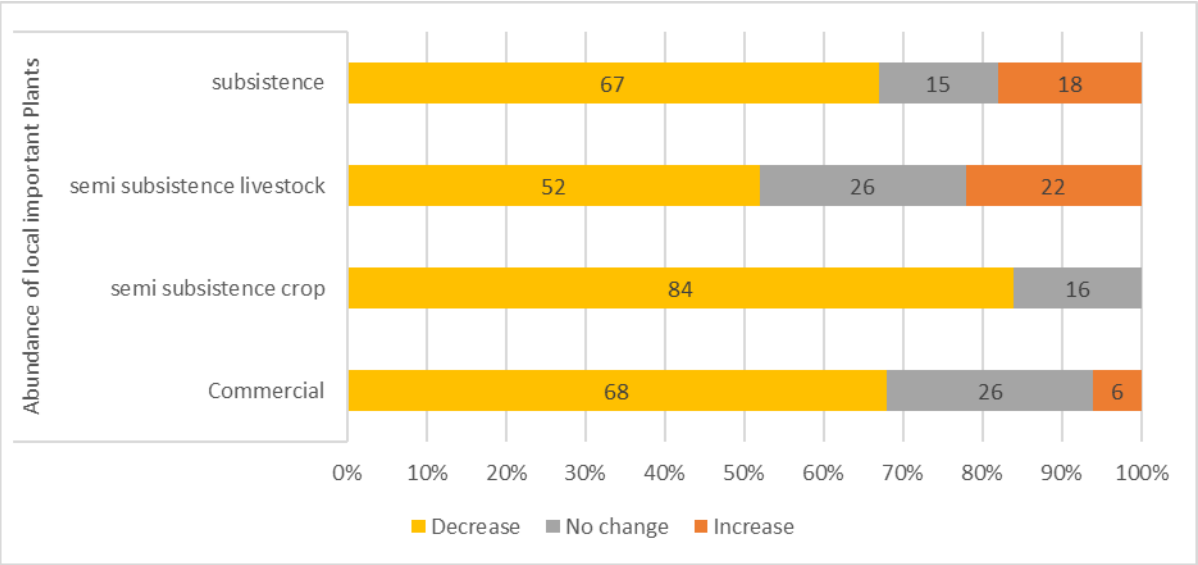

Figure 4.9: Percent (%) of respondents per Likert category per farmer type for changes that differed significantly between farmer types.

Most youth (18-34 years) perceived no change (57%) in livestock mortality, with the remaining 43% reporting a decrease (Figure 4.10). By contrast, most (60%) middle-aged (35-59 years) respondents reported a decrease in livestock mortality while the remaining 40% was evenly split between no change and an increase. The response profile of the elderly (60+ years) was somewhat in between the other two age groups. A fair proportion of youth and a small proportion of middle-aged indicated a decrease in climate change, the overwhelming majority of the elderly perceived an increase, with only a few indicating no change.

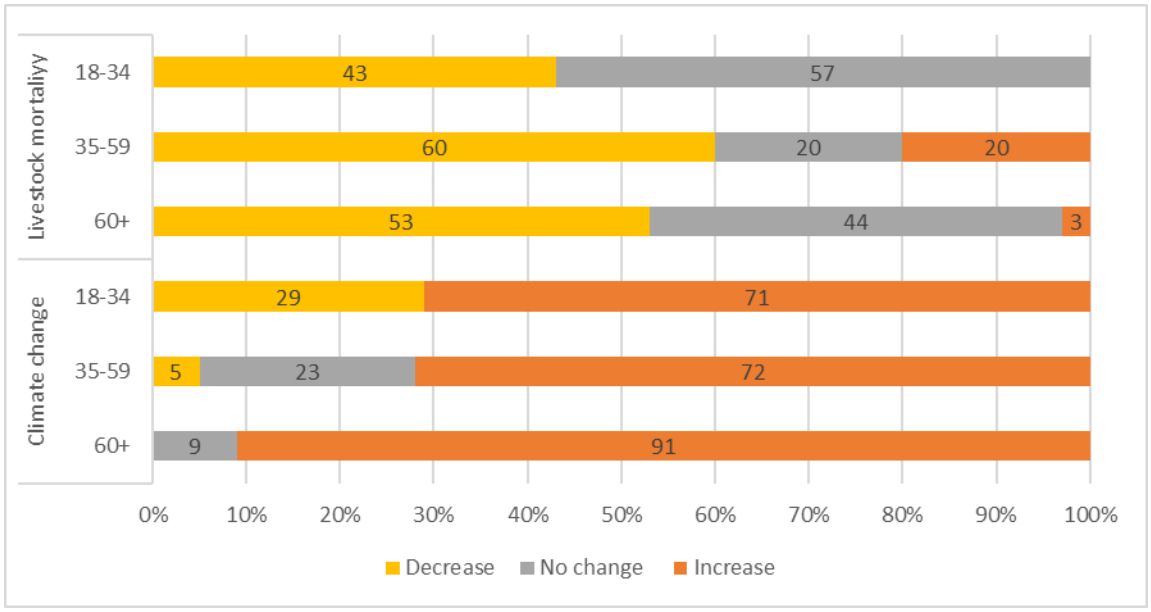

Figure 4.10: Percent (%) of respondents per Likert category per age group for environmental change that differed significantly between age groups.

Focussing on the influence of gender, more females than males perceived a decrease in livestock mortality and river water quality. However, in both cases, more females than males also perceived an increase in these two phenomena, with large proportions of males indicating no change in livestock mortality (43%) or river water quality (31%) respectively (Figure 4.11).

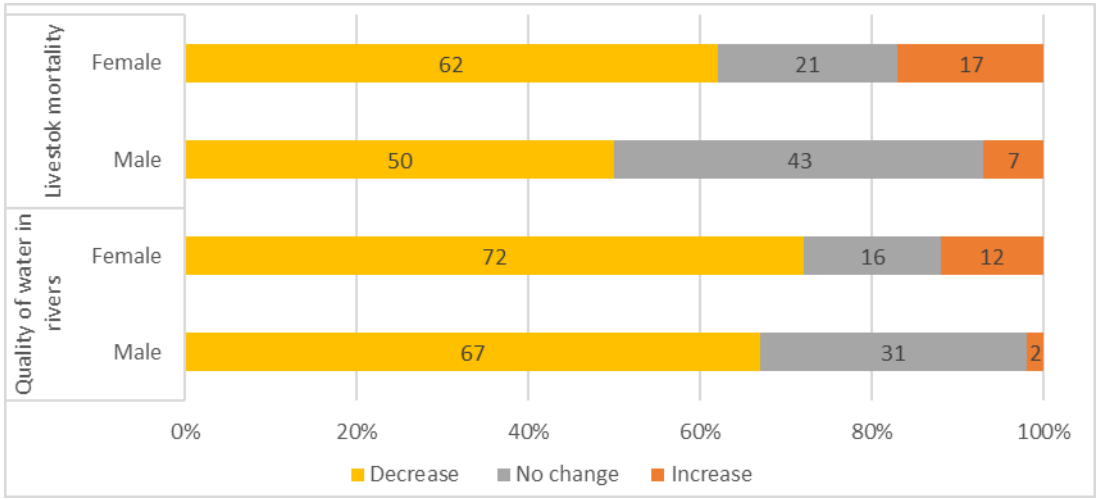

Figure 4.11: Percent (%) of respondents per Likert category for changes that differed significantly between gender.

A larger majority of males (77%) than females (53%) strongly agreed or agreed that they experience bush encroachment, while 38% of females were undecided (Figure

4.12). A larger proportion of males (81%) than females (57%) reported a later start to rainy season. Conversely more females (34%) than males (12%) reported an earlier start to the rains (Figure 4.13). More females than males strongly agreed and fewer disagreed about the occurrence of drought (Figure 4.14).

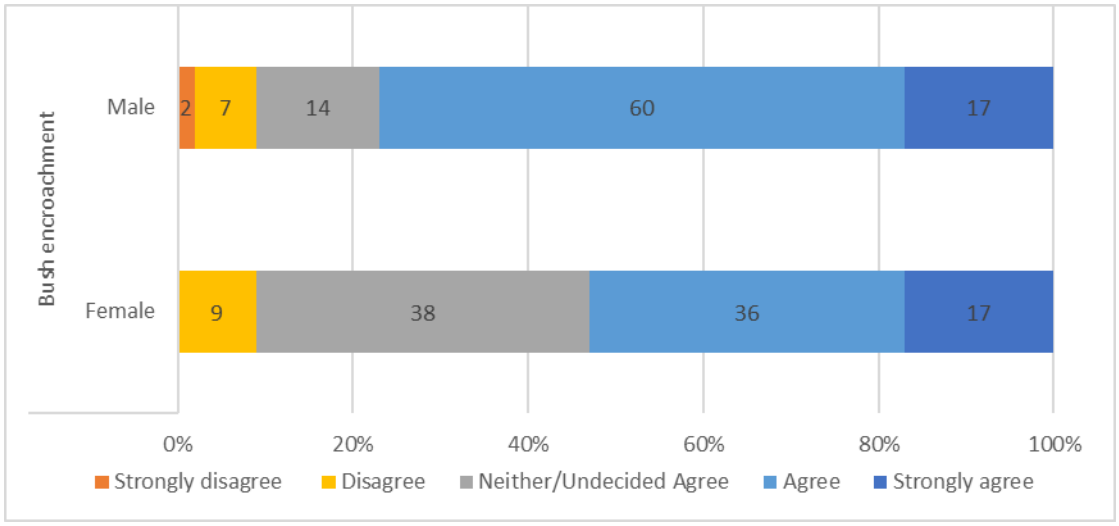

Figure 4.12: Percent (%) of respondents per Likert category for changes that differed significantly between gender.

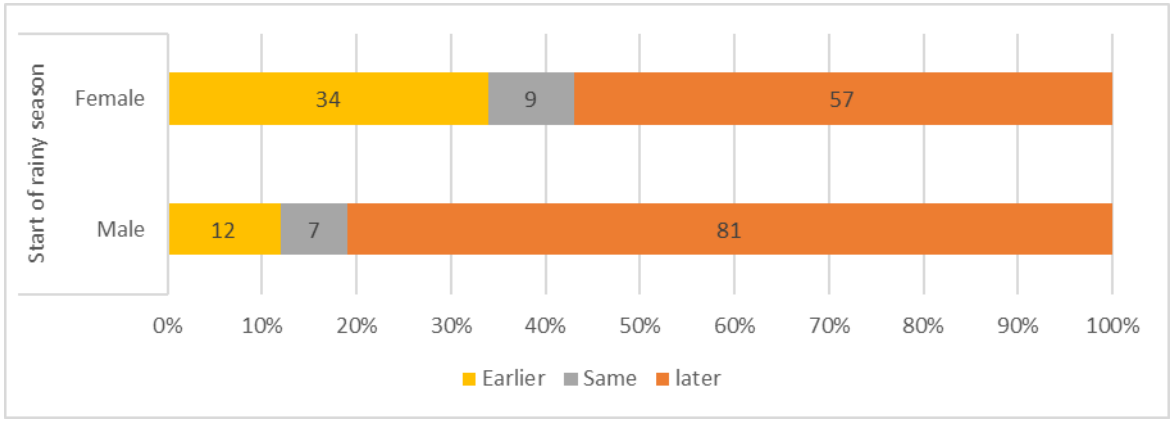

Figure 4.13: Percent (%) of respondents per Likert category for changes in rainy season that differed significantly between gender.

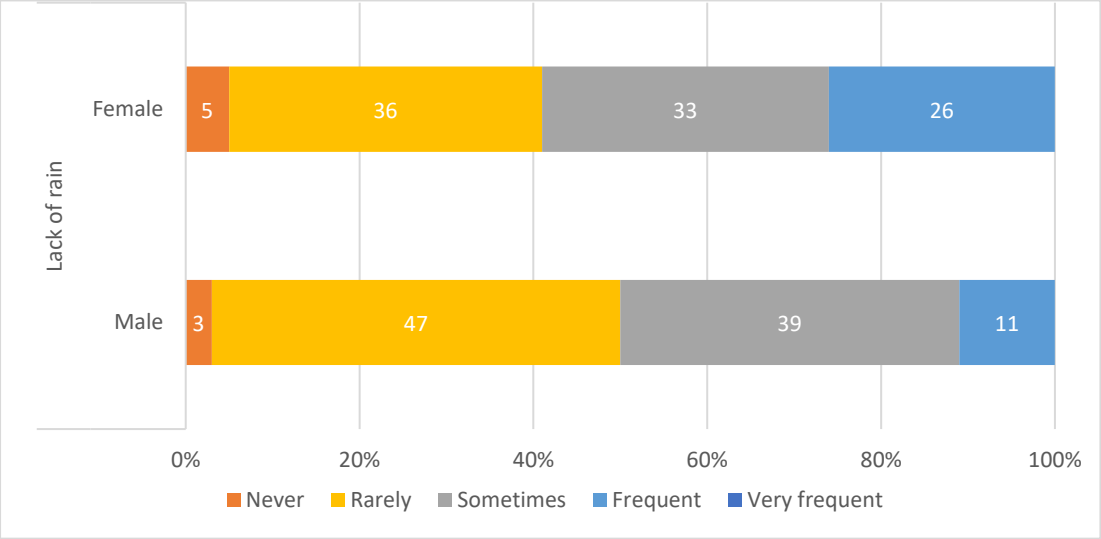

Figure 4.14: Percent (%) of respondents per Likert category for changes in rainy season that differed significantly between genders.

4.3.5 The influence of socio-demographic factors on perceptions of cause of environmental change

Table 4.8 summarises the results of statistical analyses of variation in perception scores by socio-demographic factor per aspect of the causes of environmental change. Perceptions on deforestation ($p<0.001$), overharvesting of resources ($p< 0.05$) and air pollution ($p<0.05$) differed significantly between villages. Wildfires ($p< 0.01$) differed significantly between farmer type. Overgrazing ($p<0.01$) differed significantly between age group. None of the perceived aspects differed significantly between genders.

Table 4.8: Causes of environmental changes with the chi square P-value for the following social-demographic factors: village (df.16), farming practices (df.12), age group (df.8), and gender (df.4), illustrating the Cultural ecosystem services that had significant p value (in bold) (n=100).

	Villages	**Farmers**	**Age group**	**Gender**

Cause of environmental changes	**Chi squared**	**P-value**	**Chi squared**	**P-value**	**Chi squared**	**P-value**	**Chi squared**	**P-value**
Residential development	22.421	0.130	15.635	0.209	3.564	0.894	5.245	0.263
Wildfires	23.536	0.100	26.411	**<0.01**	5.316	0.723	6.567	0.161
Deforestation	42.379	**<0.001**	9.676	0.644	7.393	0.495	5.311	0.257
Overgrazing	19.041	0.267	12.593	0.399	19.888	**<0.01**	3.351	0.501
Overharvesting	27.563	**<0.05**	14.101	0.294	3.205	0.921	2.474	0.649
Air pollution	28.182	**<0.05**	16.652	0.163	13.748	0.089	4.486	0.344
Littering	23.387	0.104	6.737	0.874	7.088	0.527	3.548	0.471

Regarding the influence of village, agreement that deforestation was a cause of environmental change was much higher in Makushane (74%), Ndengeza (95%) and Gavaza (93%) than in Selwana (29%) and Mafarana (55%). The large majority of Makushane (78%) and Gavaza (87%) agreed or strongly agreed that overgrazing was a cause of change, with none disagreeing. By contrast, less than 62% of respondents from Ndengeza, Mafarana and Selwana agreed and between 20% and 29% disagreed, or strongly disagreed (Figure 4.15). There was an agreement from most of the respondents (55-87%) from all the villages except in Selwana with a fair proportion of 46% that overharvesting was one of the causes of environmental changes. The greatest consensus was in Gavaza, with 87% agreeing or strongly agreeing. Less than 26% for all the villages were undecided. Most respondents in all the villages disagreed or strongly disagreed (56-96%) that air pollution has been a cause of environmental change, but this was lowest in Mafarana, which also had a much higher proportion agreeing or strongly agreeing (38%).

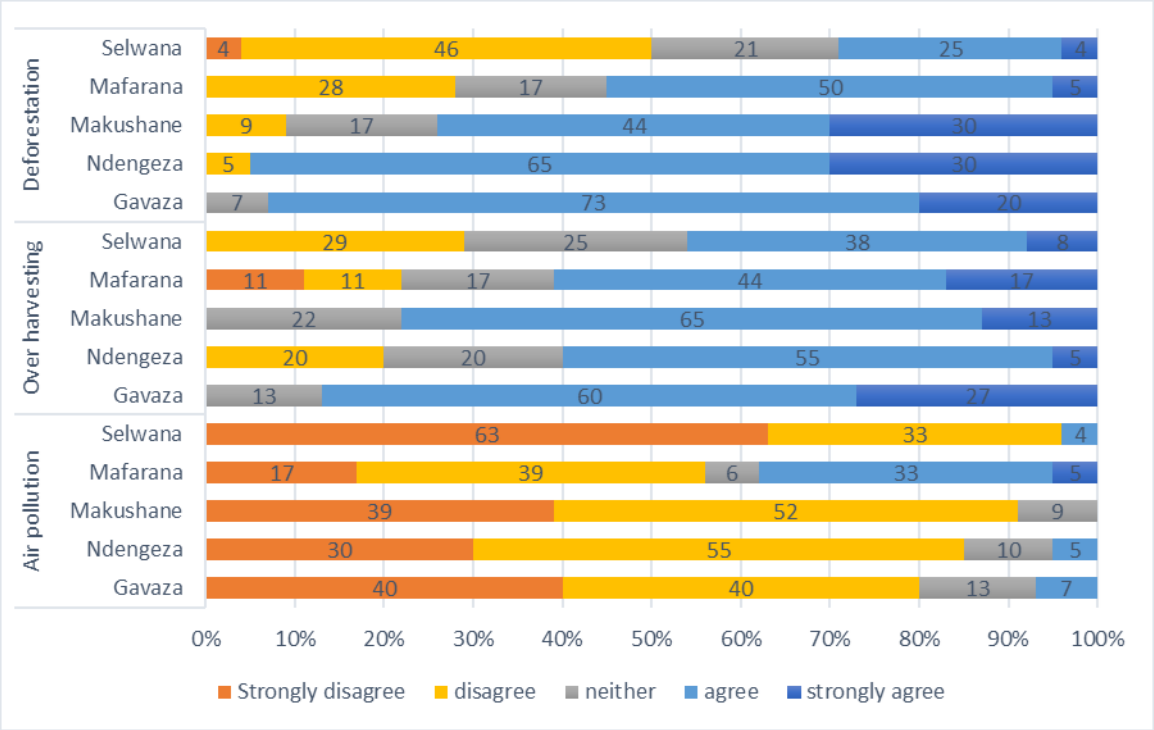

Figure 4.15: Percent (%) of respondents per Likert category per village for causes of change that differed significantly between villages.

There was a widespread agreement among all the farmers (58-76%) that wildfires have been a cause of change. The greatest consensus was from semi-subsistence farmers with 76% (Figure 4.16). Conversely greatest disagreement was among commercial farmers with 37% agreeing and 21% strongly disagreeing. Less than 10% of all the farmers, with an exception to semi-subsistence with 26%, were undecided.

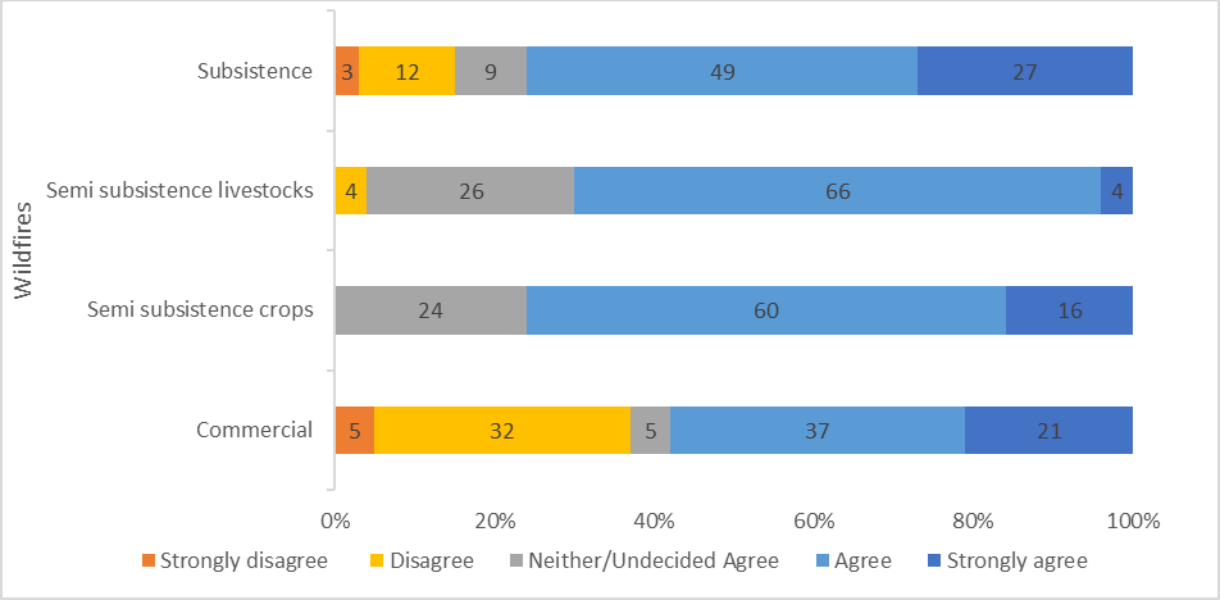

Figure 4.16: Percent (%) of respondents per Likert category per farmer type for causes of change that differed significantly between farmer types.

Most middle-aged (35-59) (72%) and elderly (60+) respondents (66%) agreed or strongly agreed that overgrazing was a cause of change (Figure 4.17). Conversely, most (57%) of the youth (18-34) disagreed. The respondents aged 35 and above mentioned that now livestock must be taken further away than in the past for grazing as there is not enough vegetation nearby.

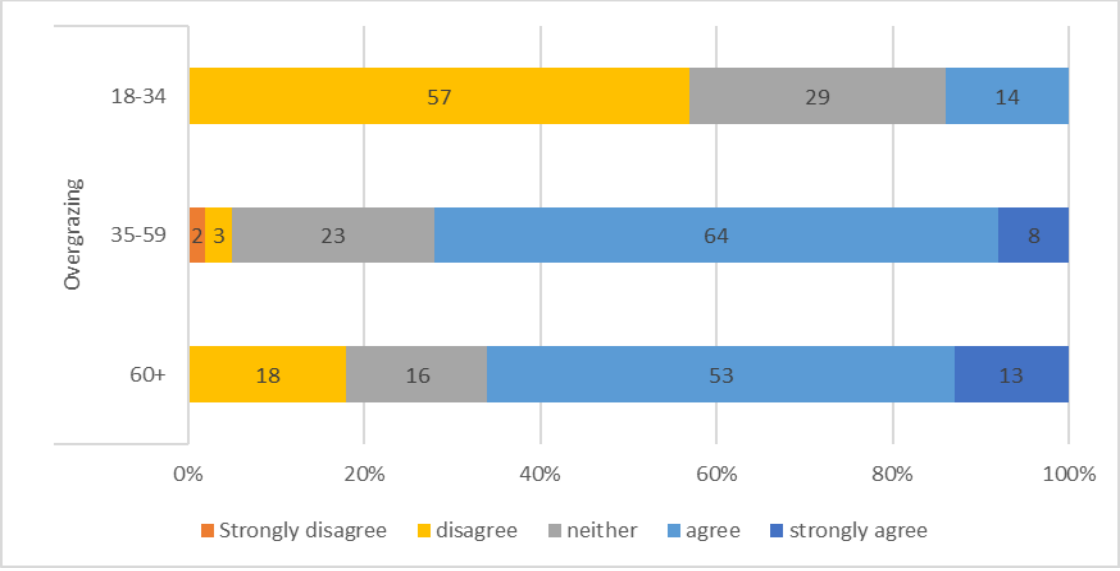

Figure 4.17: Percent (%) of respondents per Likert category per age group for causes of change that differed significantly between age groups.

4.3.6 The influence of socio-demographic factors on local perception on the Impacts of environmental change

Table 4.9 summarises the results of statistical analyses of variation in perception scores by socio-demographic factor per aspect of the impacts of environmental change. The local perception on the decrease in the availability of *marula* and *mopani* trees having an influence on the cultural practices ($p<0.05$), and extreme temperatures influencing cultivated crops which are important for cultural practices ($p<0.05$) differed significantly between villages. The other socio-demographic factors had no influence.

Table 4.9: Impacts of environmental change on CES with the chi square P-value for the following social-demographic factors: village (df.16), farming practices (df.12), age group (df.8), and gender (df.4), illustrating the impacts of environmental change on the provision of CES that had significant p-value (in bold). (n=100).

Impacts on the provision of CES	**Village**		**Farmer**		**Age group**		**Gender**	
	Chi squared	**P**	**Chi squared**	**P**	**Chi squared**	**P**	**Chi squared**	**P**
Reduction in the availability of the most important livestock animal in our cultural practices.	10.595	0.564	5.966	0.743	9.192	0.163	2.842	0.417
Reduction in the availability of the most important wild animal in our cultural practices.	16.694	0.406	11.169	0.514	7.450	0.489	4.106	0.392
Decrease in the availability of *marula* tree and *mopani* trees influences our cultural practices	21.729	**<0.05**	7.454	0.590	6.606	0.359	1.402	0.705
Extreme temperatures influence our	30.034	**<0.05**	10.999	0.529	9.275	0.320	1.878	0.758

cultivated crops								

Focussing on the influence of the village on perception that extreme temperatures have an impact on cultivating crops most respondents (79-95%) agreed or strongly agreed, except in Mafarana in which a total of 34% disagreed (Figure 4.18). Most respondents from all the villages (78-100%) agreed or strongly agreed that environmental change had caused a decrease in availability of important tree species, although 13% in Makushane disagreed. The respondents mentioned that *mopani* worm and *marula* fruits are the community's legacy and pride. They spoke about these with passion. One respondent mentioned that the consumption of these has been part of their tradition for many generations.

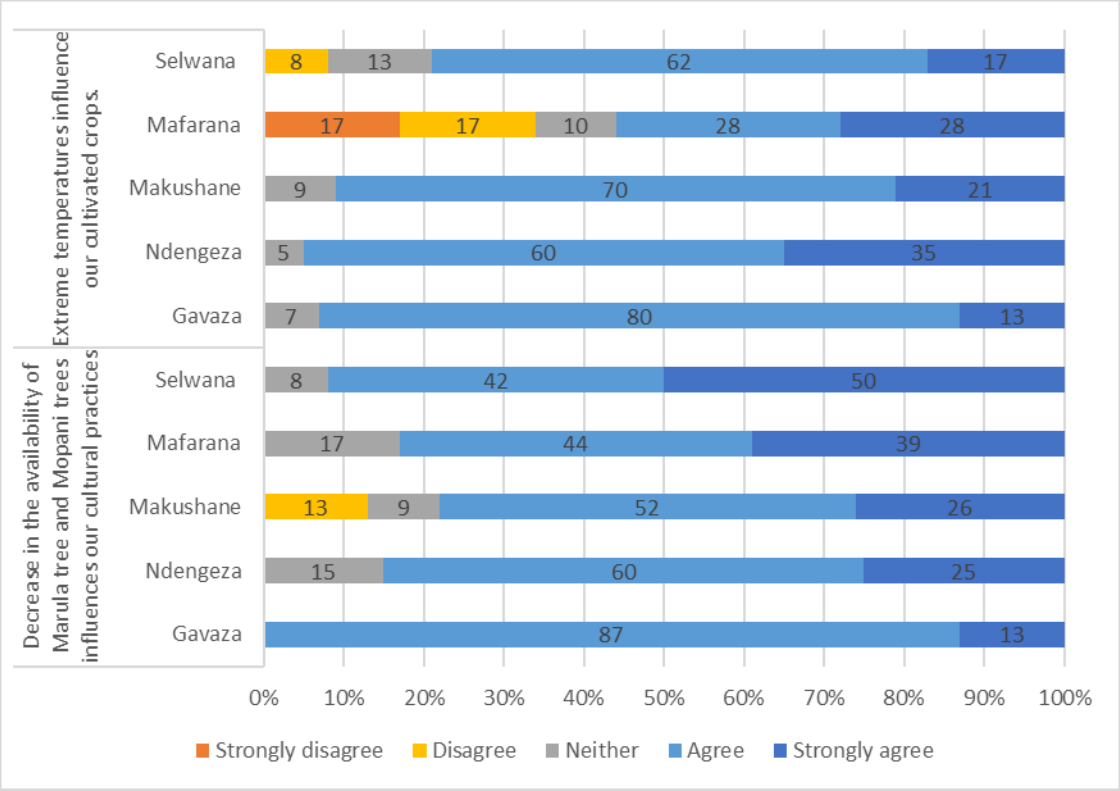

Figure 4.18: Percent (%) of respondents per Likert category per village for perceived influence of environmental changes on the provision of CES.

4.4 Discussion

This chapter examined the perceived local environmental changes, the causes, and the impacts on CES. Firstly, focussing on the findings of the environmental changes, the key findings were that some perceived environmental changes such as soil fertility, soil erosion, decrease in the abundance of local important plants and animals, decrease in the quality of water in the river, the decrease in the amount of water in the river, bush encroachment and climate change were worsening. These findings were expected as it has been suggested by most scientists that environmental change in the rural communities of South Africa has been worsening (Alcamo, 2005). This was also supported by the study by Alcamo (2005) and Anthony & Bellinger, (2007) which showed that these areas have undergone substantial local environmental change, due to large and growing settlements, conversion of rangeland to arable land and heavily utilised communal rangelands, which have in turn led to declines in soil structure and loss of vegetation cover, severe soil erosion, and bush encroachment (Anthony & Bellinger, 2007).

Surprisingly, this study found widespread perception that livestock mortality had decreased. This was due to an ongoing crime spree in these areas, as the respondents mentioned that they experience livestock theft, which in turn forced them to sell their livestock. This finding was similar to the study by Maluleke (2006) in which a farmer cited that the incidences of stock thefts are rising at an alarming rate, affecting their livelihoods.

It was expected that the mentioned environmental aspects differ significantly between socio-demographic factors as supported by one of the studies by Dlamini, (2020). Quality and amount of water in the river differed between villages, which was not surprising as different villages experience different rainfall and are in different size catchments. For instance, at Ndengeza their rivers are naturally seasonal or ephemeral, and as such it was expected that many will not have much to mention about the rivers. However, it was mentioned by one respondent that it affects their cultural practices. For instance, they must travel great distances when they have to do cleansing rituals in rivers. By contrast it was surprising that equal proportions mentioned that the amount of water in river has decreased and increased. This raises the question about whether this is influenced by the rainy season because the rivers

are likely to be flowing during the rainy season, as when it rains the water in river increase and when it does not it decreases.

The perceived decrease in the abundance of local important plants differed significantly between farmer type. As expected, semi-subsistence crop famers had the highest proportion of agreement, followed by commercial farmers. The commercial farmers mentioned that among other causes, climate change also influences the local plants, and they mentioned that they have been strained financially as they must adapt, however other farmers cannot afford to adapt like commercial farmers. A study by Musetha (2016) indicated that at the farm level, climate change has an impact on the physical capital and can reduce income. He also emphasised that farmers can be forced to sell productive capital, for instance cattle, to absorb income shocks (Eriksen et al., 2011). This directly allows social impacts on farming households, limiting their capacity to face other expenditures, such as health and education (Musetha, 2016).

Livestock mortality and climate change differed significantly between age groups. Most youth mentioned that there is no change in livestock mortality. However, in most cases they mentioned no change as they were not sure if it has increased or decreased as such it was observed that young people were not interested in livestock. Another important observation was that perceived bush encroachment differed significantly between genders, with more men than women agreeing that they experience bush encroachment. This was expected as men are likely to travel further from the village to herd cattle in the natural vegetation. Bush encroachment is likely to be most pronounced further from the villages where there is less harvesting for fuelwood. Bush encroachment also impacts heavily on availability of grazing land, most community members felt woody encroachment was harmful to their household and general wellbeing, citing loss of grazing for livestock, and fear of attacks by wild animals and criminals as the main impacts (Luvuno et al., 2022).

Focusing on the cause of the environmental aspects, it was observed that most respondents strongly agreed that deforestation, overgrazing, overharvesting, wildfires and littering are the main causes of the environmental changes. In contrast, air pollution was mentioned not to be a cause. Residential development and littering were the greatest concerns in these areas. Similarly, Musetha (2016) in his study indicated that change in land use, such as village expansion and the conversion of arable land

into residential stands, was common in rural villages of Limpopo. Additionally, the findings were that village expansion, which in this context of the study is residential development and the conversion of arable land into residential stands, exacerbated the soil erosion. The villages mentioned that although there is deforestation, they are aware of the most important plants which are meant to be conserved as such when they harvest the fuelwood, and they are selective in which tree to avoid and which they should cut. Furthermore, they mentioned that they usually target the dry trees. Some trees in rural villages in Limpopo are cut down as fuelwood (Shackleton, 2004). All these villages have access to electricity. However, they mentioned that electricity is expensive and its mostly used for lights and television, but for boiling water for bathing and cooking they mostly used fire (Matsika et al. 2012).

There were important differences in these perceptions about the environmental changes and the causes. Another important finding was that the locally important plants such as *mopani* and *marula* were reported to have decreased due to the residential developments. These plants used to be available in most areas within the villages, but now their availability has reduced, as a result of residential expansion. *Marula* fruits and *mopani* worms from these trees are mostly traded in these communities as they are a source of income for many households (Blair et al. 2021).

It was necessary to reflect on how these causes differed with socio-demographic factors. It was observed that Gavaza had the greatest consensus on the deforestation and over-harvesting. This is so because most people in Gavaza still rely on the fuelwood to make fire to meet their daily needs. Respondents mentioned that they cannot afford many units, as such they must improvise where possible. Another important finding was that wildfires as one of the causes of the environmental changes differed significantly between farmers. Some farmers rely on fire to manage natural resources for subsistence needs (Shaffer, 2010). There are few studies of local fire knowledge and practices which exist, one study cited that fire in southern Africa suggests that traditional ecological knowledge (TEK) of fire could provide further insight into location-specific anthropogenic contributions to fire-savanna interactions (Shaffer, 2010). Fire regimes are presented for five common livelihood activities including frequency, seasonality, area, and type of habitat burn (Shaffer, 2010). However, most farmers mentioned that wildfires are frequent in the villages, and fire management is practiced ineffectively as most livestock suffers during the wildfire, and

as such they are forced to take livestock longer distances and some are forced to sell. As such this reduces the quantity of most cultural livestock in the villages affecting their cultural practices, for instance, *ho phahla* which requires a goat. As such they might be forced to travel longer distances seeking a goat with a certain preference (Siphesihle and Lelethu, 2020). Another important observation was that perception of overgrazing differed significantly between age group. Most young people disagreed that overgrazing is a cause, while middle aged and genders above agreed that overgrazing was one of the causes of the changes. It was expected as mentioned previously most young people showed no interest in farming as such it was expected that they might not be aware of the cause of environmental changes.

Lastly, focusing on the impacts of environmental changes, fewer impacts of environmental change on the provision of cultural ecosystem services emerged than expected. The findings were that there was high agreement on the reduction in the availability of the most important livestock animal impacting cultural practices, and reduction in the availability of the most important wild animal impacting cultural practices, decrease in the availability of *marula* tree and *mopani* trees impacting cultural practices and extreme temperatures influencing important cultivated crops. Changes to the climate such as drought, and human activities such as deforestation and livestock theft were the cause of the reduction in the most important livestock animals. Due to insufficient plants and water, animals were suffering, and the resident had to eat and sell some before they died, and wild animals had to relocate to other areas. Overharvesting and climatic changes such as extreme temperatures have been identified as the common cause on the reduction of the most important trees, such as *marula* and *mopani* trees and medicinal plants. The majority of medicinal plants used in South Africa are over harvested (Mbongwa, 2018). and some respondents mentioned that during droughts, crops dried out due to extreme heat.

These findings were expected as it was perceived by the key informants that livestock particularly cattle and goats are important during the cultural practices such *ho phahla*. As such, when it was mentioned that the availability has decreased, it was expected to have an influence. An interesting perception was that reduction in wild animals impacts their cultural practices. Livestock and wild animals hold great cultural significance and are used in various social and religious rituals and practices (Ntuli, 2011). These animals also play a crucial role in the daily lives and economy of the

rural communities It was observed that it is only traditional healers who find the wild animals important as they use their skins to make their traditional attires, others do not. However, it was unexpected that most people were aware of the influence of the wild animals on the cultural practices.

It was expected that the decrease in the availability of *marula* and *mopani* tree has an impact on the cultural practices. It was mentioned and also known that *marula* fruits are used to make *marula* beer which is used during cultural practices such as *ho phahla*, as an offering to the ancestors. However, it is questionable if this was the same as the past, as one would expect that most people particularly young people would prefer modern beer.

It was also important to reflect on how these environmental changes, causes and impacts vary by socio-demographic factors. It was unexpected that these impacts of environmental change on the provision of cultural ecosystem services would differ by village only. Gavaza had a fair proportion of respondents disagreeing and strongly disagreeing that extreme temperatures have an impact on important cultivated crops. This was expected as Gavaza has the least semi-cultivate crop farmers as compared to other villages.

4.5 Conclusion

Community perceptions in the villages studied reflect that climate, soil, land and plants have changed. The communities are most exposed to soil erosion, decline in soil fertility, and increasing deforestation due to ongoing residential development. The rate of residential development is due to population growth.

It was very interesting to learn that the communities were aware of climate change specifically. Additionally, they were not only aware of the changes but also of the causes. Livelihoods within the communities were mostly based in agricultural farming, and the communities acknowledged this, the impacts of climate change on agriculture are of concern to them, as most farmers mentioned that climate change influences their crops, and it is important to address this issue. As such I recommend that the local municipalities and other organisation should provide awareness and education on how to make farming successful during harsh climatic conditions such as drought, floods, and extreme heat. The issue of littering, which was a concern to most

communities, can be addressed by waste management departments in local municipalities through increasing the budget allocation towards waste removal and investing in waste management infrastructure. Additionally, awareness campaigns need to be conducted for residents to encourage their active participation in waste management activities (Mukheli et al., 2019).

The impacts of environmental change on the CES are a concern to the communities. These impacts such as the decrease in most important animals in cultural practice due to drought and extreme temperatures, make it difficult for residents to practices their traditions, as such the practice of these cultures will not be effective leading to the destruction of cultural traditions. Changes in natural environment have frustrated rural communities who feel that such changes threaten rural livelihoods and the traditional practices such as traditional gatherings, ceremonies and rituals. Additionally, they are concerned that the role of the natural environment on the culture will no longer be acknowledged. When the role or importance of natural environment in no longer acknowledged in culture, the attachment of the residents to the natural environment will be affected. For recommendation since some of the changes on the natural environment impacting the CES are influenced by human activities, the community leaders and local municipality particularly the environmental department should implement environmental awareness campaigns within these villages, and educate communities on the effects of deforestation, littering, burning, etc., and how these could impact their cultural practices. Studies like this can be made available online so that the officials within these municipalities can reference them during the presentations on the environmental awareness campaigns and enlighten communities on the impacts of environmental change on their cultural practices, as most rural communities respect ancient rituals and cultural norms as they are viewed as centred on the existence of ancestors (Mbongwa, 2018). Additionally, it is critical to educate people about the environmental crisis and enhance their environmental awareness in order to encourage behavioural changes and improve their quality of life without harming the environment (Adeeyo et al., 2022).

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CHAPTER 5: SYNTHESIS OF FINDINGS

5.1 Overall discussion and conclusions

The purpose of the present research was to investigate the impacts of environmental change on the provision of cultural ecosystem services, and how perceptions of these differ by socio demography in selected rural villages of the Limpopo Province. This study investigated firstly, local perceptions of past and present cultural ecosystem services provided by the local natural environment and how they differ by socio-demography factors. Secondly it investigated the perceived environmental changes, their causes and the impacts on cultural ecosystem services, and how they varied by the socio demography factors.

The key findings were that residents identified a wide range of cultural ecosystem services provided by the natural environment, spanning importance in ceremonies, as significant places for culturally important practices, or providing important resources. These included services more typically considered as provisioning or supporting services, but which had particular cultural value beyond meeting material needs. All but two of the cultural events mentioned are still important today. Most important were crop cultivation and indigenous trees and fruit. Village of residence had a greater influence on perceptions of CES than farmer type, age or gender. The local residents identified a wide range of changes on climate, soil, plants, animals and water bodies, which were driven by local and external drivers. Local drivers identified by the resident was littering, overgrazing, wildfires, deforestation, overharvesting and residential development. On rainy seasonal changes, the residents reported that the rain starts earlier and ends later, as such they are experiencing longer rainfall seasons. On the occurrence of extreme climatic events, the residents identified extreme temperature as the most frequent extreme climatic event than droughts, floods and severe winds. External drivers were those which have an impact on the climate such as air pollution, which was not regarded as the main cause within the villages, but rather by the nearby areas with mine. All the socio demography factors had nearly equally influence on the changes and causes. The residents identified few impacts of environmental change on CES, the identified impacts were mostly on plants and livestock and these impacts were indirectly influenced by extreme climatic events and local actions. Only village of residence had an influence on perceptions of CES.

The study showed that there is a relationship between environmental factors and cultural ecosystem services. It was expected that the environmental change would have an influence on the cultural ecosystem services. These findings are similar with the finding on the study by Musetha (2016), which showed that changes of the environmental, particularly climate change have an influence on the ecosystem services (Musetha, 2016). The most important finding was that the perceived influence of environmental change on the provision of cultural ecosystem services was mostly influenced by residential development, with only a few being influenced by climate. For instance, the decrease in the availability of the most important local plants, extreme temperatures and lack of rain or too much rain, which affected the cultural practices. This is particularly important because the findings show that cultivation was the most highly valued CES, which is most likely to be impacted by climate change. Extreme temperatures have been observed to influence crops and most important plants such as medicinal plants.

Important finding in this study was that environmental aspects differed with the socio demography factor. Village was particularly important in shaping perceptions about CES. This was not surprising, as a study by Dlamini (2020) indicated that the place of residents is a significant factor to influence one perceptions, attitudes and belief. For instance, elderly people showed more concern and interest in environmental aspects than younger generation, and females were shown to have more concern about cultural practices than males. Conversely regarding culture this study confirms with the finding in the study by Hunter (2010) the findings showed that households headed by females showed a greater concern with regards to water quality and quantity.

This study complements with the study by Adeyemi et al (2020), which identified key ecosystem services, and described the influence of sociodemographic aspects on ecosystem services preferences and identify the trade-off, interactions and properties of ecosystem services demand. The findings of the study showed that there were 18 key ecosystem services demanded with more preference for provisioning ecosystem services such as crops than other ecosystem services. Few sociodemographic aspects were identified to influence the preferences of people on ecosystem services. Additionally, major trade offs were identified between provisioning ecosystem services with interactions observed among regulating cultural and provisioning ecosystem services.

The findings of this study make a valuable contribution to the knowledge body as they have indicated the perceived most valuable cultural ecosystem services and how they are impacted by the environmental change in rural communities, thus filling a knowledge gap. Although the study did provide significant findings more research is still needed to further build on the knowledge. For instance, it still not explicit on the relationship between farming and cultural ecosystem services. This study showed most CES differed significantly between farmer type, hence its postulated that, might be a reason behind that. As such it will be important to find out and understand why some CES are significant to some farmer type than others.

The findings of this study do not only provide valuable information and insight about the local communities on the environmental changes that have the potential to impact cultural ecosystem services, but it also provides an insight which can be used in local decision-making management strategies and process that could help in maintaining rural livelihoods. Hunter, (2010) argued that local residents concerns should assist to inform policies and outline programs committed to alleviating local environmental issues, which is what this study presents.

5.2 Recommendation

This study and other studies show that most livelihoods in rural communities are land based particularly farming. Having environmental change including climate change and soil erosion worsening, farming will become difficult to practices. The smallholder and subsistence dry land farmers will continue to be more vulnerable to climate change than commercial farmers, as most commercial farmers have large-scale sufficient water supply for irrigation. The communities who are farmers need to adapt to these changes and be educated on different climate change mitigation for instance ploughing methods which are friendly or less vulnerable to the extreme temperature or heavy rains.

5.3 Constraints of the study

The original plan was to collect data first in focus group discussions and then followed by face-to-face individual interviews by visiting sampling households. However, due

to the constraints imposed by the COVID-19 crisis, I conducted telephonic key informant interviews instead of face-to-face focus group discussion.

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Appendices

Appendix 1: Key informant interview semi-structured interview questions

1. Please tell me about any cultural practices, gatherings and ceremonies in your village that are associated with nature.
2. Please tell me about any local plants (including grasses, reeds, herbs, trees) that are important in your cultural practices, gathering and ceremonies.
3. Has the availability or abundance of each of these changed since you were a child? If so, how and why?
4. Are there local plants (including grasses, reeds, herbs, trees) that were important in your culture in the past, but no more? If so, how and why?
5. Please tell me about any local animals (including mammals, birds, reptiles, and insects) that are important in your culture e.g., for cultural practices, gatherings and ceremonies.
6. Has the abundance or availability of each of these changed since you were a child? If so, how and why?
7. Are there local animals (including mammals, birds, reptiles, and insects) that were important in your culture in the past, but no more? If so, why did this change?
8. Please tell me about any particular features or places around your village that are important in your culture e.g., for cultural practices, gatherings and ceremonies.
9. Are there any particular features or places that are important to your culture e.g., cultural practices, ceremonies and gatherings that have changed since you were a child? If so how and why?
10.Are there any features or places on the natural environment around your village that were important for cultural practices, gatherings or ceremonies in the past but no more? If so, why this change?
11.Are there any important feature or place (natural environment) where people go and relax when they are tired or stressed?

12.Are there any particular feature or place that is important to your social wellbeing (e.g., gatherings, ceremonies) in your village?
13.Are there any particular feature or place that is fascinating, or you like to view or visit due to its beauty?
14.Are there any feature or place that were fascinating or enjoyed viewing due to its beauty but no more? If so, why this change?
15.If you were to move what will you miss about the environment around your village?
16.Is there a difference in the role and importance of nature in your culture if you compare now with the past? If yes, how?
17.Are there any changes in the natural environment (including changes on soil, vegetation and water bodies) around your village? If yes, what are they?
18.Has the availability or abundance of the natural environment (e.g., Soil, vegetation and water bodies (streams, lakes and rivers)) in your village changed since you were a child? If yes how?
19.Are there any human activities that you think could have contributed to the changes in the natural environment in your village? If yes, what are they?
20.Are there any impacts that occurred as a result from changes in the natural environment? If yes, what are they?
21.Are there any changes on the climate (including temperature, rainfall, wind and cloud cover) in your village? If yes, what are they?
22.Has the changes on climate (including temperature, rainfall, and wind) affected the local natural environment (including, soil,
vegetation and water bodies (lakes, streams and rivers))? If yes how?
23.Are the any human activities that you think might have contributed to the
local climate change? If yes, what are they and how?
24.Are there any impacts of climate change (including drought, decrease in

crop productivity, loss of biodiversity, soil erosion and livestock mortality) in
your village? If yes, what are they?
25.Are there any changes on the natural environment (climate and landscapes)
that has impacts on your culture e.g., cultural practices, gathering and
ceremonies? If yes, what are they and how do they affect your culture?
26.Do you see the changes on the natural environment in your village
worsening or improving? Substantiate your view?

Appendix 2: Survey questionnaire

A. For each of the statements below, describe the response that best characterize how you feel about the statements, where 1= strongly disagree, 2= disagree, 3=Undecided, 4=Agree, 5= strongly Agree.	
1.	Mhlaba day celebration is an important ceremony in my village.
2.	Circumcision or initiation school is an important cultural practice in my village.
3.	Traditional healer`s graduation ceremony is an important practice in my village.
4.	*Go loma lerotse* and *go loma marula* are important cultural ceremonies in my village.
5.	Ho Phahla (ritual) is an important cultural practice, which we communicate with our ancestors in my village.
6.	*Marula* festival is a very important cultural gathering in my village.
7.	Traditional wedding, first born celebration and Lobola are the very important cultural celebrations in my village.
B. For each of the below, please state their importance in your cultural activities, practices, gatherings and ceremonies, where 1= unimportant, 2= little important, 3=moderately important, 4=important, 5= very important	
1.	Indigenous plants: e.g., *Marula* tree, Mopani tree, Xirongolo, Xibaha, Khukhuma, Mohwelere, malomanama, mohlobe and nkuhlu.
2.	Medicinal plants: e.g. kgopha, Mokhanare, makgate, serodedane,Xilangamahlo, Xirhomberhombe, Lengana, Muhlome,Mutungababara,Ndzhulwane, and Nkungulantila.
3.	Traditional food: e.g., Tihove, hlopi, xigugu, bokoma and maraka.
4.	Edible insects: e.g. magege/majenje, dinhlwa, and *mopani* worms.
5.	Morogo: lerotho, thepe, monyaku, guxe, cheke, and morogo wa dithaka.
6.	Grasses: deke, xinatsi, banyi, Nxenhe, Rikatsu,Xihovane Xilungwa and ncema
7.	Wild fruits:tintoro,mabilo/mfilwa, figs/kuwa, mahlatswa,and mabupudu
8.	Cultivated plants: dimaake/ timanga, mafela/swifaki ditloo, lerotse, dinawa, mova and ntsumbula.
9.	Domestics animals: Goat, cattle, chickens, and sheep
10.	Natural features: water bodies (rivers and dams)
11.	Natural features: Mountains or Hills
12.	Grazing lands
13	Cultivated lands
C. For each of the environmental features please indicate whether they have increased, decreased or stayed the same over the last 20 years, where 1=Decrease and 2= No change, 3= Increase.	

1.	Soil fertility.
2.	Livestock mortality
3.	Amount of water in rivers
4.	Quality of water in rivers
5.	Animals (including mammals, birds, insects and reptiles) in the environment around the village
6.	Plants including trees that are importantly culturally such as *Marula* tree, Mopani tree, Xirongolo and *rikatsu/rikatsi.*
7.	Quality of Grazing lands
D. Choose the likelihood that best characterize the causes of local environmental changes in your village, where 1= very unlikely, 2= unlikely, 3=not sure, 4=likely, 5= very likely.	
1.	Deforestation.
2.	Overgrazing.
3.	Overharvesting of local important plants.
4.	Residential development.
5.	Littering of plastics and used nappies.
6.	Air pollution
7.	Change in climate e.g., temperature, rain
8.	Wildfires
E. Compared to 20 years ago, how would you describe the rainy season to now, it starts earlier, same as in the past or later, where 1= earlier, 2= same and 3=later.	
1.	Start of rainy season
2.	End of rainy season
F. Choose the frequency that best describe the occurrence of the following local climate change in your village for the past 20 years, where 1= never, 2= rarely, 3=sometimes, 4=often, 5= frequently.	
1.	Lack of rain (drought).
2.	Severe winds.
3.	High temperature.
4.	Low temperature.
5.	Too much rainfall (floods).
G. For each of the statements below choose the response that best characterize how you feel about the statements, where 1= strongly disagree, 2= disagree, 3=neither (neither agree nor disagree), 4=Agree, 5=	

strongly Agree.	
1.	Change in the flow of rivers
2.	Experiencing soil erosion.
3.	Change in the role and importance of nature on our culture over time.
4.	Reduction in the availability of the most important livestock animal in our cultural practices.
5.	Reduction in the availability of the most important wild animal in our cultural practices.
6.	Reduction in the availability of the most important plants such as traditional vegetables, medicinal plants and cultivated crops in our cultural practices.
7.	Bush encroachment.
8.	Decrease in the availability of *Marula* tree and Mopani trees has an effect on our cultural practices.
9.	Extreme temperatures have an effect on our cultural dances such as *sekgapa, moxongolo and dinaka.*
10.	Extreme temperatures have an effect on our cultivated crops.
11.	Lack of rain resulted to decreased quality of the grazing lands.
12.	Christianity, westernization and ignorance of indigenous knowledge and culture, influences the cultural practices, gatherings and ceremonies.
13.	Human activities have an effect on the local environmental change (climate and landscape).
14.	Environmental change is worsening
H. If you had to move from this place, what would you miss most about the environment around this village?	