Description of vegetation types secured through the Biodiversity Stewardship Programme within the North Eastern Cape Grasslands Priority Site, South Africa.

By

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Dedication

It is with great pleasure and excitement to dedicate this dissertation to two special women in my life, my dearest Mother Mrs. M.J Nsibande and my lovely Wife Mrs. S.P Nsibande for their endless support and ensuring that I become a better person each day!!

Declaration

I **Thembanani Siyanda Nsibande** hereby declare that the dissertation/thesis, which I hereby submit for the degree of **Master of Science in Environmental Management** at the University of South Africa, is my own work and has not previously been submitted by me for a degree at this or any other institution. I declare that the dissertation / thesis does not contain any written work presented by other persons whether written, pictures, graphs or data or any other information without acknowledging the source. I declare that where words from a written source have been used the words have been paraphrased and referenced and where exact words from a source have been used the words have been placed inside quotation marks and referenced. I declare that I have not copied and pasted any information from the Internet, without specifically acknowledging the source and have inserted appropriate references to these sources in the reference section of the dissertation or thesis. I declare that during my study I adhered to the Research Ethics Policy of the University of South Africa, received ethics approval for the duration of my study prior to the commencement of data gathering, and have not acted outside the approval conditions. I declare that the content of my dissertation/thesis has been submitted through an electronic plagiarism detection program before the final submission for examination.

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List of abbreviations

ADU	: Animal Demography Unit
BSP	: Biodiversity Stewardship Programme
BSAT	: Biodiversity Site Assessment Tool
CAPE	: Cape Action for People and Environment
CBA	: Critical Biodiversity Area
CBAs	: Community Property Associations
DFFE	: Department of Forestry, Fisheries, and the Environment
DEDEAT	: Department of Economic Development, Environmental Affairs and Tourism
ECBCP	: Eastern Cape Biodiversity Conservation Plan
ECPAES	: Eastern Cape Protected Areas Expansion Strategy
ECPTA	: Eastern Cape Parks and Tourism Agency
EIM	: Ecological Index Method
EWT	: Endangered Wildlife Trust
FEPA	: Freshwater Ecosystem Priority Area
GEF	: Global Environment Facility
GID	: Geographic Information System
GPS	: Geographic Positioning System
IUCN	: International Union for Conservation of Nature
QGIS	: Quantum Geographic Information System
KMZ	: Keyhole Markup Language
MEC	: Member of the Executive Council
NBSAP	: National Biodiversity Strategy and Action Plan
NEMPAA	: National Environmental Management: Protected Areas Act
NGO	: Non-Government Organisation
NPAES	: National Protected Areas Expansion Strategy
NR	: Nature Reserve

OECMs : Other Effective area-based Conservation Mechanisms

PAs : Protected Areas

PAMA : Protected Area Management Agreement

PAMP : Protected Area Management Plan

PE : Protected Environment

SA : South Africa

SABAP2 : South African Bird Atlas Project 2

SANBI : South African National Biodiversity Institute

SANParks : South African National Parks

SDGs : Sustainable Development Goals

SWSA : Strategic Water Source Areas

VCA : Veld Condition Assessment

VCS : Veld Condition Score

WWF-SA : World-Wide Fund for Nature South Africa

Abstract

A study was undertaken in the northern region of the Eastern Cape Province within the Grassland Biome located in the Eastern Cape Drakensberg Strategic Water Source Area. Vegetation surveys were undertaken on two privately owned properties, the Glencoe Farm (~1 007 ha) and the Reedsdell Farm (~1 158 ha). Livestock (cattle and sheep) grazing is the primary land-use activity for both properties. The aim of this study was to determine and describe the different plant communities, their veld condition as well as their biodiversity value for inclusion into the biodiversity stewardship programme in the North Eastern Cape Grasslands Priority areas. The Braun-Blanquet technique was employed for the classification and description of vegetation, the Ecological Index Method for the veld condition assessment, and the Biodiversity Site Assessment Tool (BSAT) developed by the Eastern Cape Parks and Tourism Agency (ECPTA) to evaluate the biodiversity value of the two study sites. The Glencoe study site falls under the Lesotho Highlands Basalt Grasslands vegetation type. Not only the Lesotho Highlands Basalt Grasslands vegetation type but also the Southern Drakensberg Basalt Grasslands vegetation type are present on the Reedsdell study site. Both areas are homogeneous and only two major plant communities were identified for each. The veld for both study sites is in a moderate condition (49 for the Glencoe study site and 48 for the Reedsdell study site) and dominated by the Increaser II species. Based on the Biodiversity status results, both properties qualify for Nature Reserve protected area status in accordance with the ECPTA's Biodiversity Stewardship Programme assessment procedures (total score of 32,5 for Glencoe and 35,7 for Reedsdell).

Key words:

Protected area, Braun-Blanquet technique, Step-point method, biodiversity site assessment, vegetation classification, Grasslands Biome, plant community, veld condition assessment.

Table of contents

List of Tables

List of Figures

Chapter 1: Introduction

1.1 Background

Worldwide, South Africa is ranked as the third most biologically diverse country, with a remarkably high proportion of endemism (SANBI, 2014). For conservation of South Africa's biodiversity, establishing and managing a representative and efficiently managed system of protected areas is a necessary and critical strategic approach (SANBI, 2014). Keeping natural ecosystems intact both within and beyond protected areas helps to ensure continued provision of essential ecosystem services. It sustains South Africa's ecological infrastructure, without which sustainable development could not occur (Reeves, 2015). Much of the biodiversity that is critical for conservation, including the country's most threatened ecosystems, is either privately or communally owned and is often under substantial pressure from other land and resource users (Wright, 2018). Moreover, it is often not feasible for the country to expand protected areas through the acquisition of land due to the high cost of land acquisition and high associated operational costs.

The Biodiversity Stewardship Programme (BSP) is a mechanism that allows private landowners and communities to enter into legal agreements with a conservation authority to formally protect and manage land in biodiversity priority areas (SANBI, 2018). It recognises both private landowners and communal landowners as stewards of biodiversity within their properties and landowners participate in voluntary commitments depending on their willingness. Biodiversity Stewardship Programme offers a range of different types of categories/agreements that exist to support and promote sustainable resource use and conservation at large (SANBI, 2018). Some types of BSP categories/agreements allows for a formal declaration of privately owned properties as protected areas in terms of the National Environmental Management: Protected Areas Act No. 57 of 2003 (NEM:PAA), providing long-term security for participating properties such as Nature Reserves and Protected Environments. The high level of protection like the Nature Reserve category offers more support but has more restrictions and requires a greater commitment from land users.

Properties participating in the Nature Reserve category are formally declared as protected areas in accordance with Section 23 of the National Environmental Management: Protected Areas Act 57 of 2003 (SANBI, 2018). This category/status is offered to qualifying properties with the highest biodiversity value. The declaration of Nature Reserve status is binding on the property and has a title deed restriction that requires a landowner to enter into a binding legal agreement for 99 years or in perpetuity. Most importantly, properties participating in this category are considered to be part of South Africa's protected area estate as they also contribute substantially towards meeting the set protected area targets in the country (Davey *et al*., 2010; SANBI, 2018; Wright, 2018).

Protected Environment category offers an opportunity for willing/participating landowners to have their respective properties formally declared as Protected Environments in accordance with Section 28 of the National Environmental Management: Protected Areas Act 57 of 2003 (SANBI, 2018). This category/status allows for a declaration of multiple properties with different landowners in a given area, and it is considered to be less restrictive in terms of land use activities as compared to the Nature Reserve category, it is binding on the property for declaration as a Protected Environment. However, the title deed restriction is optional in this category; the landowner must enter into a legal agreement for 30 years minimum. The other Biodiversity Stewardship categories such as Biodiversity Management Agreement, Biodiversity Agreement and Conservation Agreements do not qualify properties for a formal declaration process. However, they are essential in the implementation of activities and interventions that promotes improved and well-managed biodiversity within properties of participating landowners.

The Biodiversity Stewardship Programme plays an important role in realising the economic, ecological, and social benefits that healthy ecosystems can supply over the long term. Furthermore, it has the potential to stimulate rural economic development by creating a focus on nature-based tourism and sustainable natural resource use (SANBI, 2018). This assists in the diversification of rural livelihoods, especially in agriculturally marginal areas as well as a potential to contribute towards the creation of job opportunities and skills development through the direct restoration and improved land management, and/or indirectly through compatible commercial land-use activities

(SANBI, 2018). In addition, BSP assists landowners with better management of natural resources to improve the future for society through improved water quality and production in catchments; reduced erosion and flooding; access to support from dedicated conservation agencies and Non-Government Organisations (NGO's); diversifying income-base ecotourism and conservation associated opportunities; and so forth.

However, not any land is ideal or suitable for formal protection and conservation, for this reason, biodiversity site assessments and vegetation analysis processes are essential in measuring, quantifying, and assessing the biodiversity value of each property/site before succeeding to participate in the Biodiversity Stewardship Programme (Barendse, Roux, Currie, Wilson, & Fabricius, 2016). The National Protected Area Expansion Strategy (NPAES), together with the provincial strategies such as the Eastern Cape Protected Areas Expansion Strategy (ECPAES), guides the implementation of the programme through spatially refined data analyses which are also applied for identification of biodiversity hotspot/priority areas (Cockburn, Cundill, Shackleton, & Rouget, 2019). These strategies allow protected area expansion to be focused on exclusive areas.

Additionally, every site identified to form part of legally recognised protected areas must undergo a scientifically proven assessment in accordance with the National Environmental Management of Protected Areas Act, thereby conducting biodiversity site assessments and vegetation analysis processes (South African National Biodiversity, 2017). To guide the operational activities and procedures for all conservation authorities and NGOs implementing BSP, a Biodiversity Stewardship Guideline Document was produced by the Department of Forestry, Fisheries, and the Environment (DFFE) in 2009 and was recently reviewed in 2018 (SANBI, 2018).

According to Schipper & Rovero (2018), a Biodiversity site assessment is the measurement of some defined components of an ecosystem, and this refers to amongst others the components that are thought of as indicators of the conservation status of a species or area. The processes involved may include assessing areas or sites of high biodiversity to determine key areas to focus the conservation effort but not limited to measuring the species communities for both flora and fauna

found on site, which may even lead to the discovery of new species in an area (Schipper & Rovero, 2018). Various tools have been developed by conservation authorities to guide the implementation and the process of undertaking biodiversity site assessments. The process is inclusive of two interventions: the desktop exercise and actual infield inspections and assessments.

With regard to the vegetation analyses process, it is vital for different vegetation types of data to be collected and to be scientific and accurate in terms of both the actual vegetation community distribution and floristic detail to allow for effective planning and implementation of management programmes/interventions (Van Wyk, Cilliers, & Bredenkamp, 2000). Therefore, it is vital to conduct a comprehensive vegetation analysis process in all participating Biodiversity Stewardship sites before management programmes are formulated and before the Protected Area Management Plan (PAMP) is developed for each respective participating property (Rutherford, Mucina, & Powrie, 2012).

Thus, this study will contribute significantly to describing vegetation types secured through the Biodiversity Stewardship Programme in terms of protected areas' expansion and valuable biodiversity that are under or poorly protected within the Province of the Eastern Cape and South Africa as a whole. The biodiversity site assessment plays a critical role in BSP through determining the conservation importance of the site and identification of the required management interventions, determination of the preferred protected status / category that site qualifies for. It also provides defensible scientific evidence for declaration of the site as a protected area and its inclusion into the protected area network database.

As a result, Glencoe and Reedsdell farms were identified as the two study sites that make up the study area. These properties are situated in the Barkly East area along the northern part of the Eastern Cape Province. They were assessed through the biodiversity site assessment and vegetation analysis processes using both desktop and infield verification assessments to determine their biodiversity value and the vegetation types occurring on them as well as their contribution towards the protected areas network. These study sites were selected based on their strategic location as they fall within the North Eastern Cape Grasslands Priority Area identified through the

ECPAES (Skowno *et al*,. 2012), they fall within the underrepresented Grassland Biome, they fall within a Strategic Water Source Area and they are categoriesed as critical biodiversity area due to their importance as an ecological corridor. The owners of these two properties have shown interest to have their properties formally declared as Protected Areas in accordance with the National Environmental Management: Protected Areas Act (no 57 of 2003).

1.1.1 Research problem

South Africa (SA) is falling far behind from reaching the protected areas target, as a result, there is a high need to seek different mechanisms to expand the representation of globally important terrestrial habitats in SA (SANBI, 2014). This may be established by acquiring new Protected Areas (PAs) to a size of 197 000 hectares (ha) by 2020 (Brown, 2015).

Back in 2010, the Convention of Biological Diversity agreed on achieving a target of 197 000 ha of new protected areas by the year 2020, comprising of at least 10% of coastal and marine areas and at least 17% of terrestrial and inland water (Brown, 2015). The focus from conservation authorities should be ensuring that areas of biodiversity and ecosystem services of particular importance are effectively conserved and equitably managed to ensure ecologically representative and well-connected systems of PAs that are effective area-based conservation measures and integrated into the wider landscapes and seascapes (Brown, 2015).

Brown (2015) further suggests that to achieve the set target on these areas, a low-cost solution should be employed for the rapid protected areas expansion. The intervention of introducing a partnership approach towards protected areas management that will include both communities and private landowners through contractually protected areas, biodiversity stewardship and partnerships should be implemented as a shift from direct land purchase (Brown, 2015).

In addition, to expand South Africa's protected areas network within the hotspot regions, transfers, as well as the formalisation of conservation tenure of available state land consisting of valuable and critical biodiversity, should be persuaded. By so doing, the protected areas expansion costs

per hectare will be reduced drastically while enabling SA to achieve and meet or improve the target of meeting the protected areas system and to better meet required expenditures for effective management of PAs (SANBI, 2014).

Therefore, Brown (2015) reports that it was agreed by the Convention of Biological Diversity held in 2010 that interventions be employed to secure conservation tenure, which is defined as securing areas for conservation as means of benefit to the present and future generations. This would be achieved through negotiation processes with both communal and private landowners, with a goal of leading to a formal declaration of their respective areas/properties as Protected Areas under the applicable South Africa legislation, namely the National Environmental Management: Protected Areas Act (No. 57 of 2003).

Furthermore, according to Hoekstra, Boucher, Ricketts, & Roberts (2005), habitat loss of the grassland terrestrial ecosystem type has been portrayed to the largest extent worldwide; therefore, the grasslands of the world are facing a massive conservation crisis. Fragmented landscapes are a result of the transformation of the land-cover, where ecosystem composition, structure and function are compromised because of the interference with ecological processes (White & Murray, 2000). Predictions made by Sala *et al*., (2000) stated that grasslands will experience a high level of biodiversity change in the next 100 years due to the sensitiveness of the ecosystems towards all global change drivers. In addition, human-driven land use was also identified as one of the crucial drivers for loss of grasslands biodiversity and land-cover worldwide (Sala *et al*., 2000; Conant, Cerri, Osborne, & Paustian, 2017).

Neke & Du Plessis (2004) state that the Grassland Biome of South Africa has been classified as critically endangered due to increasing developments and urbanisation which has resulted in a substantial degree of land degradation. Rehabilitation of the Grasslands Biome may take several years, there is a need to quantify the extent to which ecosystems have been rehabilitated. This could be achieved through assessing bioindicators such as ants (Jamison *et al.,* 2016). However, in South Africa there has been very little research undertaken to assess ants' diversity in grasslands and how ant communities resemble each other following a disturbance (Zaloumis & Bond, 2010).

Jamison *et al.,* (2016) investigated the success of the rehabilitation measures applied through compering ant assemblages in areas where rehabilitation measures were applied and in nearby untransformed, natural grassland areas as an indication of the effectiveness of rehabilitation.

The grassland biome in South Africa is classified as one of the most threatened biomes. This is because approximately 45% of this biome has been transformed, degraded, or severely affected by alien plants infestation (Fourie, Rouget, & Lötter, 2015). It is clear that conservation and actions towards the protection of the Grassland biome require the most urgent attention in South Africa and the world at large. Scholes and Biggs (2015) classified the Grassland biome as critically endangered in South Africa. Hence various protected areas expansion mechanisms such as the Biodiversity Stewardship Programme are essential in addressing the challenge of grasslands degradation and the country's biodiversity at large.

In light of the above statement and in response to the Convention of Biological Diversity agreement and the set protected area target, the purpose of this study is to describe vegetation types secured through the BSP within the North Eastern Cape Grasslands Area as means of contributing towards the protected area network and conservation of the Grassland biome.

1.1.2 Research hypotheses

Properties participating in the Biodiversity Stewardship Programme do contribute significantly to securing critical vegetation types while contributing to South Africa's protected area estate and the protected area network as part of the protected area expansion.

1.1.3 Rationale

(i) No similar study has been conducted on the Glencoe and Reedsdell properties that are interested in participating in the Biodiversity Stewardship Programme within the North Eastern Cape Grasslands Priority Area. This study serves as a first scientific study to be ever conducted within the study area, thus will contribute significantly to future

research as a benchmark. Moreover, the study will assist implementers of the protected are expansion in this region and the province at large on the ecological status of the study area.

(ii) Biodiversity Site Assessment and Vegetation Analysis processes will contribute greatly to identifying and describing the biodiversity value and different vegetation communities of the Glencoe and Reedsdell study sites. Determination of the biodiversity merit is one of the key aspects of getting properties formally declared as protected areas. Defensible scientific evidence is required to quantify the biodiversity value of each formally protected site. More importantly, the protected area category, which warrants formal protection of the site is decided upon based on the biodiversity value.

(iii) The study will contribute significantly to the development of the Protected Area Management Plans for the two respective properties. In compliance with the National Environmental Management: Protected Areas Act (NEM:PAA), 2003 (Act No. 57 of 2003), management plans for biodiversity stewardship sites are strategic documents that provide the framework for the development and operation of biodiversity stewardship sites. The objective of a management plan is to ensure the protection, conservation and management of the protected area concerned in a manner which is consistent with the objectives of NEM:PAA and for the purpose for which it was declared. The management plan indicates where management intends to focus its efforts in the next five years. The management plan thus provides the medium-term operational framework for the prioritised allocation of resources and capacity in the management, use and development of the reserve. The findings of this study are therefore imperative for the process of developing Protected Area Management Plan.

1.1.4 Study aim

This study aims to describe the vegetation types found in the study area, outline the effectiveness of the Biodiversity Stewardship Programme in securing critical vegetation types and their contribution towards the protected areas network within the North Eastern Cape Grassland area.

1.1.5 Study objectives

- To identify and describe composition of vegetation communities occurring within the Reedsdell and Glencoe study sites (study area).
- To determine the veld condition and subsequent grazing capacity of the two study sites.
- To give insight into the importance of the Biodiversity Stewards Programme in contributing towards protected areas expansion since its inception and to provide recommendations.

1.2 Literature Review

1.2.1 Vegetation classification

Kent and Cocker (2001), state that the building blocks of different plant communities are the individual plants species. Daubenmire, (1968); Van Aardt, (2010) defined the vegetation as the general plant cover on earth, without providing any reference to growth forms. They further stated that, vegetation is made up of individual plants species that if grouped in one group they form a population (Daubenmire, 1968; Van Aardt, 2010). The study of different plant communities in relation to the environment in which they occur is defined as vegetation ecology (Van der Maarel, 2005). However, a community is formed by the collective species population of different groups (Daubenmire, 1968; Kent & Cocker, 2001; Van Aardt, 2010). A particular community is determined and distinguished from the others through groups of plant species showing abundance in each area (Daubenmire, 1968). They occur under similar conditions of the environment with

uniform floristic composition (Daubenmire, 1968; Van der Maarel, 2005; Van Aardt, 2010). The environment's heterogeneity is what makes the floristic composition and the vegetation structure of plant communities to be different from the other surrounding vegetation (Daubenmire, 1968; Van der Maarel, 2005; Van Aardt, 2010).

1.2.2 History of vegetation classification in South Africa

The branch that deals with plant sciences and that is responsible for vegetation classification according to different communities, sub-communities, and variants in SA is called Phytosociology (Kent, 2012). The classification and description of different plant communities is undertaken in relation to the factors of the environment that influence their geographical distribution (Brown *et al*., 2013). Historically, due to the lack of formal techniques for the vegetation classification, the floristic description was done in an informal manner in S.A. This began during the late 19400's when informal vegetation classification and description were undertaken in southern Africa (Brown *et al*., 2013). During the initial stages, the informal vegetation classification processes had no reference to the physical environment, such as climate, environmental factors, and wildlife and/or livestock (White, 1985). The classification was only focused on presenting a species list of a particular region, for which it lacked highlighting on the descriptive nature of plant communities (Brown *et al*., 2013). Hence the vegetation classification was predominantly focused on plant species as such and their physiognomy (White, 1985). When considering physiognomy covers, the vegetation classification should be focused on all aspects of vegetation structure (White, 1985).

With time, various scientists started to gain interest and commenced with the process of exploring different approaches to vegetation classification in South Africa and in various parts around the world (Kent, 2012). When computers started to be introduced in the field of vegetation science in early 1960's, the knowledge and understanding of vegetation classification became easier, more especially for analysis and interpretation processes (Podani, 2006). Based on technological advancement, the development and implementation of various computer programs have been equipped and aligned with modern technology, which makes them more user friendly and efficient to be used in vegetation studies (Podani, 2006). As a result, Bezuidenhout, Biggs & Bredenkamp

(1996) described an affordable, efficient, and rapid process for analysing Braun-Blanquet phytosociological data sets on a personal computer. While Bredenkamp & Bezuidenhout (1995) described the way to handle big data sets in their study in more detail.

During the early 20th century and the formalised vegetation classification and description began through application of various technologies across the various continents of the world (Brown *et al*., 2013). Climate, topography, and geology are the environmental factors that were classified by White (1985) as factors that influence vegetation distribution in Africa. The field of study for vegetation science has therefore developed because of ecological assessments which interpret and classify the different ecosystems (Brown *et al*., 2013). The study of Acocks (1988) focused predominantly on describing different veld types as per the various biomes. However, Mucina and Rutherford (2006), focused mainly on describing the various vegetation types of South Africa. The Mucina and Rutherford (2006) vegetation classification and description is focused on a broader regional scale, which creates the need for vegetation description at a local scale. As a result, Mucina and Rutherford (2006), in their formal vegetation classification revealed a wide variety of ecosystems in South Africa which includes nine biomes.

Most recently, formal vegetation classification and description was undertaken with the use of modern computer programs such as JUICE (Tichý *et al*., 2002). To analyse the floristic data, the Modified TWINSPAN (Two-Way Indicator Species Analysis) contained within JUICE is used (Hill & Šmilauer, 2005). It is for this reason that Brown *et al*., (2013) stated that, vegetation classification scientists in SA have employed a flexible and efficient approach to vegetation studies, which includes the application of numerous statistical classification methods. With the formal classification the description of plant communities is refined by applying the Zurich-Montpellier method which, allows for the movement of species within clusters after analysis (Brown *et al*., 2013). According to Brown *et al*., (2013) the introduction of TWINSPAN has been one of the major developments of vegetation science as the classification techniques produce a phytosociological table. The latter is therefore essential in all phytosociological studies because it offers hierarchical classification, species composition of each plant community, constancy, species fidelity, species cover and abundance (Brown *et al*., 2013). However, it is important to note that

both the formal and informal vegetation classification have contributed positively to classifying and interpreting South African vegetation (Brown *et al*., 2013).

The Braun-Blanquet method (which is also called Zurich-Montpellier method) was developed by Josias Braun-Blanquet in Europe during the early 1900s, (Whittaker, 1978; Werger, 1992) Classifying and interpreting the different plant communities was the primary purpose of developing the Braun-Blanquet method (Whittaker, 1978). According to Whittaker (1978), the Braun-Blanquet method and approach recognizes:

- "plant communities as vegetation units, build up by individual plant species".
- "certain plant species as being more dependent and forming relationships with other species".

1.2.3 Importance of vegetation classification.

South African National Parks (SANParks) (2017) recommends that ongoing vegetation monitoring and vegetation surveys must be undertaken as part of protected areas management. Masubelele *et al*., (2014) supported the SANParks recommendation by stating that, vegetation surveys help conservation managers and farm managers to determine, identify, and track changes in the ecosystem that they are responsible for. According to Rouget *et al.*, (2004), information on the vegetation of an area provides a good representation of biodiversity since most animals, birds, insects and other organisms are associated with particular plant communities. Thus, not only does a vegetation classification and description provides information on the natural resources present, but it can also be used to describe the suitability of an area for a specific species in terms of habitat and dietary requirements (Brown *et al*., 2013).

According to Brown *et al*., (2013) the different plant communities form fundamental units of ecosystems. One of the main objectives of protection and conservation of biodiversity is to achieve sustainable utilisation of the natural resources (Van Rooyen & Van Rooyen, 2017). To achieve sustainable use of natural resources, an adequate knowledge and understanding of the different plant communities is essential, its species compositions as well as their veld condition is highly

imperative. It is for this reason that state managed, or privately managed protected areas must be properly managed as part of protecting ecosystem services and to enhance sustainability of biological resources (floral and faunal) (South African National Parks, 2017).

1.2.4 Veld condition assessment

Tainton (1999) defined veld condition or grassland condition as the state of veld health in accordance with its resistance to soil erosion, ecological status, and the potential for forage production in order to sustain optimum wildlife or livestock production. Whereas Trollope & Potgieter (1968) defined veld condition as the condition of the vegetation in relation to multiple functional characteristics that includes, resistance of the veld towards soil erosion and sustained forage production.

Trollope, Potgieter, & Zambatis, (1989) state that grasslands are dynamic and their change over time can be expected regarding the condition of the veld, the trends over some few years can occur, but in terms of the short-term changes, the shortage of rainfall and/or drought make major contributions. As a result of influences such as climate change, fire and grazing patterns, the changes may be expected in species composition, species abundance and vegetation cover. It is for these reasons that constant assessments of the veld condition of grass communities constitute convenient means of comparing and identifying the changes, as well as of offering means to quantify and observe spatial and temporal changes within a particular community or vegetation type (Tainton, 1999).

1.2.5 History of veld condition assessment in South Africa

The assessment of veld condition allows for a comparison between different plant communities and provide the means to quantify and observe spatial and temporal changes within a specific vegetation type within a given period. According to Tainton (1999) there are three main objectives for assessing veld condition:

- “Veld condition evaluation relative to its potential in that ecological zone;

- Evaluation of current management effects on veld condition, monitoring changes over time; and,
- Classifying and quantifying the different vegetation types".

Before the early 1970's in southern Africa, there was little formalised research conducted on veld condition assessment methods to determine veld condition. However, currently a range of techniques are available for veld condition assessments (Tainton, 1999).

The estimation of proportional composition of the species is what southern African grasslands' range condition assessments are based upon. The wheel-point device and the nearest plant method or modifications thereof are used for the species composition estimations (Hurt & Bosch 1991). The data of species composition are mainly manipulated in various ways to fulfil the objectives of determining the grazing capacity as well as the range of condition index monitoring (Hurt & Bosch, 1991).

For the purpose of gathering vegetation data, several plant survey methods can be employed. As a result, Vorster (1982) undertook a thousand-step point survey through application of the chain method, the basal, crown and canopy spread strikes that were recorded in his study to develop the ecological index method. The Mentis (1981) study evaluated the wheel-point and step-point methods as part of assessing the veld condition. The Mentis (1981) study concluded by stating that the step-point method is used in preference to the wheel-point method, simply because the step-point method saves in terms of equipment and manpower although there may be exceptions between the two methods. It was further stated that the step-point method does not provide an estimate of basal cover and for this reason, the step-point method is not recommended to be employed in bushy veld or uneven terrain. Therefore, the modified wheel-point apparatus method is recommended if the estimate of basal cover is required for the survey.

The veld condition assessment methods can either be based on agronomic principles or on ecological principles (Tainton, 1999). The Trollope, Potgieter, & Zambatis (1989) study stated that the assessment of the veld condition must not be restrained by ecological concepts, and that the

maximum forage production for the livestock or wildlife type being grazed should be the only criterion used to estimate the veld condition.

Most recently, Hart *et al.*, (2020) on his study undertook seven parallel 100 m veld condition index transects, each separated by 2 m. A spike-point sampling was undertaken through using a survey cane where the single grass species closest to the cane after each 1 m step was identified accordingly (Ngwenya 2012; Hart *et al.*, 2020). Van Oudtshoorn (2018) recommended ecological status and relevant multiplier (Decreaser = 10, Increaser I = 7, Increaser II =4 and Increaser III = 1) for each identified and recorded grass species were determined.

All veld condition assessment methods are based on the score of the ecological principles of veld condition according to the response of the vegetation to biotic and abiotic environmental impacts (Mentis, 1981). The frequency and intensity of defoliation (such as grazing and fire) are the main environmental variables and it is presumed that the defoliation regime can be designed to change the state of the vegetation to that most suited to the management objectives (Tainton, 1999). Furthermore, Tainton (1999) presumes that the soil and climatic factors, specifically rainfall, also influence the veld condition.

1.2.6 The Biodiversity Stewardship Programme

According to SANBI (2014), the biodiversity stewardship programme may be defined as a mechanism that allows private landowners and communities to enter into agreements with a conservation authority to formally protect and manage land in biodiversity priority areas, in the form of entering into a partnership agreement with the conservation authority such as the Eastern Cape Parks and Tourism Agency (ECPTA) in South Africa. SANBI (2014) further states that the biodiversity stewardship recognises landowners as the custodians of biodiversity on their land, whereas Reeves (2015) defines biodiversity stewardship as the practice of effective management of land use to ensure that natural systems, biodiversity, and ecosystem services are maintained and enhanced for future generations as well as the present generation.

SANBI and Wildlands Conservation Trust (2015), in their report for ten lessons from biodiversity stewardship in Maputaland, unpacked the biodiversity stewardship concept as a programme that is based on voluntary commitment from landowners that are willing to participate in the programme to support conservation and sustainable resource use. The programme provides a range of different types of biodiversity stewardship agreements. In addition, SANBI (2014) states that, in terms of NEM:PAA, (57 of 2003), some types of biodiversity stewardships are formally declared as protected areas and they contribute to the protected areas network. Reeves (2015) outlined that, back then, management of large areas of public land in statutory protected areas has been a major or single focus to nature conservation approaches, with the least focus being on informal systems of non-statutory conservation areas on private lands. In response, the BSP overcomes this shortcoming by shifting the focus onto private and communal land without having to change the ownership of the land as well as management responsibilities but providing technical support.

In clarifying the BSP concept, several studies (Wright, Stevens, Marnewick, & Mortimer, 2018; Cockburn, Cundill, Shackleton, Rouget, *et al*., 2019) outlined the five different types of categories applicable in the biodiversity stewardship programme: The Nature Reserve, Protected Environment, Biodiversity Management Agreement, Biodiversity Agreement and Conservation Area, according to SANBI (2017) (**Figure 1.1**). These categories exist in a hierarchy of protected and conservation areas, with differing levels of commitment, participation, duration, permanence, and management restrictions in terms of permissible and non-permissible activities per category, which corresponds with the increasing availability of incentives. Furthermore, these categories are not just localised, but they are aligned with the International Union for Conservation of Nature (IUCN) guidance for either Private Protected Areas (PPAs) (Dudley, 2008; Stolton, Redford, & Dudley, 2014) or criteria for recognising Other Effective area-based Conservation Mechanisms (OECMs) (IUCN, 2018), subject to their specific legal status, duration, and intention. However, the degree of biodiversity importance of the site and the degree of security associated with the contract increase as one moves up the hierarchy of conservation categories (Wright, 2018).

In addition, in South Africa's nine provinces, the biodiversity stewardship programme funding opportunities have been made available by government and other international funders to allow organisations and NGOs to drive the programme's implementation (Munzhedzi & Hotel, 2017). As a result, according to SANBI (2017), the BSP in South Africa is well regarded as a resourceful and economical tool for achieving an expansion of the national protected area estate, as well as providing enhanced management of the environment, broader landscape, and seascape. In the same way, the South African National Biodiversity Strategy and Action Plan (NBSAP) recognised the critical role the programme is playing in terms of serving as an approach to protect and manage land in conservation priority areas (Stolton, Redford, & Dudley, 2014).

In a report produced by the Department of Forestry, Fisheries, and the Environment in 2016, over 564 000 ha in priority biodiversity areas have been declared as formally protected areas through BSP; this is equivalent to approximately 40% of the national protected area estate. However, it should be noted that the Biodiversity Stewardship Programme, in some instances, could also include Special Nature Reserves and National Parks. Special Nature Reserves may only be declared by the Minister in terms of Section 18 of NEM:PAA to protect highly sensitive, outstanding ecosystems, species or geological or physical features in the area and to make the area primarily available for scientific research or environmental monitoring.

Whereas the National Parks category can be declared on state, private or communal land and is managed by South African National Parks (SANParks) or involves co-management agreements with private landowners, Community Property Associations (CPAs) or the occupiers of communal land, they are geographic areas with the highest biodiversity value and ecological infrastructure, and are declared primarily for biodiversity conservation (SANBI, 2018).

However, most biodiversity stewardship programmes tend not to focus on these two categories because of the high level of restrictions in terms of permissible and non-permissible activities, they can be declared only by the Minister and the management authority must be the South African National Parks (On *et al*., 2011). In addition, according to the recently reviewed SA's biodiversity stewardship guidelines document, the minimum years for the duration of the Nature Reserve

category is now 99 years, which is different from the period stated by On *et al*., (2011) in **Figure 1.1** (SANBI, 2018).

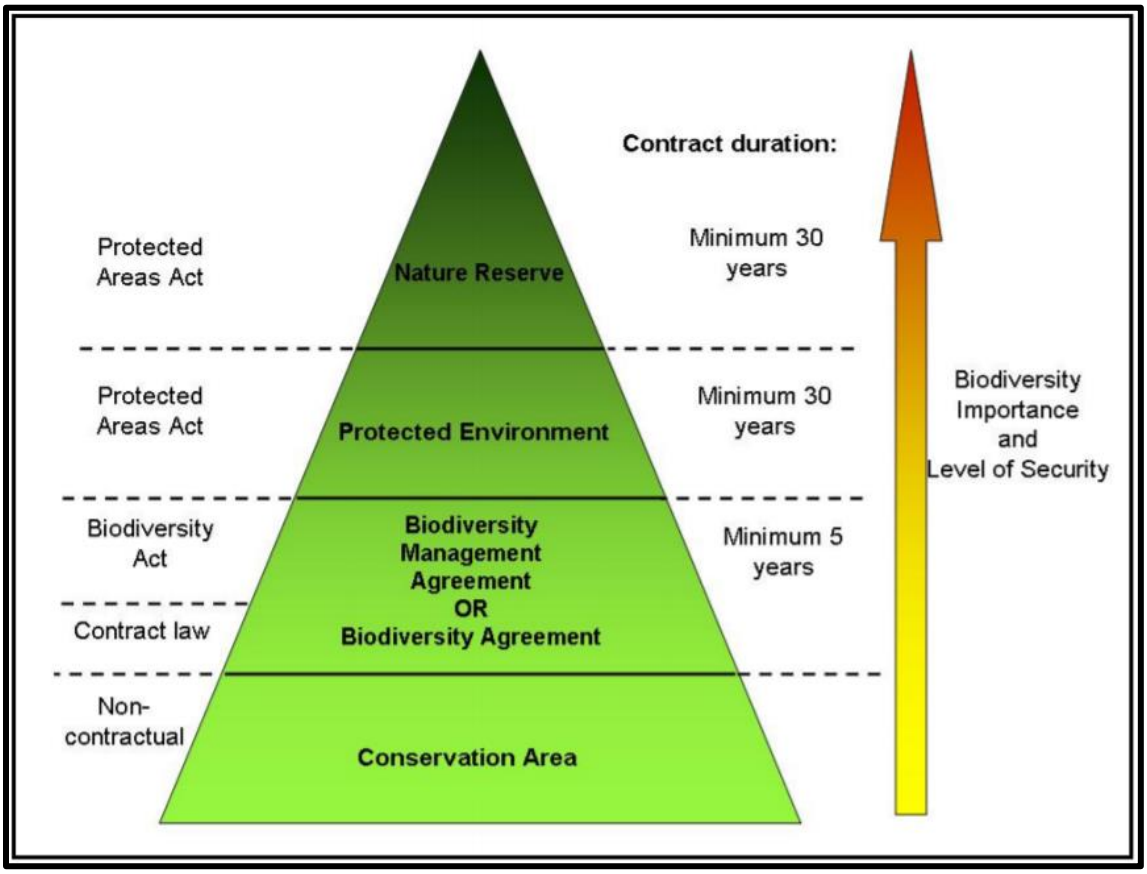


Figure 1.1: Representation of a typical set of conservation categories used in a biodiversity stewardship programme (On *et al*., 2011).

1.2.7 Biodiversity context

Globally, the IUCN & UNEP-WCMC (2016) conducted a study assessing how protected areas are contributing to achieving biodiversity targets as well as other relevant targets of Sustainable Development Goals (SDGs). In their study, recent research and case studies were highlighted as a means of outlining the role played by protected areas in conserving biodiversity and cultural heritage globally.

IUCN & UNEP-WCMC (2016) findings indicated that protected areas cover approximately 4% of the global ocean, just above 10% of coastal and marine areas, which are within the national jurisdiction and just below 15% of terrestrial and inland water in the world. IUCN & UNEP-WCMC (2016) results further clarified that only one-third of 232 marine ecoregions have about 10% of their total area under protected areas and less than half of the world's 823 terrestrial ecoregions have about 17% of their total area under protected areas.

Furthermore, less than 20% of key Biodiversity Areas are formally protected. Therefore, the implementation of a global protected area expansion mechanism is essential to ensure that adequate areas of biodiversity importance and adequate provision of ecosystem services to the present and future generation are protected, sustained, and secured (IUCN & UNEP-WCMC, 2016).

However, in South Africa, Brown (2015) states that, out of the 1.2 million km^2 of the land surface, representing just 1% of the earth's total land surface, South Africa contains about 10% of bird, plant and fish species that are known globally and over 6% of the world's known reptiles and mammal species. Sadly, about 34% of the country's diversity is threatened, with 440 terrestrial ecosystems being threatened at an alarming rate as a result of poor land management and development (Brown, 2015). Of these threatened diversities, 5% of Forest and Fynbos biomes have been classified as critically endangered, 13% of Grassland and Savanna biomes classified as endangered and 16% of Fynbos, Grassland and Succulent Karoo biomes classified as vulnerable. The delineation of three internationally recognised biodiversity areas in SA, The Maputaland Pondoland Albany (Grassland), Succulent Karoo and the Floral Kingdom Hotspot, come into effect due to the combination of high levels of diversity and high level of threat to critical diversity (Brown, 2015).

In addition to Brown (2015) regarding the SA biodiversity context, SANBI (2012) also stated that in South Africa, approximately a quarter of land-based ecosystems are well protected; however, 35% have no form of formal protection at all. Desert, Fynbos and Forest are well-protected biomes in terms of the country's target, whereas Grassland, Thicket, and Nama-Karoo are the least

protected biomes in SA (SANBI, 2012). SANBI (2012) further classified the Grassland biome as one of South Africa's largest and most threatened biomes, which echoes the need for securing more grassland areas under formally protected areas. In addition, **Table 1.1** below outlines South Africa's nine biomes, their protection status, secured percentage and the set target. The indication of achieved protected area target is represented by different colours where Green is well protected, Grey is moderately protected, and Red is poorly protected.

According to SANBI (2019), protected area network represents over two-thirds of ecosystem types, which leaves 31% falling under 'not protected' category. The ecosystem types that have the lowest level of protection are wetlands and rivers, as a result 88% of wetland areas is threatened (SANBI, 2019). While rivers, wetlands and their catchment areas are important ecological infrastructure for water security, it is, therefore, imperative that protection and integrated management of natural resources in key catchment areas located within Strategic Water Source Areas are improved (SANBI, 2019).

Table 1.1 Representation of South Africa's nine biomes protection targets (Department of Environmental Affairs, 2016).

BIOME	Biome Area (ha)	Protected Areas (ha)	Achieved (%)	20-Year PA Target (%)
Albany Thicket	2 912 755	245 825	8%	10%
Desert	716 565	181 031	25%	18%
Forests	471 452	158 467	34%	23%
Fynbos	8 394 417	1 777 028	21%	15%
Grassland	35 459 351	1 188 084	3%	14%
Indian Ocean Coastal Belt	1 428 197	77 410	5%	14%
Nama-Karoo	24 828 007	244 543	1%	11%
Savanna	41 254 462	5 117 924	12%	10%
Succulent Karoo	8 328 397	783 661	9%	12%

As part of subsequent response to increasing protected areas target in the Eastern Cape Province, more especially for the underrepresented biome types such as the Grassland, the ECPTA's

Biodiversity Stewardship Programme was initially implemented as part of the Cape Action for People and Environment (CAPE) programme in 2008 and focused mostly on the Fynbos areas of the Baviaanskloof while also capitalising on opportunities of declaring large areas in the Karoo as formally protected areas in accordance with NEM:PAA (57 of 2003) (ECPTA, 2016). As a result, since 2010, ECPTA, together with its partners, has facilitated the formal declaration of more than 150 000 hectares on 17 stewardship sites in the Eastern Cape Province (ECPTA, 2016), which has been achieved with the aid of Non-Government Organisations (NGOs), such as Endangered Wildlife Trust (EWT) and Eden to Addo who assisted with the negotiation processes and WorldWide Fund for Nature South Africa (WWF-SA) with property donations. ECPTA (2016) further clarified that the ten years target of 150 000 ha achieved in five years is a demonstration of the willingness of South African citizens to protect their conservation-worthy land through the Biodiversity Stewardship Programme in the Eastern Cape as well as a demonstration of the commitment of the Member of the Executive Council (MEC) and the Board of ECPTA to contribute to the land-based protected area network in South Africa.

ECPTA received funding support from the Global Environment Facility (GEF-5) project in 2016 to facilitate and implement the Biodiversity Stewardship Programme within the North Eastern Cape Grasslands priority area, which stretches along the upper escarpment from Lady Grey westwards along the Lesotho border to Qachas Nek border post, and southwards towards Maclear, covering a large portion of the Eastern Cape Drakensberg Strategic Water Source Area (ECPTA, 2016). The priority area is a high-altitude grassland environment dominated by Lesotho Highland Basalt Grassland and Southern Drakensberg Highland Grassland. Neither habitat is listed as threatened as the area is largely untransformed (**Figure 1.2**).

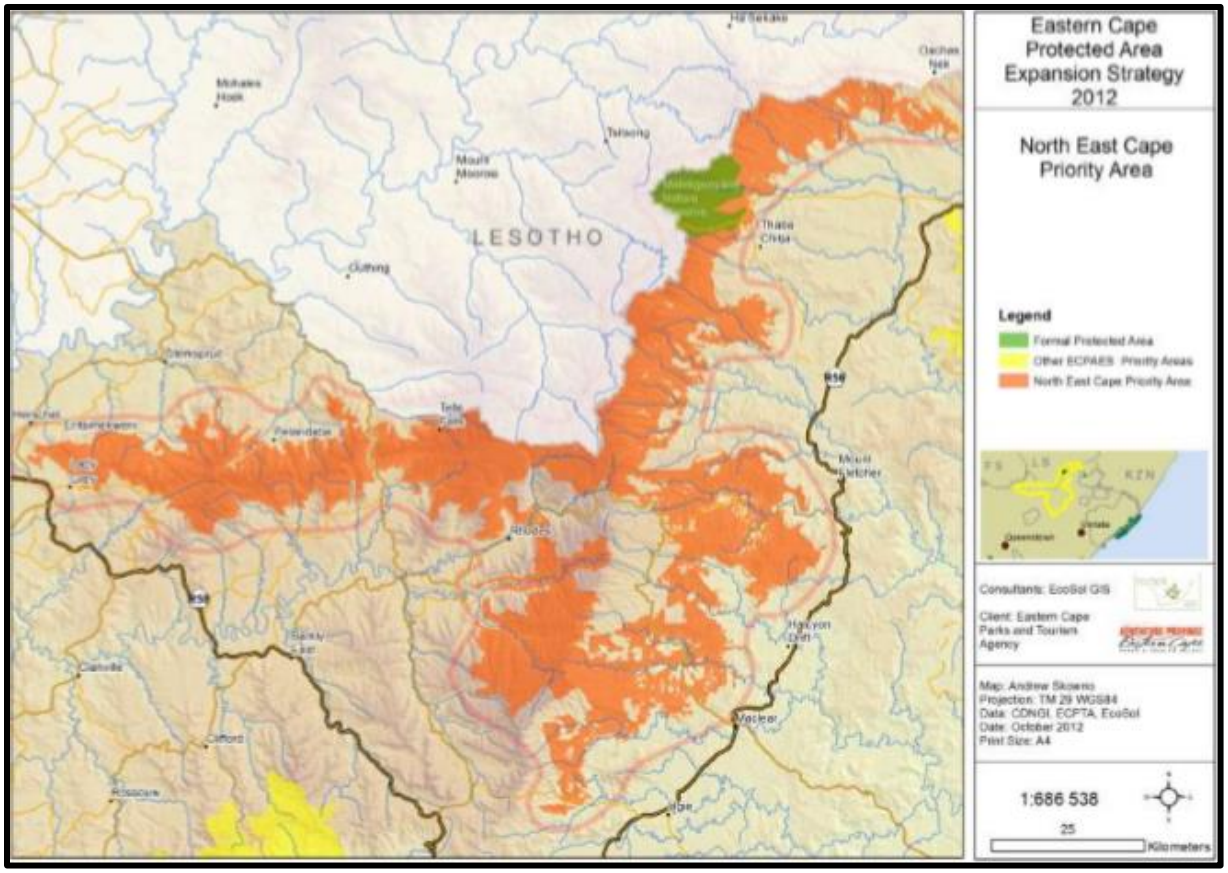


Figure 1.2: A map showing the North Eastern Cape Grasslands Priority Area (Skowno, Holness & Jackelman, 2012).

In addition to the ECPTA (2016) report, Skowno, Holness, Jackelman, and Desmet (2012) in the ECPAES outlined that in the Eastern Cape Province, there are 74 formal terrestrial protected areas (amounting to 716 701 ha) and seven formal marine protected areas (amounting to 207 397 ha). Fifteen agencies are the management authorities for these protected areas, with ECPTA and South African National Parks (SANParks) being responsible for most of the protected area system (about 579 835 ha and 277 500 ha respectively).

Skowno *et al*., (2012) further assessed the current level of progress in the province in terms of the protected area expansion, which would then allow for the development of a defensible set target about the goals for meeting the target. The results were that, currently, 23/92 habitat types are well protected, 7/92 moderately protected, 37/92 are poorly protected and 25/92 are completely

unprotected (Skowno *et al*., 2012). The gap analysis also indicated that the current protected area system would have to be more than doubled (expanded from 716 701 ha to 1 599 603 ha) to meet all targets for terrestrial habitat types within the Eastern Cape Province, which will ultimately contribute significantly to meeting the National Protected Areas Expansion target (Skowno *et al*., 2012).

1.2.8 Protected Areas Expansion studies in general

Reeves (2015) compared the previous approaches to the protected areas network against the recent approach of forming partnerships between the state and private landholders or landowners with a goal of conserving and securing critical biodiversity through the biodiversity stewardship programme. The statutorily protected area network was previously firmly based towards a particular type of geographical area and habitat. This former system did not achieve the goal of systematically conserving and preserving biodiversity. Furthermore, the former system of off-reserve conservation did not have standards for the management of sites and did not offer long-term security to biodiversity. There was also no support provided to participating landowners (Reeves, 2015; Munzhedzi & Hotel, 2017; Wright *et al*., 2018). With the current approach, there is a very strong focus on supporting conservation targets in terms of protected areas as well as achieving certain vegetation types as formal protection targets (Reeves, 2015). Furthermore, the current approach also received standards outlining how participating properties should be managed in accordance with the NEM:PAA (57 of 2003) to ensure effective and proper management and conservation of important vegetation types and biodiversity as a whole (Reeves, 2015; Barendse, Roux, Currie, Wilson, & Fabricius, 2016). Reeves (2015) further states that, with the current approach, there is provision of tangible benefits and support offered to landowners in the form of extension support.

Reeves' (2015) findings are supported by the SANBI (2014) report, which outlined the importance of the Biodiversity Stewardship Programme implemented on sites or properties that have been recognised as significant for ecosystem services and biodiversity. It is considered a highly lucrative mechanism for protected areas expansion. It entails the processes of initiating

engagements/negotiation and declaration of a protected area through the biodiversity stewardship programme. it also considers the continued cost of providing support towards the management of biodiversity stewardship sites to participating landowners once their properties have been declared as formally protected areas. This approach is comparatively much less costly to the conservation authority as compared to the costs involved for land acquisition and the costs of managing protected areas themselves.

In addition to the above benefits of the biodiversity stewardship programme, the SANBI (2014) report mentioned other opportunities of biodiversity stewardship. These included Firstly; the flexibility of allowing landowners to retain ownership of their lands and undertaking the responsibility of management authority. Secondly, the practicality and effectiveness of allowing multiple-use landscapes where biodiversity priority areas are embedded in a matrix of other land uses. Lastly and the opportunity of allowing for a flexible range of biodiversity stewardship categories and agreements that allows for a harmonious combination of biodiversity protection and sustainable agricultural production (Barendse *et al*., 2016; Jepson *et al*., 2017; Munzhedzi & Hotel, 2017; Peçanha Enqvist *et al*., 2018).

The Biodiversity Stewardship Programme in South Africa over the past several years have been considered as a key mechanism to secure priority biodiversity on land outside of state-owned protected areas through the application of contractual agreements with willing landowners (Barendse *et al.,* 2016). However, the case differs from province to province as some have effectively established and implemented Biodiversity Stewardship Programmes, while other provinces are in the process of establishing them (Andersson & Barthel, 2016; Barendse *et al*., 2016). As part of achieving the South Africa's protected area targets, the Biodiversity Stewardship approach plays a central and important role in the effective implementation of the National Protected Area Expansion Strategy (NPAES) (Barendse *et al.,* 2016). The approach also plays a crucial role in securing and conserving threatened ecosystems, for which the establishment of large traditional state-owned protected areas is usually no longer feasible.

Cockburn, Cundill, Shackleton, & Rouget (2019) alluded to the BSP benefits by revealing that the programme contributes significantly to the broader socio-economic goals. These include amongst others, rural development, and the creation of green job opportunities; and the potential to make significant contributions to land reform and livelihoods improvement of land reform beneficiaries through the implementation of various compatible interventions that supports income generation. Furthermore, BSP provides a cost-effective mechanism for government, conservation agencies and some NGOs to carry out their conservation mandate and to achieve protected area targets at a much lower cost to protected area agencies than buying land. The general benefits from this programme are savings from not having to purchase land, and partly on ongoing costs associated with managing the land borne by the landowner and not the conservation agency (Wright *et al*., 2018).

A comparative study by Wright (2018) identified advantages and disadvantages facing biodiversity stewardship in South Africa. Some of the challenges identified included the lack of high-level political will to support and adequately fund the Biodiversity Stewardship Programmes. Landowners that are willing to participate in the programme but do not fall within the priority conservation areas are also not supported by the sector (Wright, 2018). Other operational challenges included lack of funding opportunities to support landowners with maintenance and management of established sites. The high legal costs to declare properties as being a formally protected area was also identified as a challenge, as well as the short-term funding cycles and opportunities offered to NGOs to facilitate the Biodiversity Stewardship Programme (Wright, 2018; SANBI, 2018). The lack of succession planning in extension services provided to participating landowners, the lack of long-term funding to sustain and cater for permanent staff to support the programme were also identified as key concern. The lack of resources to provide adequate training to Extension Officers on social science skills such as negotiation were all identified as some of the key challenges (Wright, 2018).

1.2.9 Importance of vegetation survey as part of Protected Areas Expansion

Bhatt, Kushwaha, Nandy, & Bargali (2013) defined vegetation types as an embodiment of unique physiognomy, structure and floristic features influenced by anthropogenic factors, topography, and climate. Bhatt *et al*. (2013) further mentioned that the scheme of vegetation type classification follows a hierarchical system wherein climatically driven forest ecosystems systems with different physiognomy and phenology are primarily classified as a group type. In addition to the vegetation types, the classification scheme is structured to facilitate accounting of habitat diversity and species, the naturalness of the study area or that site/s being assessed and its ecological uniqueness (Bhatt *et al*., 2013).

Furthermore, according to Pressey (2004), systematic conservation planning is used globally to inform policy and legislation for facilitating durable conservation of biodiversity as well as for the identification of priority areas for biodiversity conservation. The purpose of systematic conservation planning is to reflect and indicate the target of the conservation value of existing protected areas that have been declared in accordance with the NEM:PAA (Jewitt, 2018). This is to inform the selection of additional areas to address and measure the success of conservation actions, meet conservation goals, as well as to allow for defensibility and accountability of conservation decisions (Jewitt, 2018).

Deutschländer & Bredenkamp (1999) study explained that classification of vegetation in a protected area is necessary to enable the identification of different habitat types. Vegetation analysis also aid in creation of new optimal habitat situations through proper management Deutschländer & Bredenkamp (1999). Their study employed the Braun-Blanquet cover-abundance scale where a total of twenty 10 x 10 m sample plots were surveyed in a grassland vegetation.

Chapter 2: Methodology

2.1 Study Area Description

2.1.1 Location of the study area

This study was conducted in the northern region of the Eastern Cape Province near Barkly East Town (Glencoe Farm GPS Coordinates: 30°46'49.98" S and 27°43'10.33"E; Reedsdell Farm GPS Coordinates: 30°42'21.06" S and 27°44'31.68"E). The study constitutes two different properties or farms (henceforth study sites) of different sizes/hectares, the Reedsdell, which is ~1 158 ha and the Glencoe, which is ~1 007 ha. These properties are all situated within the North Eastern Cape Grasslands priority area in accordance with the Eastern Cape Protected Areas Expansion Strategy and are close to each other (approximately 5km apart) (**Figure 2.1**) (Skowno, Holness & Jackelman, 2012). Both study sites (forming the study area) are privately owned and are mostly used for small-scale commercial farming. In terms of the locality, both study sites are in the Senqu Local Municipality, approximately 30 km north-east of Barkley East within the Joe Gqabi District Municipality, Eastern Cape Province, South Africa. The study sites are situated in an area commonly referred to as Wartrail area, south of the southern tip of Lesotho and close to Lundin's Nek (R393), which is considered as one of the most underrated big gravel mountains passes of South Africa (Vromans, 2018). They both straddle the foothills and high-altitude plateaus of the Witteberg Mountain Range, locally known as the Balloch Mountains, which forms part of the Eastern Cape Drakensberg.

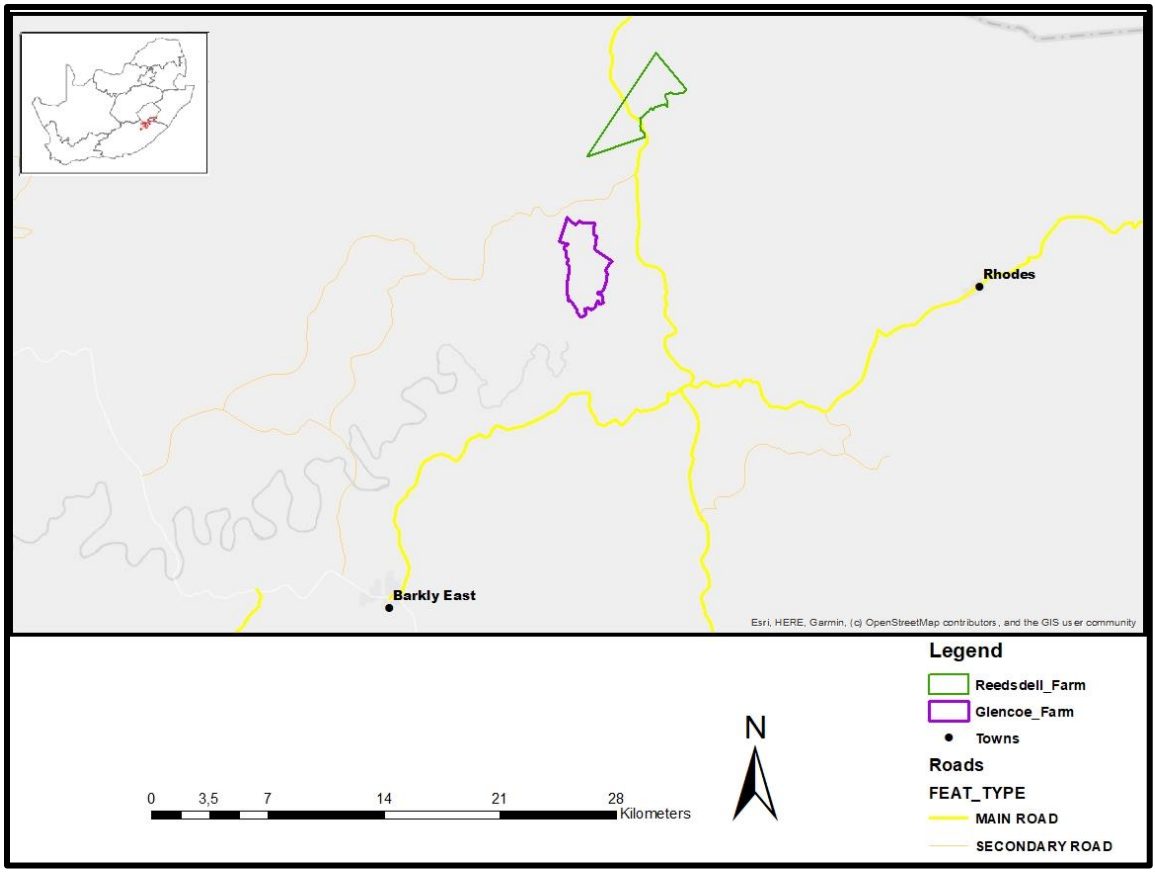


Figure 2.1: Map showing the two study sites, Glencoe, and Reedsdell.

The study area supports numerous seep wetlands, along drainage areas and streams, such as the Vioolkloofspruit and KwaSijora, which flow from the mountain top, with highly diverse montane grasslands. Both study sites fall within the planning domain of several important landscape-level biodiversity conservation initiatives which seek to expand and link key Protected Areas and ecological corridors across the region. Given the high altitude, the region supports the largest extent of C3 grasslands in South Africa, almost none of which is found in existing protected areas. Therefore, these sites are of significant conservation value and form part of the proposed area for "High Altitude Tourism and Conservation Development" (Golder Associate, 2011).

The ECPTA selected these study sites for formal protection consideration through the BSP as they fall within the North-East Cape grasslands priority area in accordance with the ECPAES (Skowno *et al.*, 2012). Furthermore, these study sites are of high biodiversity value because of their

importance as breeding sites for the Endangered Bearded Vulture (*Gypaetus barbatus*) and Vulnerable Cape Vulture (*Gyps coprotheres*), the presence of the Endangered Mountain Reedbuck (*Redunca fulvorufula*), and their importance from a hydrological perspective, with numerous seeps and the source of rivers falling within the Critical Biodiversity Area (Vromans, 2018).

2.1.2 Historical background of the study area

The nomadic San people, known as Khoisan hunter-gatherers, are believed to be the earliest inhabitants of the area. Post-1820, settlers travelled northwards from the Grahamstown area and created the farming districts of Wartrail and New England. Many of the farms in the district are still owned by fourth and fifth-generation descendants of the original settlers (Eastern Cape Highlands, 2018). The district was initially surveyed in 1861 by an Irishman, Joseph Orpen. As the landscape reminded the land surveyor of the Scottish Highlands, many of the farms in the area bear the names of their Anglo associates, such as Reedsdell, Ben Nevis, Glen Gyle, Pitlochrie and Glencoe (Nortje, 2006; Eastern Cape Highlands, 2018). The town of Barkly East was later established in circa 1873 and is named after Sir Henry Barkly, Governor and High Commissioner to the Eastern Cape Province from 1870 to 1877 (Nortje, 2006; Eastern Cape Highlands, 2018).

The Wartrail area has derived its name from skirmishes between the cattle raiding parties of King Moshesh and the Xhosa people living near Barkly East (Nortje, 2006). Once the cattle were enroute to Lesotho, King Moshesh's party were often pursued by the Xhosa inhabitants to leave their area and to forsake their cattle, opposed to forsaking the cattle; they would drive them into the river to drown (Eastern Cape Highlands, 2018). This is the origin of the name of the river flowing through the area, the river Joggem meaning the "eater-of-cattle" (Nortje, 2006; Eastern Cape Highlands, 2018).

2.1.3 Fauna

Although a formal survey is yet to be conducted, a rich diversity of mammalian species has been recorded and expected to occur within the landscape. Threatened mammal species include the

Endangered Mountain Reedbuck (*Redunca fulvorufula*), Near-threatened Grey Rhebok (*Pelea capreolus*), Near-threatened Cape Clawless Otter (*Aonyx capensis*) and possibly the Vulnerable White-tailed Rat (*Mystromys albicaudatus*), see **Table 2.1** (Miller Riggio, Funston, Power, Williams, 2017). Originally from Eurasia, the alien fallow deer (*Dama dama*) were introduced to the landscape many decades ago. Their tendencies to permeate stock fences have assisted them in colonising the region. Fallow deer are deemed invasive and are listed as NEMBA Category 2, and keeping them requires a permit (DEA, 2016).

Table 2.1: The inventory of confirmed (recorded) and unconfirmed faunal species of special concern, including endemic species in the study area (Apps, 2012; Oberprieler, 2012; Underhill *et al*., 2017).

Fauna		
Common Name	**Species**	**Red Listing / Conservation Status**
Recorded fauna (birds, mammals) – confirmed species		
Bearded Vulture	*Gypaetus barbatus*	Endangered
Cape Vulture	*Gyps coprotheres*	Vulnerable
Mountain Reedbuck	*Redunca fulvorufula*	Endangered
Verreaux's Eagle	*Aquila verreauxii*	Vulnerable
Birds – recorded by the SANBI Bird Atlas Project (3027DA)		
African Grass Owl	*Tyto capensis*	Vulnerable
African Marsh Harrier	*Circus ranivorus*	Endangered
Black Stork	*Ciconia nigra*	Near Threatened
Blue Crane	*Anthropoides paradiseus*	Near Threatened
Bush Blackcap	*Lioptilus nigricapillus*	Vulnerable
Denhams bustard	*Neotis denhami*	Vulnerable
Grey Crowned-Crane	*Balearica regulorum*	Vulnerable
Lanner Falcon	*Falco biarmicus*	Near Threatened
Secretary bird	*Sagittarius serpentarius*	Near Threatened

Fauna		
Amphibians (Frogs) – unconfirmed		
Berg Stream Frog / Drakensberg Stream Frog	*Strongylopus hymenopus*	Near Threatened. Endemic to the high slopes of the Drakensberg and Lesotho highlands. The southernmost record from Barkley East (3027DC) appears isolated, probably due to inadequate sampling.

According to the SA Bird Atlas data, 241 bird species have been recorded from the three-quarter degree squares that encompass the area (Underhill, Brooks, & Loftie-Eaton, 2017). This is the area along the Eastern Cape Drakensberg mountains, covering Lady Grey, Barkly East, and Rhodes Village Town with an extent of about 50 000 ha in total. A number of endemic and threatened bird species recorded on the study areas include: the Critically Endangered Bearded Vulture (*Gypaetus barbatus*), the Endangered Cape Vulture (*Gyps coprotheres*), the Endangered Grey Crowned Crane (*Balearica regulorum*), the Near-threatened Blue Crane (*Anthropoides paradiseus*), Endangered Black Harrier (*Circus maurus*), the Endangered Southern Bald Ibis (*Geronticus calvus*) and the Vulnerable Secretary bird (*Sagittarius serpentarius*), **Table 2.1** (Underhill *et al*., 2017).

2.1.3.1 The Bearded Vulture, Cape Vulture and Verreaux's Eagle

The Endangered Bearded Vulture (*Gypaetus barbatus*) and Vulnerable Cape Vulture (*Gyps coprotheres*) nests are found in the basalt rock formations of the North Eastern Cape Grasslands priority area's mountains (**Table 2.1**). The Cape Vulture is endemic to southern Africa (Oberprieler, 2012). It prefers mountainous habitats and nests on cliff edges. Adults are tied to their breeding colony, venturing only 10-20 km away, but sometimes up to 150 km away (Oberprieler, 2012). Bearded Vultures inhabit the Drakensberg massive and foothills, above 1 800

m, nesting mostly in caves but sometimes on ledges under overhangs. They are solitary and may forage up to 90 km from the nest (Oberprieler, 2012). The Verreaux's Eagle (*Aquila verreauxii*) also inhabits the North Eastern Cape Grasslands priority area. The area could potentially harbour a nesting population due to suitable habitat and availability of cliffs for nesting.

2.1.3.2 Mountain Reedbuck

The Endangered Mountain Reedbuck (*Redunca fulvorufula*) inhabits grasslands with scattered bush, which grow on the Drakensberg Mountain Range, including the Witteberg. It is a water-dependent antelope that may migrate seasonally. It prefers short grass burnt within the previous year (Apps, 2012).

2.1.4 Description of the vegetation types

Glencoe and Reedsdell study sites are located within one of Southern Africa's 19 centres of plant endemism, specifically the Drakensberg Alpine Centre, renowned for its high levels of rare and endemic plant species (Cadman, DeVilliers, Lechmere-Oertel, & McCulloch, 2013). The centre further hosts both sub-tropical and temperate elements with a strong floristic link to the Cape Floristic Region. Given the many climatic change uncertainties, the properties are befittingly situated to facilitate the movement and dispersal of several species along the Great Escarpment gradient (Cadman *et al*., 2013). These study sites are located within the Grassland Biome of South Africa, which is typically described as a landscape dominated by graminoids, typically of the family Poaceae (grasses), whereby woody plants are rare and usually confined to specific habitats (fire-protected areas) (Cadman *et al*., 2013).

The Reedsdell study site is dominated by the two-grassland vegetation types; the Lesotho Highland Basalt Grassland and the Southern Drakensberg Highland Grassland (**Figure 2.2**) (Mucina & Rutherford, 2006). Whereas, the Glencoe study site, is represented by one vegetation type described as the Southern Drakensberg Highland Grasslands (Mucina & Rutherford, 2006), as illustrated in **Figure 2.2**. The grassland units are referred to as high-altitude grasslands or

Drakensberg Grasslands. High-altitude grasslands are divided into two broad units, namely escarpment grasslands (1 400 – 1 800 m.a.s.l) and alpine grasslands (>1 800 m.a.s.l) (Cadman *et al*., 2013). These grasslands are largely dependent on fire for maintaining structure. The sandstone formations dominate the lower altitudes, which represent the geology of the Southern Drakensberg Highland Grasslands, before the landscape rises steeply, forming the basaltic lava of the Drakensberg Formation.

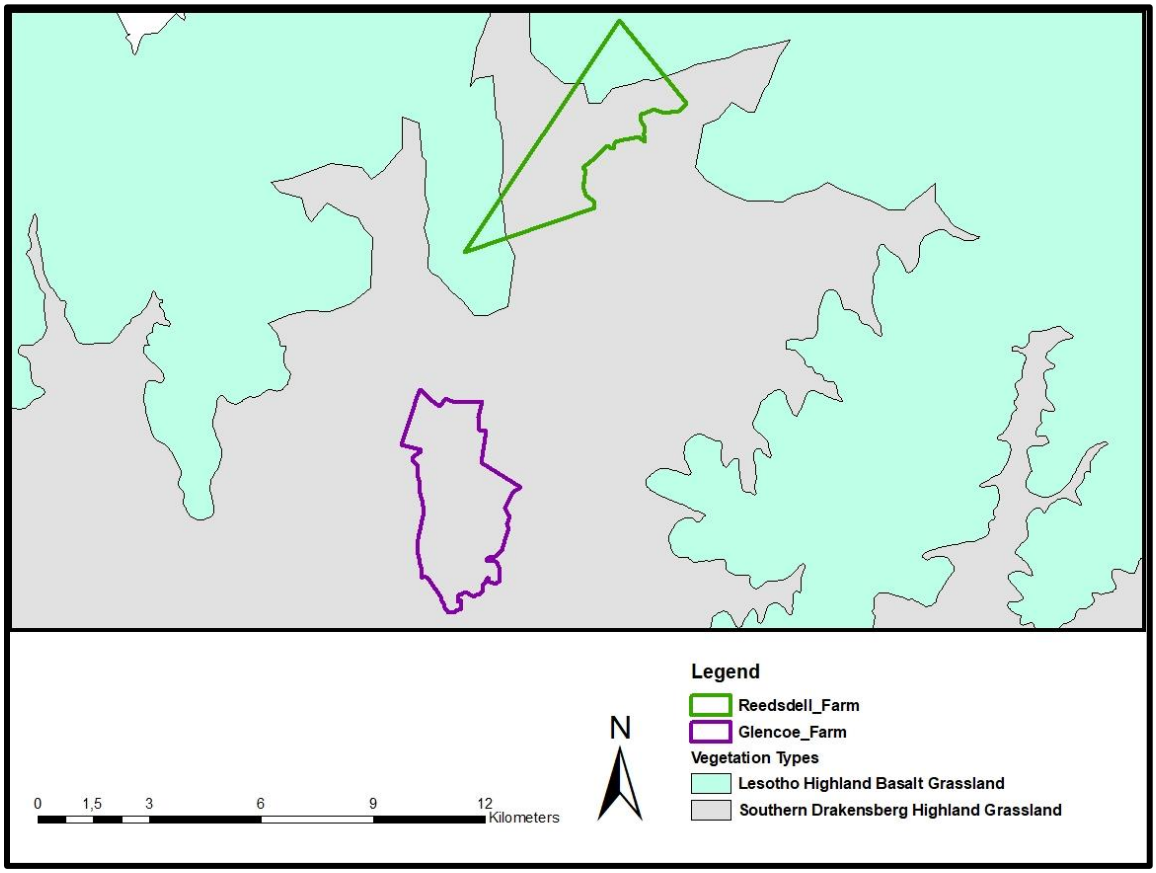


Figure 2.2: Map showing vegetation types that occur at Glencoe and Reedsdell study sites (Mucina & Rutherford, 2006).

Both vegetation types of Lesotho Highland Basalt Grassland and Southern Drakensberg Highland Grassland) are poorly protected in the Eastern Cape Province. This means that declaring these two study sites as protected areas would contribute towards achieving the protected area target in the

province. A detailed description of these vegetation types is provided in **Appendix 1** and **Appendix 2**.

2.1.5 Climate and weather

According to the Köppen's (1884) climate classification, the Barkley East area is characterised by a subtropical highland climate (Cwb), which is a variation of the oceanic (Cfb) climate classification. These climates are typically found in mountainous areas in subtropical and tropical countries. The higher altitudes give rise to a climate that share characteristics with oceanic climates, but there is noticeably drier weather during the lower sun "winter" season. Summers are mild, whereas winters are cold and dry, with occasional snow.

The Glencoe study site receives a mean annual rainfall of 663 mm and increases to 715 mm in a northerly direction. Whereas the Reedsdell study site receives a mean annual rainfall of 848 mm, but most rainfall occurs in the summer months between September and March for both study sites (Schulze, 2007). The high incidence of lightning experienced in the region contributes to the area being considered an "extreme veld fire risk area". Snow and frost frequently occur in the winter months and is generally coldest in the winter months, with an average of 7.4 °C in June, increasing in temperature to a mean of 18.7 °C in February on both properties (Schulze, 2007).

A Climate Change Vulnerability Assessment and Response Plan (2018) has been developed for the district municipality, indicating that under the current climatic projections, the region is expected to be exposed to increased temperatures, drought, an increase in frequency and severity of storm events (DEA, 2018).

2.1.6 Topography, geology, and soils

Both study sites are located in the foothills of the Witteberg Mountain Range, the topography can be described as rugged, with numerous koppies, sandstone ridges, and a central plateau. The steep valleys and deep gorges have been shaped by the Joggemspruit and Vlooikraalspruit rivers, which form the western and eastern boundaries, respectively.

The highest point on the Glencoe study site is located 1 987 m above sea level, while the lowest point is 1 716 m at the confluence of the two river systems. The Reedsdell study site has a dramatic variation in altitude, from 1 797 m on the banks of the Edgehill Stream to 2 592 m along the peak of the escarpment (Green, 2008; SLM, 2017). The study area forms part of a narrow valley bound by steep basalt cliffs. For both study sites, the underlying geology consists predominantly of red and greenish-grey mudstone, subordinate sandstone of the Elliot Formation, which represents the Karoo Sequence. The remaining areas constitute fine-grained sandstone and siltstone of the Clarens Formation, also of the Karoo Sequence – **Figure 2.3** (Green, 2008; SLM, 2017). As the Reedsdell study site is characterised by a central plateau bound by steep cliffs, the area may be vulnerable to accelerated soil erosion. To reduce susceptibility to soil erosion, rangelands should be managed to promote the cover of vegetation and reduce the extent of exposed soil (Green, 2008; SLM, 2017).

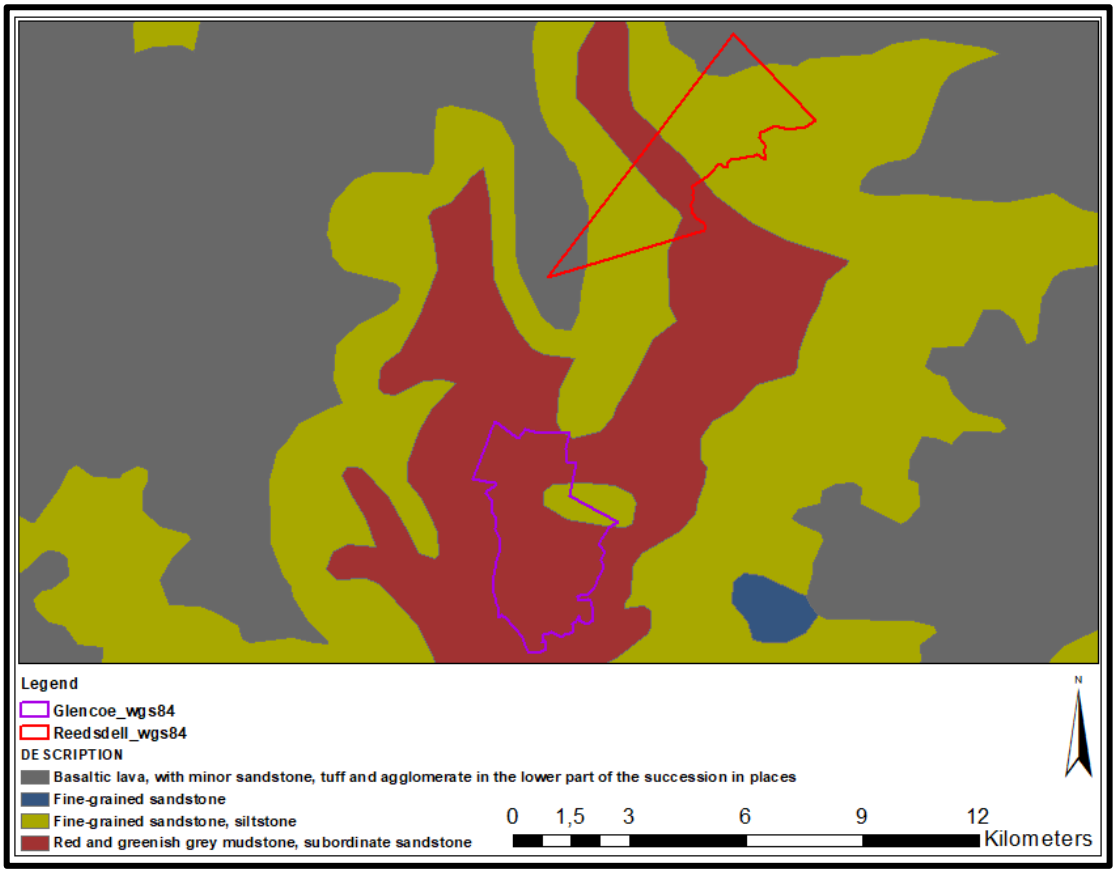


Figure 2.3: Map showing general lithology for Glencoe and Reedsdell study sites.

2.1.7 Hydrology

Both study sites are situated within the Upper Orange Water Management Area. They fall within the primary D-Catchment (Orange River Catchment) and the D13E quaternary catchment (Nel *et al*., 2011). The Glencoe study site forms the confluence of the non-perennial Joggemspruit and Vlooikraalspruit rivers, which flows for approximately three kilometres before joining the Kraai River. However, at the Reedsdell study site, the Edgehill Stream bisects the property, which acts as a tributary of the Joggemspruit and Kraai Rivers. The Kraai River and its tributaries are recognised as a national flagship free-flowing river and should, therefore, receive top priority for retaining its free-flowing character (Nel *et al*., 2011). The wetland vegetation type grouping for wetlands in the region is Drakensberg Grassland (Group 3). Seeps in this group are Vulnerable,

whereas valley head seeps are Critically Endangered and channelled valley bottom wetlands Endangered (Macfarlane & Bredin, 2017).

Furthermore, the study area forms part of the Eastern Cape Drakensberg National Strategic Water Source Area (**Figure 2.4**)**.** In addition, the two sub-quaternary catchments overlapping the study areas have been identified as a river national freshwater ecosystem priority area (NFEPA) – **Figure 2.5** (Nel, Colvin, Le Maitre, Smith, & Haines, 2013). Given that the area supplies a disproportionate amount of mean annual runoff to the geographical region of interest, therefore, the strategic water source areas can be regarded as natural 'water factories', supporting growth and development needs that are often a far distance away (Nel *et al*., 2013). Deterioration of water quality and quantity in these areas can have a disproportionately large negative effect on the functioning of downstream ecosystems and the overall sustainability of growth and development in the regions they support (Nel *et al*., 2013). Therefore, appropriate management of these areas, which often occupy only a small fraction of the land surface area, can greatly support downstream sustainability of water quality and quantity.

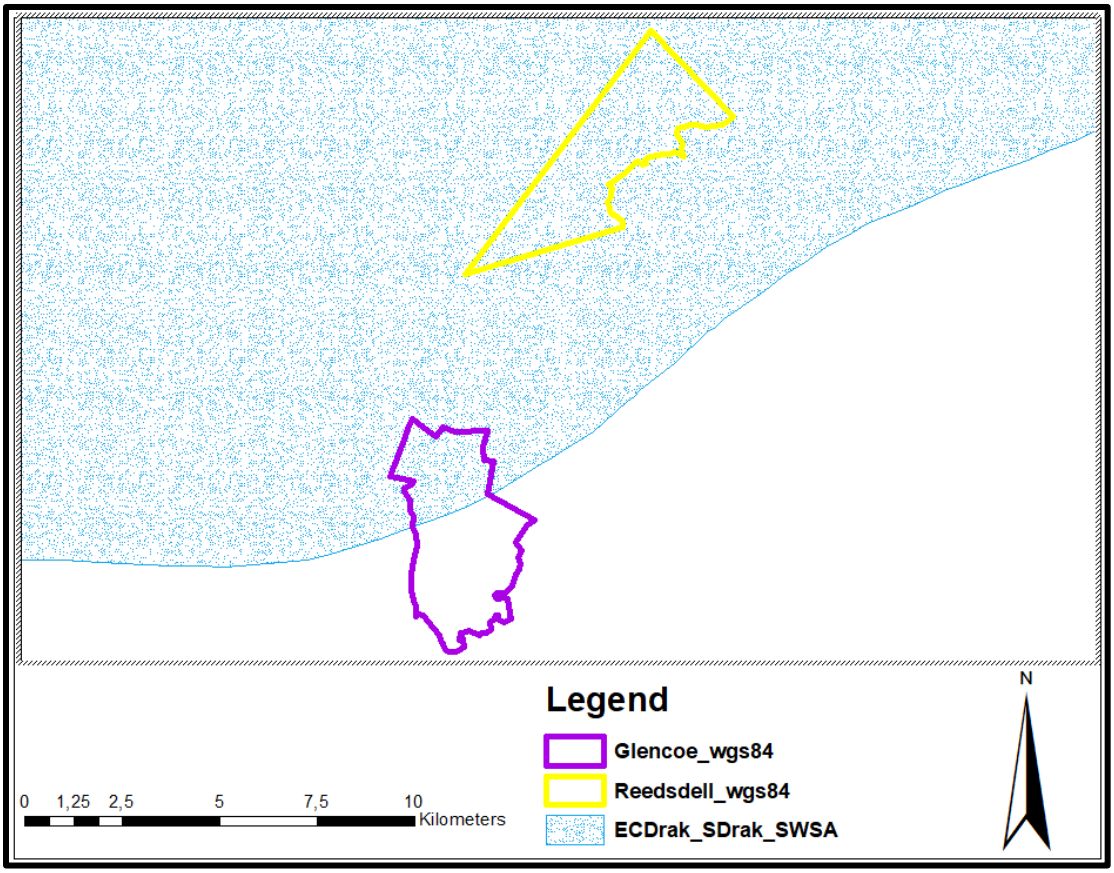


Figure 2.4: Map showing Eastern Cape Drakensburg Strategic Water Source Area (SWSA) for Glencoe and Reedsdell study sites.

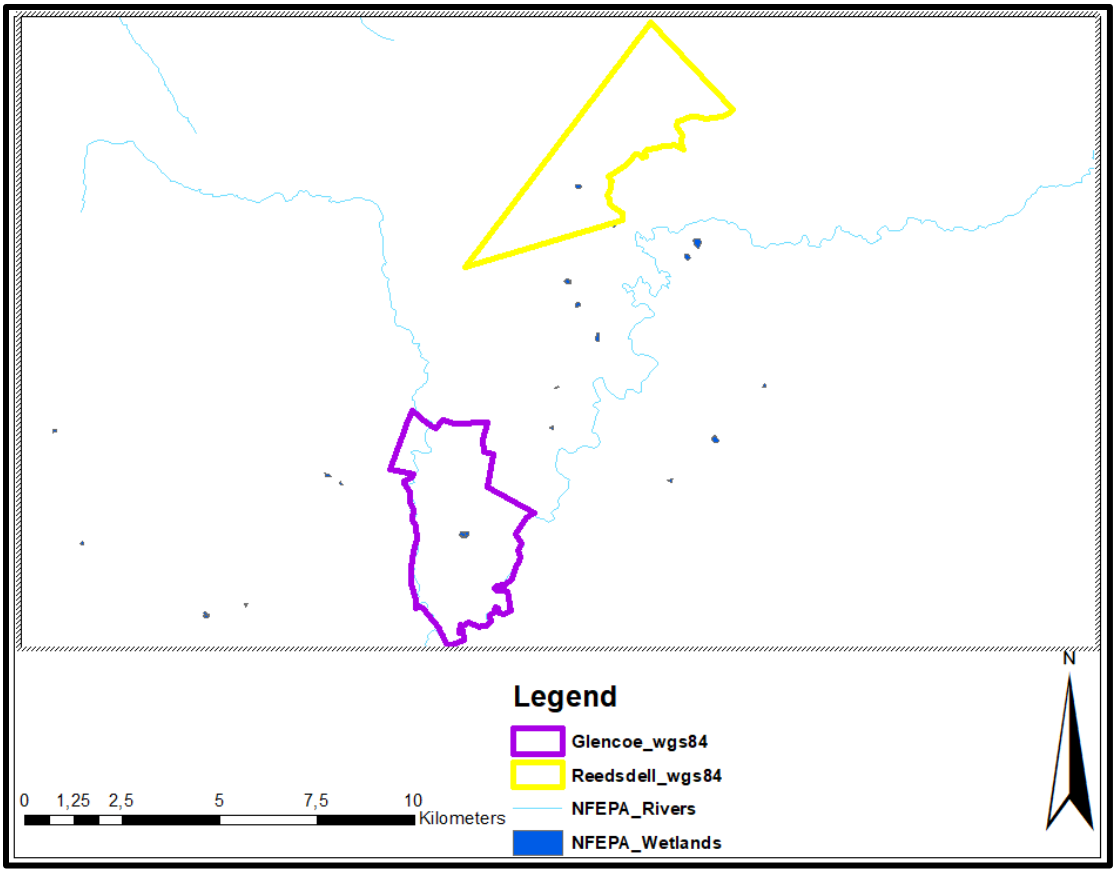


Figure 2.5: Map Showing National Freshwater Ecosystem Priority Areas (NFEPA) for Glencoe and Reedsdell study sites.

2.1.8 Alien and invasive species in the area

Several (**Table 2.2**) invasive alien plant species occur in the area, especially along the rivers, infrastructure, and wetlands. Invasive species tend to spread and colonise new environments, often to the detriment of the environment, human economy, or human health. Therefore, emerging weeds must be controlled while still relatively manageable.

Table 2.2: List of invasive alien plant species recorded in the study area (RSA, 2004).

Common Name	Scientific Name	NEMBA Category
Black Locust	*Robinia pseudoacacia*	1b
Chines Elm	*Ulmus parvifolia*	Unknown
Crack Willow	*Salix fragilis*	2*
English Oak	*Quercus robur*	Unknown
Hawthorn	*Craetaegus laevigata*	Unknown
Loblolly pine	*Pinus taeda*	2
Nassella Tussock	*Nassella trichotoma*	1b
Saligna gum, Rose gum	*Eucalyptus grandis*	2
Silver Wattle	*Acacia dealbata*	2
Spear Thistle	*Cirsium vulgare*	1b
Spear Thistle	*Cirsium vulgare*	1b
Sweet Briar	*Rosa rubiginosa*	1b
White popular	*Populus alba*	2
* No longer listed on NEMBA		

In terms of the National Environmental Management: Biodiversity Act No.10 of 2004 – NEMBA and the Conservation of Agricultural Resources Act No.43 of 1983 – CARA, landowners are required to control and eradicate listed invasive alien species on their land (RSA, 2004; RSA, 2014). NEMBA categorises such plants as category 1a (prohibited), category 1b (prohibited / exempted if in possession or under control), category 2 (permit required) and category 3 (permit required) (RSA, 2004).

2.1.9 Cultural heritage & socio-economic context

In terms of cultural heritage, formal heritage surveys are yet to be conducted in the area. Of particular importance is the presence of several San rock art sites depicting images of eland (*Taurotragus oryx*), other wildlife species and hunters. The long-term persistence of these artefacts is threatened to a degree, seemingly through fires established by sheltering shepherds and natural weathering (SLM, 2017). Considering the rich historical past of the study area it is almost certain that other elements of cultural heritage (i.e., graves, tools, and so forth) may occur within the study area (SLM, 2017).

In terms of the socio-economic context, the study area is located within the Senqu Local Municipality (SLM), which is characteristically rural. Land types range from extensive landholdings utilised for commercial farming purposes to the rural settlement areas of the former Transkei, where dispersed settlements and free-range grazing are the predominant forms of land use (SLM, 2017). Major regional service centres in the SLM are fragmented and include Lady Grey, Barkly East, Sterkspruit, Rhodes Rossouw and Herschel. Pointing to semi-emigration, the estimated population size is subject to a negative growth rate of -0.89%/pa, totalling 134 151 individuals. Africans (97.3%) constitute the greatest component of the SLM population demographics, followed by coloured (1.2%) and white (1.1%). Youth (< 20 years) form the largest profile in the SLM (45.28%) (SLM, 2017).

A major part of the SLM is categorised as non-arable land, with low to moderate grazing potential (37%) or wilderness (43%) (SLM, 2017). However, agricultural enterprises form the greatest contribution (73%) to the domestic economy (SLM, 2017). Stock theft is a major threat in the region, leading farmers to move away from farming with small stock such as sheep to larger stock such as cattle to reduce stock theft. Glencoe and Reedsdell study sites employ four full-time staff members, each with their direct families residing on the properties.

2.2 Materials and Methods

As part of data collection, three methodologies were applied in this study, namely the: Braun-Blanquet technique, the Step-point method and the Biodiversity Site Assessment tool. Due to the spatial extent of the two study sites the timing of each data collection method was implemented over a period of five months, from November 2020 to April 2021 which is the raining season when plant species are easy to identify.

2.2.1. Braun-Blanquet technique

2.2.1.1 Selection of sample sites and sizes

A topographic map which was downloaded from Google Earth-Pro was used as an initial guiding tool to demarcate the different homogeneous units within each study site. The different homogeneous units were then grouped according to their similarities and polygons were created for each of the units and allocated labels as different communities of the two study sites (**Figure 2.6** and **2.7**). For each demarcated plant community unit, sample sites were randomly placed in each stratified polygon with a minimum of three sample plots per community and more sample plots placed for broader communities (Brown *et al*., 2013). The Geographic Positioning System (GPS) coordinates were marked on the google earth image to represent the sample plots and later exported into a handheld GPS device for field navigation. The created polygons and the sample plot's location data were exported as a Keyhole Markup Language (KMZ) file into a Quantum Geographic Information System (QGIS) for further analysis.

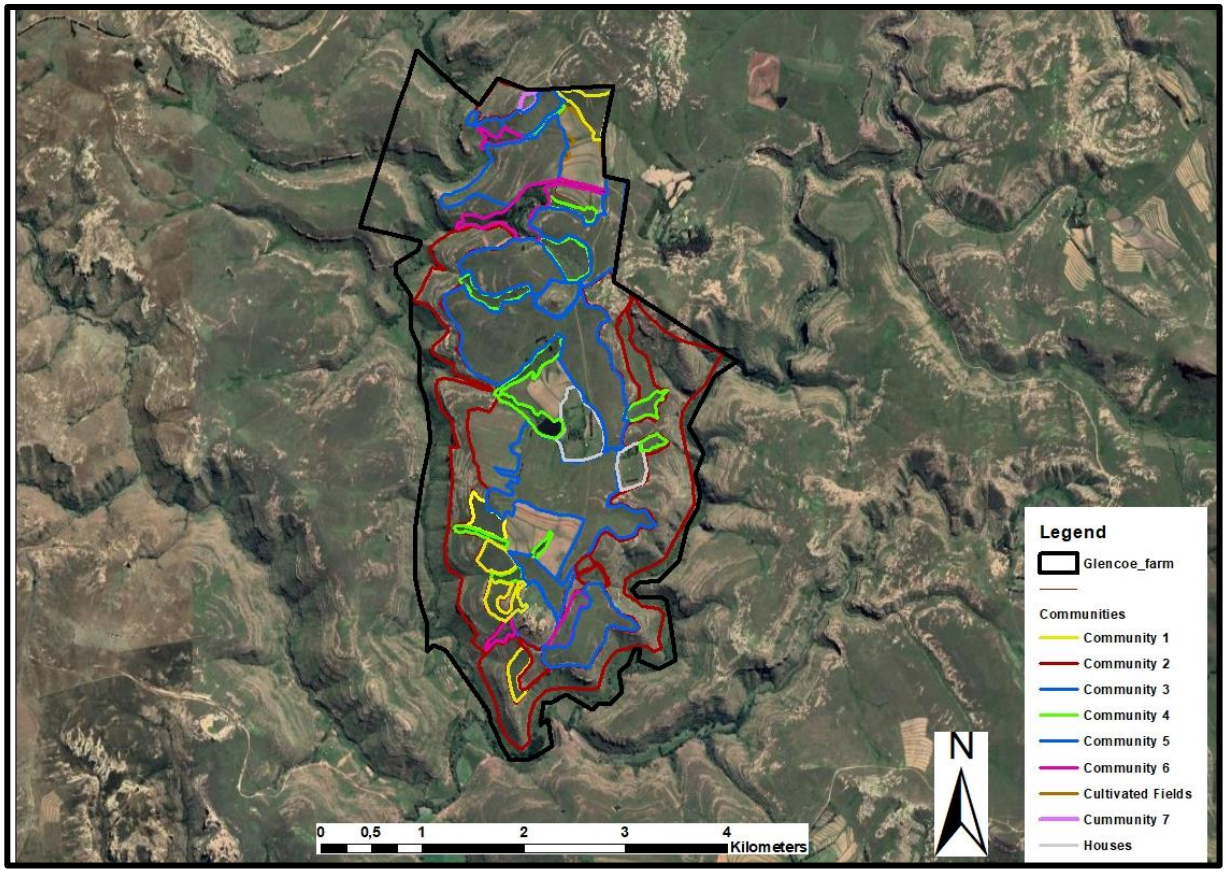


Figure 2.6: Map representing the delineation of different vegetation communities for the Glencoe study site.

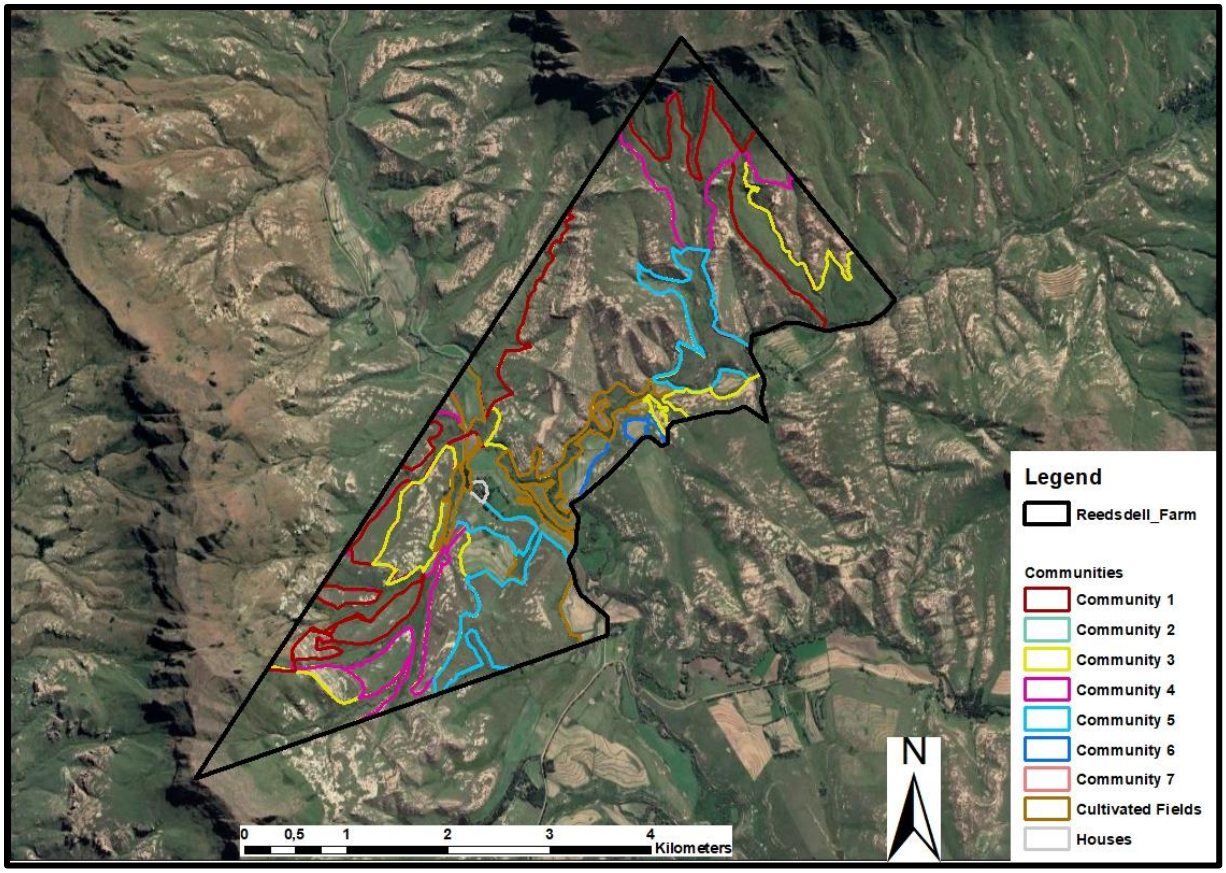


Figure 2.7: Map representing the delineation of different vegetation communities for the Reedsdell study site.

Different plot sizes are recommended for homogeneous vegetation. Westhoff & Van der Maarel (1979) suggest plot sizes for various vegetation types such as those found in the study area: 2 x 2 m for wetlands, 4 x 4 m for open grasslands and 10 x 10 m for woodlands. For this study, 10 x 10 m plots were randomly placed at representative areas for data collection due to the occurrence of woody plants.

2.2.1.2 Data sampling procedure

The mapped homogeneous units and sampling plots were then verified infield to ensure their similarities and allocations in different communities. In cases where the homogeneous unit identified from Google Earth-Pro did not match the actual homogenous representative vegetation

stand in the field, those sampling plots were moved to the nearest location that was representative of the vegetation stand (Westhoff & Van der Maarel, 1978; Brown *et al*., 2013). Sampling plots that were randomly placed on the stratified homogenous units were navigated to in the field using a GPS. A 50 m rope marked with a brown-tape at 2 m intervals was used to demarcate each sampling plot (Werger, 1992). Wooden sticks were used as pegs to mark the four corners of each sample plot.

A sampling data collection sheet (**Appendix 3**) was created and printed out for data recording purposes. Various information was collected and recorded at each sample plot; this information included: Plot number (recorded in sequence for each site starting from number 1); Soil type (determined through wetting the soil using water and using the hand to create a bolus of soil that will be assessed for texture class –**Table 2.3** (Sally *et al*., 2018); GPS Coordinates (using a handheld GPS); Slope (using a built-in App - Digital Compass on the researcher's mobile phone); Aspect (using a built-in App - Digital Compass on the researcher's mobile phone); Altitude (using a built-in App – GPS Altitude on the researcher's mobile phone). Erosion percentage (through an estimation scale in **Table 2.4** (Laker, 2004); Rockiness (estimating the percentage cover of rockiness –**Table 2.5**); Signs of animal (visual observation of trampling and grazing activities, visual spotting of game, and presence of faecal deposits). General remarks for any other observation were recorded based on the sample site and its surrounding area. The date of data collection as well as data collectors' information was recorded. A camera was used to take pictures of all sample plots and unidentified plants species for later identification.

Sandy soils are made up of loose and single grained particles. These single grains are easily seen and felt with the use of a hand (Dubbin, 2001). They fall apart if after being realised if squeezed by hand when dry, whereas they form a cast or hold together when squeezed while moist, however, they crumble when touched (Dubbin, 2001).

Loam soils are made up of a mixture of different grades of clay, silt, and sand. They are relatively smooth, with a little bit of stickiness and somewhat plastic. It tends to turn water cloudy when

placed in it. They can be handled without breaking while moist and in the form of a cast (Dubbin, 2001).

Sandy loam soils are weak in aggregates, and they contain about 45%-85% of sand, however, they contain enough silt and up to 20% clay, this makes it slightly coherent (Dubbin, 2001). Through a use of a hand, the single sand grains can be felt. Similar, to sandy soil, when squeezed by a hand when dry it falls apart, but when moist it forms a cast that require careful handling without breaking. Just like loam soil it tends to turn water cloudy when placed in it (Dubbin, 2001).

Table 2.3: A table representing the soil texture classes and descriptions (Laker, 2004).

Texture class	Bolus* formation – the way the soil feels, and the type of ribbon formed when manipulated by hand.	Estimated clay content
Sand	Zero to slight coherence; cannot be moulded; single sand grains stick to fingers.	< 5%
Loamy sand	Slight coherence: can be sheared between thumb and forefinger to give minimal ribbon of about 5 mm.	~5%
Clayey sand	Slight coherence; sticky when wet; many sand grains stick to fingers; discolours fingers with clay stain; will form a minimal ribbon of 5 – 15 mm	5 – 10%
Sandy loam	Bolus is coherent but very sandy to touch; dominant sand grains are of medium size and are readily visible; a ribbon of 15 – 25 mm	10 – 20%
Loam	Bolus is coherent and rather spongy; no obvious sandiness or silkiness; will form a ribbon of about 25 mm	~25%
Sandy clay loam	Strongly coherent bolus; sandy to touch; a ribbon of 25 – 40 mm	20 – 30%
Clay loam	Coherent plastic bolus; smooth to manipulate; will form a ribbon of 40 – 50 mm	30 – 35%
Clay loam, sandy clay	Coherent plastic bolus; sand grains visible in finer matrix; sandy to touch; a ribbon of 40 – 50 mm	30–35%

Table 2.4: Modified soil classification scale (Laker, 2004).

Scale	Percentage	Description
1	0 – 25%	Slight
2	25 – 50%	Moderate
3	50 – 75%	Intense
4	75 – 100%	Severe

Table 2.5: Modified semi-quantitative surface rockiness cover scale (Laliberté, Paquette, Legendre, & Bouchard, 2009).

Scale	Percentage
1	≤1%
2	1 – 5 %
3	5 – 15%
4	15 – 25%
5	25 – 50%
6	50 – 75%
7	≥75%

In each sample plot, all plant species (tree, shrub, forb, and grass species) present were identified and recorded (Newman, 1983; Greene, 2008; Boon, 2010; Van Oudtshoorn, 2012). The modified Braun-Blanquet cover-abundance scale (**Table 2.6**) was used to estimate the cover-abundance of each species occurring at each sample plot (Mueller-Dombois & Ellenberg, 1974; Westfall, 1981). Data of all woody species occurring within the 10 x 10 m sample plots was collected. The species names were recorded, and the woody stratum was divided into three classes, namely: Lower (0-1 m), Middle (> 1-3 m) and upper classes (> 3 m) (Brown & Bredenkamp, 1994). Edwards (1983) guidelines were employed to distinguish trees and shrubs.

Table 2.6: Modified Braun-Blanquet cover-abundance scale (Mueller-Dombois & Ellenberg, 1974; Westfall, 1981).

Scale	Description
r	One individual with a very small cover percentage
+	Present, but not abundant with a crown cover of less than 1% of the plot
1	Present, but not abundant with a crown cover between 1% and 5% of the plot
2a	Present, but not abundant with a crown cover between 5% and 12% of the plot
2b	Present, but not abundant with a crown cover between 12% and 25% of the plot
3	Present, but not abundant with a crown cover between 25% and 50% of the plot
4	Present, but not abundant with a crown cover between 50% and 75% of the plot
5	Present, but not abundant with a crown cover between 75% and 100% of the plot

The Plant-Net Cell phone App was also used to verify some of the identified plant species. Most species were identified on-site. Unidentified plant species were put into a plant press, a photo of each was taken and a field name allocated (As specimen and sample plot number – Plant A1, which is the first plant specimen in Community A) for later identification. Some of the specimens were identified with the assistance of local botanists and the South African National Biodiversity Institute (SANBI) CREW unit.

A total of 59 plots were sampled at the Glencoe study site and 57 at the Reedsdell study site. An overall total of 116 sample plots were surveyed for the total study area (**Figure 2.8 & 2.9)**.

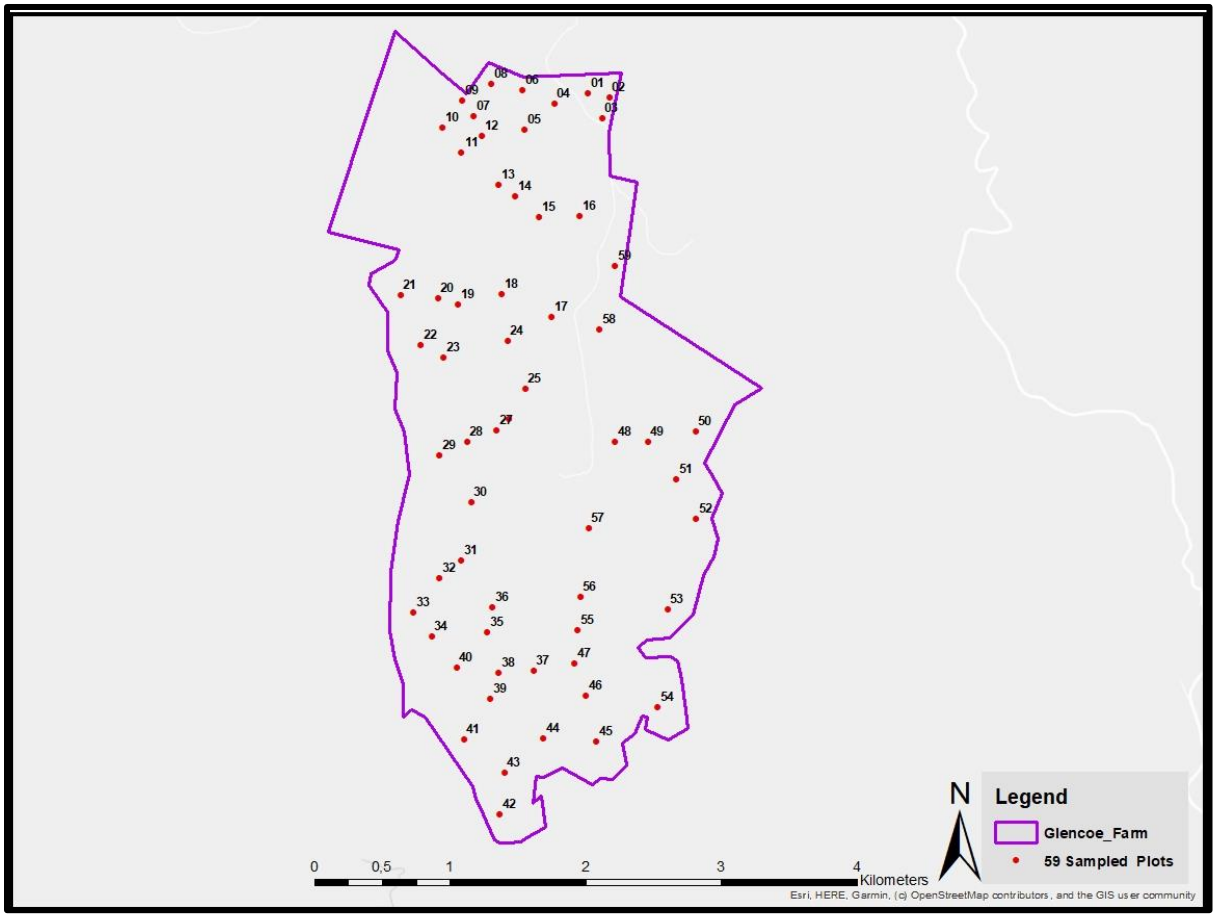


Figure 2.8: Locality map of the 59 randomly placed sample plots in the Glencoe study site.

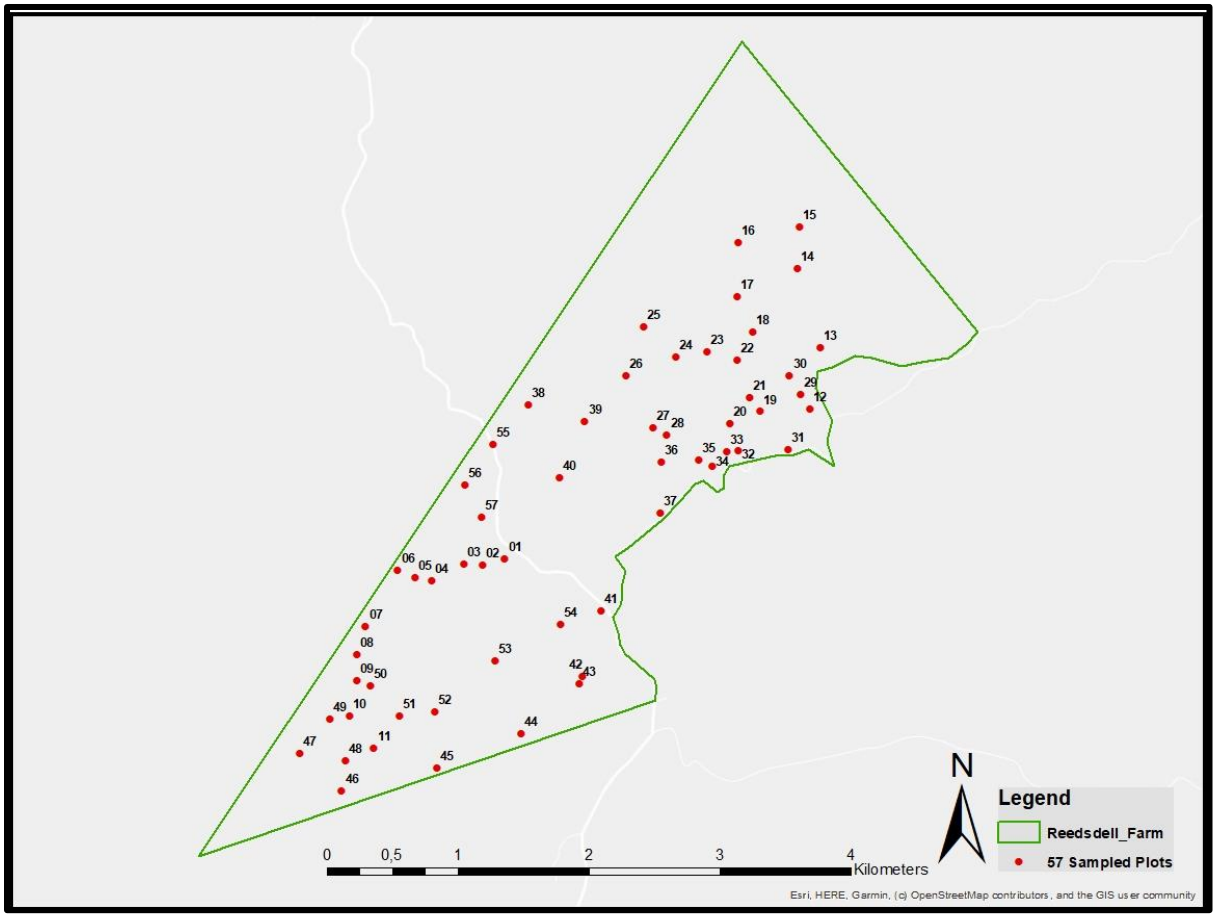


Figure 2.9: Locality map of the 57 randomly placed sample plots in the Reedsdell study site.

2.2.1.3 Vegetation classification data analysis

Data was formatted into an Excel spreadsheet and imported into the JUICE 7.1 program (Mueller-Dombois & Ellensberg 1974; Tichy 2002). The data was later exported as a 'csv' file into the JUICE 7.0 software package for editing and analysis of phytosociological data (Tichy, 2002). The first approximation of plant communities was classified using a modified TWINSPAN (Rolecěk *et al*., 2009). Pseudo-species cut levels of Whittaker's beta diversity were set at 0–5–15–25–50–75 and the dissimilarity figures were set between 160 and 24 and placed in the different clusters (Whittaker, 1977). TWINSPAN measures the aspects of heterogeneity of the clusters and the type of fidelity measure. The *phi*-coefficient of association based on the presence and absence of species and not on cover-abundance data was used. The physiological table was compiled from the JUICE program for the interpretation of the different plant communities (Westhoff & Van der Maarel, 1978).

The Braun-Blanquet procedures were employed to further refinement of the phytosociological table to indicate the different plant communities and possible variants based on the species that are shared. A species list of all the floristic data of the study areas was compiled.

2.2.1.4 Naming and describing plant communities.

To name the different plant communities identified for the study area, the first name of the plant community was based on the name of the dominant plant species found in each of the classified plant communities and the second name was based on the plant that dominates the structure in the community (Brown *et al*., 2013). The sub-communities' names were based on the main plant community names followed by the characteristic or dominant species for that sub-community (Weber, Moravec, & Theurillat, 2000).

Plant communities were based on guidelines stated by Brown *et al*., (2013) that the locality and habitat (soil, land type, geology, rock cover, altitude, erosion) of the area must be included in the description, followed by the characteristic species as reflected on the phytosociological table.

Prominent and conspicuous species were included in the descriptions of the plant communities in terms of their percentage cover, growth form as well as all other information collected during field surveys based on visual observations. Desktop QGIS software was used to produce the vegetation maps of the two study sites.

To determine species diversity and species evenness, Shannon-Wiener index of diversity – '*H*' was employed. In the same way, Shannon Equitability Index – 'E_H' was used for calculating species evenness. For both species' diversity and evenness, the frequency data of top ten species were selected for calculations. Species diversity is a mathematical measure of species diversity in a community based on species richness, which is a number of species present and species abundance, which is the number of individuals per species. Whereas species evenness is a mathematical measure of how similar the abundances of different species are in the study area. A higher *H'* value represents higher diversity of species and a lower *H'* value represents lower diversity of species. The Shannon Equitability Index values ranges from 0 to 1, where 1 would represents complete evenness of species within the study area (Statology, 2021).

2.3 Ecological index method

As recommended by Foran, Tainton & Booysen (1978), the Ecological Index Method (EIM) was applied to determine the veld condition of the two study sites, Glencoe and Reedsdell. A minimum of 300 step-point surveys at one step interval was completed for each representative and homogeneous vegetation unit (Mentis, 1884; Van der Westhuizen *et al*., 2001). De Wet (2015) stated that the step-point method could be adapted for use in a variety of vegetation types. It is an ecologically based method and one of the recommended methods to be applied in conservation and farming areas. Its basis is the assumption that defoliation is the key environmental factor that has an effect on the succession stages of grass species and that plants species respond equally to the impact of defoliation (Foran *et al*., 1978). It is for this reason that the step-point method was adopted to determine the veld condition of the Glencoe and Reedsdell study sites.

2.3.1 Sampling procedure

A 2 m-long stick was used to determine whether the recorded herbaceous plant was a 'hit' or a 'miss' (a 'hit' was recorded where a stick touches the grass rootstock and a 'miss' was recorded where no rootstock was touched by the stick). The closest or hit herbaceous plant was identified and recorded accordingly at each step taken (Van Rooyen, Bredenkamp & Theron, 1991). In the case where no herbaceous plant was found within a 25 cm radius of the stick, it was considered and recorded as a 'bare' patch, and the nearest plant recorded as well.

A field data collection sheet was developed and used to record all identified grass species (**Appendix 4**). A total of 3 300 step-points data were recorded at the Glencoe study site and 3 500 at the Reedsdell study site. An overall total of 6 800 step-point data was surveyed for the study area.

2.3.2 Veld condition assessment data analysis

Using the step-point data, all grass species were grouped into the different ecological classes of Decreaser and Increaser species (Tainton 1999; Bothma, 2002). The ecological classes were used for multiplying species cover or composition (%) with the following index values: Decreaser = 10, Increaser 1 = 7, Increaser II = 4, Increaser I and forbs = 1 (Tainton, 1999; Bothma, 2002). Decreasers are species that are dominant in a good veld, Increaser I are species that increase when the veld is underutilised, Increaser II are species that increase when the veld is over utilised, and the Increaser III are species that increase with selective grazing (Tainton, 1999). All herbaceous species recorded in the study area were grouped according to the ecological classes and assigned relative index values.

The Veld Condition Score (VCS) was calculated by multiplying the frequency of each species by the relative index value assigned to it based on the ecological group. According to Bothma (2002), if the VCS is less than 40%, the veld is considered to be in a poor condition; if the VCS is between

40% and 60%, the veld is considered to be in a moderate condition, and if the VCS is above 60%, then the veld is considered to be in a good condition.

2.3.2.1 Grazing value, plant succession and palatability

Collected grass species were further classified according to their grazing value and palatability status. Grazing value was defined by Van Oudtshoorn (2012). The field guide to grasses of southern Africa were used to determine the grazing value, plant succession class and palatability (Van Oudtshoorn 2012).

The grazing value refers to the quality and quantity of the material produced by grasses for grazing. This is because some grasses are palatable, and some are not palatable. The palatable grass species obtains more fertilizer from the grazing animals and gains extra sunlight levels. Non-palatable grasses are not preferred for grazing. The grazing value is classified in three classes, high grazing value, average grazing value and low grazing value.

Van Oudtshoorn (2012) defines plant succession as the progressive succession of plant succession. When a disturbance occurs in a plant community, the plant community is re-occupied by new adaptable plant species, which then improves the condition of the area for growth. Once the condition of the area improves, another plant community takes over and replaces the existing community. Similarly, to the grazing value, it is classified in three classes: a pioneer grass, a subclimax grass, and a climax grass. Pioneer species are species that are hardened annual plants and they are capable of growing in very unfavourable conditions, with an ability to create favourable conditions for other species, subclimax species are species that are classified as denser than pioneer species, these species tend to offer protection to the soil and climax species are classified as strong perennial plants adapted to normal optimal growth conditions, (Van Oudtshoorn, 2012).

Palatability refers to the acceptability of grass for grazers, faunal species prefers to palatable grass species, and they graze palatable grass species first before moving to the unpalatable grass species

(Van Oudtshoorn, 2012). It is classified in two classes, the palatable grass species, and non-palatable grass species. The grazers mostly prefer the palatable grass species over non- palatable grass species. According to Galt *et al.,* (2000) the grazing capacity is considered to be the average number of animals that an area can accommodate over a period of time without resulting in the deterioration of the vegetation or animal production and is based on the stocking rate that the property can sustain.

2.4 Biodiversity site assessment

A biodiversity site assessment was conducted to determine the biodiversity value, the different vegetation types, and the protection status of the two study sites, the Glencoe and Reedsdell study sites, in relation to the Biodiversity Stewardship Programme within the North Eastern Cape Grasslands Priority Site. The two study sites were selected because they fall within the North Eastern Cape Grasslands priority area for the Biodiversity Stewardship Programme and based on the fact that landowners have indicated willingness to have their properties declared as protected areas. The Biodiversity Site Assessment Tool was developed by a group of Ecologists in the Eastern Cape and was endorsed by the ECPTA for use to evaluate the biodiversity value of all Biodiversity Stewardship Site to determine if they qualify to be declared as a Protected Area or not (**Appendix 5**).

Every province in South Africa has its own vegetation type's protection status and set targets data that feed into the national vegetation type's protection and set targets data that is frequently updated as new protected areas are declared for formal protection (SANBI, 2018; Wright, Stevens, Marnewick, & Mortimer, 2018). The updated Eastern Cape Province data for vegetation type's protection status was used to determine the protection status of each vegetation type occurring within the two study sites (ECPTA, 2016).

According to Bowles-Newark, Arnell, Butchart, & Chenery (2014), a biodiversity assessment refers to the state of biodiversity at the ecosystem, species, or genetic level. The biodiversity assessment focus in this study was on the assessment of the biodiversity value across the two study

areas. In addition, the biodiversity site assessment on this study focused on identifying and determining the extent to which the composition, structure and function of an area or biodiversity feature have been modified, varying from areas that remain in a natural or near-natural condition to those that are severely or irreversibly modified (Bowles-Newark *et al*., 2014).

As recommended by ECPTA (2013), the relevant biodiversity information was collected from the study sites to justify their inclusion in the protected area network and determining their specific purpose to be conserved or considered for conservation. The biodiversity site assessment tool (**Appendix 5**) was used to collect and provide information regarding the significance of the two study areas. The biodiversity site assessment tool was used to determine each property's contribution to the national and provincial set targets for vegetation types, species, ecological processes, and ecosystem services (ECPTA, 2013). The information or data collected during the biodiversity site assessment guide the development of the Protected Area Management Plans for each property.

2.4.1 Biodiversity assessment data analysis

The biodiversity site assessment was achieved by using both desktop and field verifications to determine percentages of vegetation types of contribution towards protected areas network acquired from the study area. The biodiversity site assessment tool allowed for the measurement of vegetation types of percentages' contribution to the provincial set target and vegetation protected area status in the country.

The following aspects were verified using the biodiversity assessment tool as part of data collection:

- Biodiversity Plans - verification and scoring were done to determine whether the systematic biodiversity plan has identified the site as falling within a Critical Biodiversity Area (CBA). The Eastern Cape Biodiversity Conservation Plan (ECBCP) was loaded on the QGIS tool to determine the critical biodiversity category of each property (Berliner &

Desmet, 2007). The national freshwater priority areas layer was used to determine if each property falls within the Freshwater Ecosystem Priority Area (FEPA) or not.

- Species – verifications and scorings were done to track whether threatened or range-restricted species occur in the study areas. Several species data sources were used to obtain the list of species of special concern. The latest IUCN species protection status was used, and all listed species were indicated accordingly (IUCN, 2018). The South African Bird Atlas Project 2 (SABAP2) was used for bird species, the SA Red List and Animal Demography Unit (ADU) was used for mammal species, SANBI species database was used for flora species and the Animal Demography Unit was also used for reptiles, lepidoptera and amphibian's species. Infield, confirmation was then undertaken to confirm if the species obtained from the various species data sources were still present in the study areas. Visual observations were used in the field and species of special concern were identified and recorded accordingly. Binoculars were used for bird species identification together with various field guidebooks (Newman, 1983).
- Ecological processes – As part of determining the habitat heterogeneity of each site, the latest vegetation type layer was consulted and overlayed on each property using the QGIS (Mucina, Rutherford, & Powrie, 2006; Rutherford, Mucina, & Powrie, 2012). Vegetation maps were then produced for each study site and infield verifications were conducted to verify if the desktop assessments were true reflections of the habitat heterogeneity.

To determine the importance of sites for climate change resilience, the climate change resilience areas shapefile was used and loaded on to QGIS (Skowno, Holness & Jackelman, 2012; Holness, Skowno, & Balfour, 2016). Climate Change resilience maps were then produced for each site and infield verifications were conducted to verify if the desktop assessments were true reflections of the climate change resilience.

To determine if the sites were of strategic value as a buffer to protected areas or as protected areas consolidation or expansion area for Eastern Cape Parks and Tourism Agency, the ECPTA's Protected Areas Expansion Layer together with the SA's Protected Areas Layer were consulted

and loaded into the QGIS (ECPTA, 2016). Relevant maps were produced accordingly, and infield verifications were conducted to confirm the desktop assessments.

- Ecosystem goods and services – The field observations were used to determine the importance of sites in terms of the occurrence of provisioning services as a result of the natural systems. Provisions such as clean water production, water purification (wetland function), food, medicinal plants, harvesting of plant material, grazing, pollination, and animal harvesting were verified through infield inspections and interviews with the Landowners. Other services like regulating services and cultural services were also verified.
- Threats – any existing threats to the biodiversity were identified through field assessments and interviews with the Landowners. All threats identified were listed accordingly on the assessment sheet and the scale of high, moderate, low or none was used to rate the level of significance of each biodiversity threat on site. Biodiversity threats like invasive alien plants, poaching / illegal harvesting, fire, accelerated soil erosion, extra-limital / alien animal, land invasion, mining, water abstraction, pollution, and uncontrolled access were verified.
- Management issues and partnership opportunities development were determined through interviews with all Landowners and the findings recorded accordingly into the assessment sheet for each property.
- Land claims – land claims status verification status for each study site were verified through the Eastern Cape Land Claims Commissioner in the form of a written letter and the outcomes were recorded accordingly on the assessment sheet.

Chapter 3: Results on Vegetation Classification

3.1 Vegetation classification for Glencoe study site

A total of 156 different plant species for the Glencoe study site (**Appendix 6**) was recorded and two major plant communities (**Figure 3.1**), three sub-communities and four variant communities (**Figure 3.2**) were classified (**Table 3.1**).

1. *Schoenoplectus corymbosus – Juncus effusus* wetland community.
2. *Eragrostis chloromelas – Scirpus ficinioides* open grassland.

2.1 *Eragrostis chloromelas – Scirpus ficinioides–Pennisetum thunbergia* wetland.

2.2 *Eragrostis chloromelas – Scirpus ficinioides–Microchloa caffra* open grassland.

- 2.2.1 *Eragrostis curvula* variant community.
- 2.2.2 *Eragrostis plana* variant community.
- 2.2.3 *Leucosidea sericea* variant community.
- 2.2.4 *Cymbopogon caesius* variant community.

2.3 *Eragrostis chloromelas – Scirpus ficinioides– Carex cognata* disturbed shrubland.

Species Group J: These are companion species which do not have significance based on their partial occurrences in all the relevés. These species were moved to the bottom of the table where they were listed in sequence as per the different communities grouping.

Eragrostis chloromelas, Scirpus ficinioides, Lobelia erinus, Microchloa caffra, Eragrostis capensis, Loudetia simplex, Themeda triandra, Harpochloa falx, Elionurus muticus, Trachypogon spicatus, Tristachya leucothrix, Koeleria capensis, Eragrostis curvula and *Searsia divaricate* are the common species across all relevés and mostly found in plant community 2 (**Table 3.1**). Two forb species: *Scirpus ficinioides* and *Lobelia erinus*, were recorded, while the rest of the plants were grass species. The dominance of grass species supports the fact that the study site is located within a Grassland Biome as identified by Skowno *et al*. (2012).

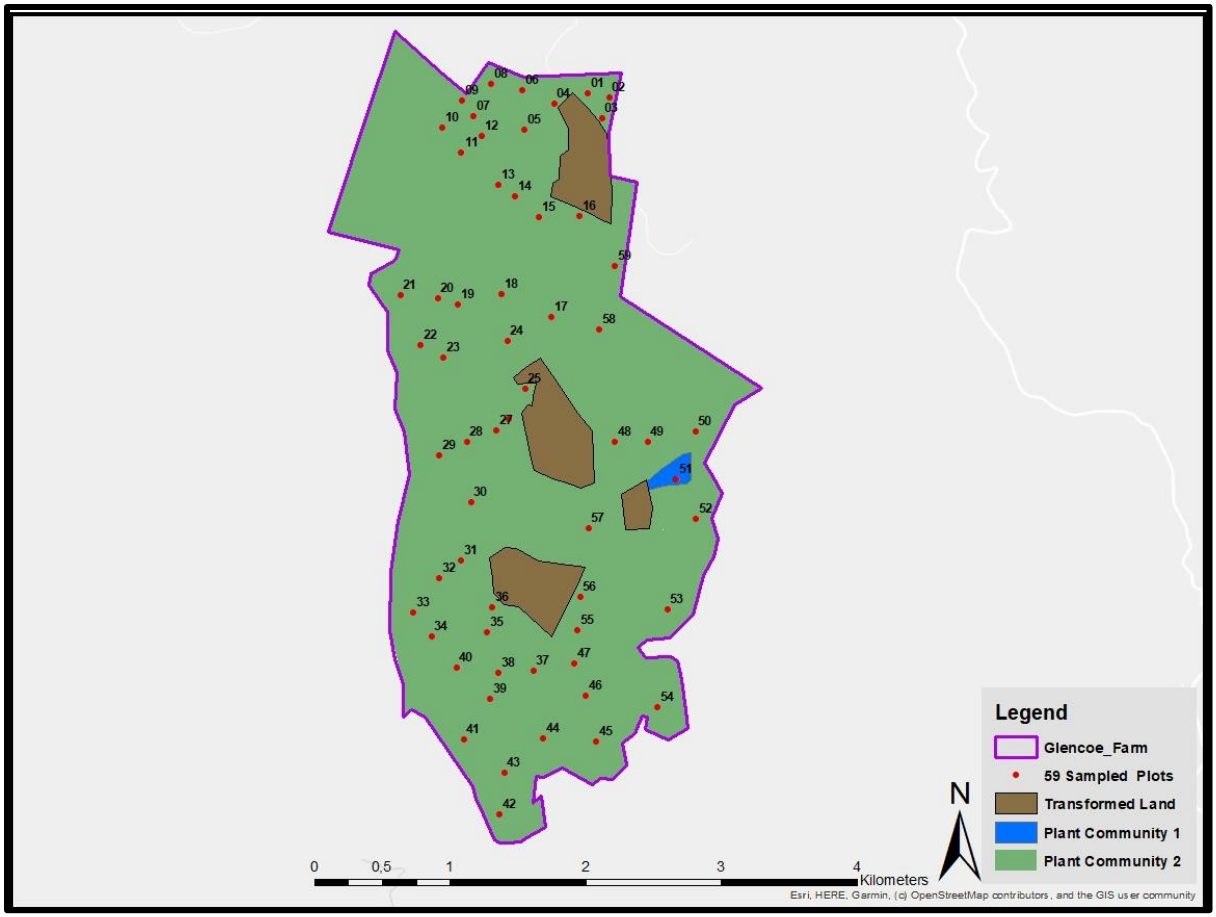


Figure 3.1: Output map indicating major plant communities in the Glencoe study site.

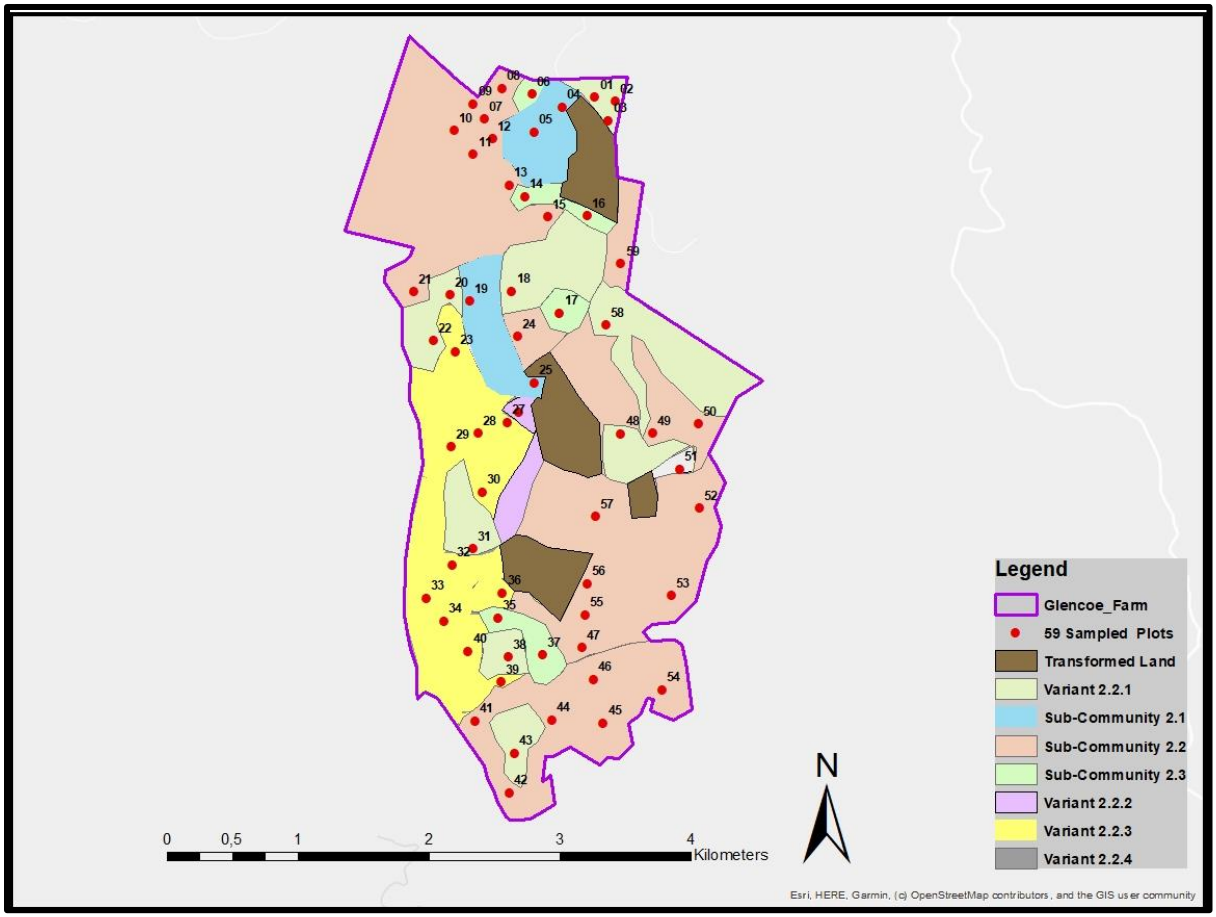


Figure 3.2: Output map indicating sub-communities and variants in the Glencoe study site.

Table 3.1: The phytosociological table of the Glencoe study site.

	Relevés 59	5	2			1	3	1	1	1	4	3	1	2	4		2	5						5	2	4	5	5	4	5	4	5	4	3	5	2	3	5	4	4	2	3	3	1	2	2	1	2	4	5	4	3	3	2	3	1	3	1	1	
		1	5	5	4	9	8	5	3	1	3	1	8	2	8	7	0	8	2	3	9	8	1	6	6	6	9	4	7	7	9	2	5	0	5	9	9	0	0	4	4	2	3	2	7	1	0	8	2	3	1	6	4	3	7	4	5	6	7	6
	Species 156																																																														
	Communities	1	2																																																											
	Sub-communities		2.1				2.2																																																			2.3						
	Variants						2.2.1																		2.2.2 and 2.2.3									2.2.4																														
	Species Group A - Diagnostic species of the *Schoenoplectus corymbosus - Juncus effusus* Community (1)																																																													
1	*Schoenoplectus corymbosus*	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	*Juncus effusus*	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.
3	*Cyperus marginatus*	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Species Group B - Diagnostic species of the *Eragrostis chloromelas - Scirpus ficinioides* Community (2)																																																												
4	*Eragrostis chloromelas*	.	3	.	.	+	.	1	1	.	+	.	2	.	+	.	2	2	1	3	5	.	.	5	4	1	3	4	2	1	1	1	+	2	2	2	.	+	+	.	5	5	2	2	.	5	.	3	.	.	.	.	1	4	3	2	+	.	2	4
5	*Scirpus ficinioides*	.	5	5	5	4	1	.	+	.	.	+	3	1	.	1	+	+	2	2	.	+	.	+	1	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
6	*Helichrysum auriomiten*	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	2	.	.	.	.	.	2	1	.	.	+	.	1	.	.	.	.	+	2	2	.	1	.	.	.	1	.	+	.	.	.	.	.	.	2	.	+	.	.	.	.	.	.
7	*Lobelia erinus*	.	.	.	.	1	.	.	.	2	.	.	+	.	.	.	+	1	.	.	.	.	.	+	+	+	+	.	+	1	.	.	.	.	1	1	+	+	+	.	+	+	+	.	1	+	.	+	.	.	.	.	.	1	+	.	.	.	.	.
8	*Fuirena hirsuta*	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9	*Felicia muricata*	.	.	.	.	r	.	.	.	.	.	.	.	+	.	.	+	.	.	r	.	.	.	.	.	.	2	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1
10	*Setaria incrassata*	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	1	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
	Species Group C - Diagnostic species of the *Eragrostis chloromelas - Scirpus ficinioides - Pennisetum thumbergii* Sub-Community (2.1)																																																												
11	*Pennisetum thunbergii*	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12	*Senecio glaberrimus*	.	.	.	.	3	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
13	*Populus canescens*	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	*Helichrysum splendidum*	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
15	*Bolboschoenus maritimus*	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
16	*Arundinella nepalensis*	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	*Abrus laevigatus*	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18	*Fingerhuthia africana*	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
19	*Senecio lividus*	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.
20	*Epilobium ciliatum*	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
21	*Rumex salicifolius*	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22	*Bromus catharticus*	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.
23	*Pennisetum sphacelatum*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	*Ranunculus acris*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Species Group D - Diagnostic species of the *Eragrostis chloromelas - Scirpus ficinioides - Microchloa caffra* Sub-Community (2.2)																																																												
25	*Microchloa caffra*	.	.	.	.	.	.	5	5	.	+	.	3	.	5	5	3	5	3	2	4	4	4	.	.	.	1	.	.	+	.	.	.	.	.	.	+	.	.	3	.	.	.	.	.	1	.	.	.	.	.	.	3	.	.	.	.	.	.
26	*Eragrostis capensis*	.	.	.	.	.	3	1	3	+	4	1	4	.	2	4	2	+	1	.	2	2	1	+	1	3	+	.	.	+	.	+	.	5	+	+	+	+	.	+	+	+	+	.	.	.	.	+	.	+	.	+	+	1	.	.	.	.	.	.
27	*Loudetia simplex*	.	.	.	.	.	4	.	.	3	.	+	3	.	.	.	2	+	.	.	1	.	.	+	.	5	.	4	4	4	.	2	2	.	3	+	4	+	2	3	.	.	+	.	.	.	.	2	2	2	3	2	2	.	.	.	.	.	.
28	*Themeda triandra*	.	.	.	.	.	+	.	.	+	+	1	.	+	.	.	.	.	+	2	.	+	.	.	.	.	.	+	.	.	.	3	1	+	+	3	1	+	1	.	.	+	2	r	+	.	.	4	5	1	4	+	4	.	.	.	.	.	.
29	*Harpocloa falx*	.	.	.	.	.	+	1	4	4	+	+	+	2	+	3	.	+	4	3	.	+	4	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	+	.	.	.	.	2	2	+	.	.	+	+	.	.	.	.	.	.	.
30	*Elionurus muticus*	.	.	.	.	.	.	2	1	.	.	2	2	2	.	2	3	1	.	+	3	3	.	4	.	1	1	+	+	3	.	+	.	4	1	.	.	+	.	+	1	+	2	.	.	+	1	+	.	+	+	4	.	1	.	.	.	.	.
31	*Trachypogon spicatus*	.	.	.	.	.	2	.	.	.	.	.	.	.	2	.	.	1	.	.	.	.	.	+	.	4	+	+	3	2	.	+	.	.	+	.	+	+	+	+	.	+	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.

32	*Tristachya leucothrix*	.	.	.	.	.	2	r	2	.	2	3	.	+	.	2	.	.	2	+	.	1	1	.	.	.	.	.	.	.	.	2	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	4	+	4	+	.	.	.	.	.	.	.
33	*Koeleria capensis*	.	.	.	.	.	.	.	.	2	+	.	.	4	.	2	.	+	4	.	.	.	3	+	.	.	+	+	2	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	2	+	1	.	.	+	+	.	.	.	.	.	.	.	.	.
34	*Artemisia stelleriana*	.	.	.	.	.	.	2	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	+	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
35	*Helichrysum pallidum*	.	.	.	.	.	2	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	r	.	.	+	1	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.
36	*Sebaea filiformis*	.	.	.	.	.	1	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.

Species Group E - Diagnostic species of the Eragrostis *curvula* Variant (2.2.1)

37	*Eragrostis curvula*	.	.	.	.	.	.	.	.	4	+	.	.	1	.	.	2	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	2	.	.	1	2	.	+	.	+	.	2	.	.	.	+	.	.	+	.	2	+	2	1	.
38	*Helichrysum chionosphaerum*	.	.	.	.	.	.	.	3	.	.	.	.	.	.	2	.	.	+	3	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
39	*Leersia hexandra*	.	.	.	.	.	.	.	.	1	.	.	.	4	.	.	.	.	.	.	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
40	*Eragrostis racemosa*	.	.	.	.	.	.	.	.	.	1	.	.	.	+	.	.	+	.	2	.	+	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
41	*Helichrysum nudifolium*	.	.	.	.	.	.	2	1	.	.	.	.	.	.	.	.	.	r	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42	*Searsia divaricata*	.	.	.	.	.	.	.	.	2	.	.	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	r	1	+	+	+	.	+	.	.	.	.	2	.	.	.	+	.	1	+	.	.	.	.	.	.
43	*Scleria angusta*	.	.	.	.	.	.	.	.	.	+	.	.	1	.	2	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	.	.	.	.	.
44	*Chrysocoma oblongifolia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
45	*Cyperus obstusiflorus*	.	.	.	.	.	.	+	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
46	*Senecio ulopterus*	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
47	*Cyperus semitrifidus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
48	*Hypoxis acuminata*	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	r	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49	*Haplocarpa scaposa*	.	.	.	.	.	.	.	.	.	1	+	.	.	.	+	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
50	*Crassula vaginata*	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
51	*Helichrysum cephaloideum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Species Group F - Diagnostic species of the *Eragrostis plana* Variant (2.2.2)

52	*Eragrostis plana*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	4	.	.	+	.	+	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.
53	*Panicum schinzii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
54	*Setaria sphacelata var. sphacelata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	+	.	2	.	2	.	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
55	*Erica arborea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	r	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.

Species Group G - Common species of Sub-Community 2.2 and Variant 2.2.2 of the *Leucosidea sericea* Variant (2.2.3)

56	*Leucosidea sericea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	4	.	.	.	.	+	3	2	4	2	+	.	1	5	+	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.
57	*Sebaea sedoides*	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	2	.	2	.	+	1	2	r	+	.	+	+	+	+	.	.	+	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
58	*Rosa rubiginosa*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	4	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.
59	*Artemisia pontica*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	+	+	.	+	2	.	+	.	+	.	.	.	.	.	.	.	.	.
60	*Wahlenbergia krebsii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	1	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.

Species Group H - Common species of Sub-Community 2.2 and Variant 2.2.3 of the *Cymbopogon caesius* Variant (2.2.4)

61	*Cymbopogon caesius*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	3	.	.	2	.	.	.	.	+	.	.	4	.	3	+	+	.	.	.	.	.	.	.	.	.
62	*Andropogon appendiculatus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	+	4	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
63	*Barkheya purpurea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	1	.	.	.	.	.	r	.	.	.	.	.	.	.
64	*Eleocharis dregeana*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
65	*Mexmuellera macowanii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	.	.	.	.	.	.	.
66	*Cymbopogon pospischilii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
67	*Crassula alba*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
68	*Hyparrhenia hirta*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
69	*Hypericum lalandii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
70	*Robinia pseudoacacia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

No.	Species																																																											
71	*Helichrysum glumaceum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
72	*Asparagus officinalis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	1	.	r	+	.	.	.	.	.	.	.	.	r	.	.	.	.
73	*Garuleum sonchifolium*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	r	.	.	.	.	.	.	.	.	r	.	.	1	.	.	.	.	.	.	.	.	2	.	.	.
74	*Buddleja salviifolia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.
75	*Athrixia angustissina*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
76	*Helichrysum stoechas*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
77	*Trifolium dubium*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Species Group I - Diagnostic species of the *Eragrostis chloromelas - Scirpus ficinioides - Carex cognata* Sub-Community (2.3)

No.	Species																																																											
78	*Carex cognata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.
79	*Portulaca oleracea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.
80	*Schkuhria pinnata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
81	*Panicum natalense*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
82	*Tagetes minuta*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	2	.	.	.	.
83	*Dactylis glomerata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
84	*Chenopodium album*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
85	*Enneapogon scoparius*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
86	*Senecio squalidus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	2	.
87	*Amaranthus blitum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
88	*Atriplex prostrata boucher*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
89	*Pinus taeda*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
90	*Cyperus subsquarrosus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
91	*Melica decumbus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.

Species Group J - Companion species

No.	Species																																																											
92	*Helichrysum inornatum*	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
93	*Stiburus alopecuroides*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
94	*Cyperus congestus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
95	*Oxalis latifolia*	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
96	*Helichrysum krookii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
97	*Indigofera dimidiata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
98	*Dianthus mooiensis*	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
99	*Helichrysum odoratissimum*	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
100	*Mesembryanthemum nodiflora*	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
101	*Senecio paucicalyculatus*	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
102	*Gazania krebsiana*	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
103	*Corycium nigrescens*	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
104	*Helichrysum aureum*	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.
105	*Kniphofia rooperi*	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
106	*Vernonia fastigiata*	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
107	*Pycreus mauritius*	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.
108	*Delosperma cooperi*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
109	*Scabiosa columbaria*	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
110	*Dianthus crenatus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
111	*Diospyros lycioides*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
112	*Dipcadi serotinum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
113	*Helichrysum pilosellum*	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.

114	*Heteropogon contortus*	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.
115	*Hypochaeris radicata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
116	*Cyperus rupestris*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
117	*Dierama floriferum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
118	*Merximuellera dura*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
119	*Trifolium burchellianum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
120	*Dryopteris pentheri*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
121	*Oxalis obliquifolia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
122	*Cyperus sphaerocephalus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
123	*Nidorella anomala*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
124	*Erica reunionensis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
125	*Cotula socialis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
126	*Gerbera aurantiaca*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
127	*Diclis reptans*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
128	*Cheilanthes feei*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
129	*Kniphofia porphyrantha*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
130	*Pycreus macranthus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
131	*Pycreus nitidus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
132	*Sonchus arvensis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
133	*Cephalaria galpiniana*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
134	*Olea europaea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
135	*Cliffortia paucistaminea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
136	*Lotononis galpini*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
137	*Delosperma caespitosum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
138	*Helichrysum italicum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
139	*Helichrysum halicum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
140	*Miscanthus junceus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
141	*Helichrysum nanum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
142	*Myriopteris gracilis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
143	*Panicum ecklonii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
144	*Moraea huttonii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
145	*Gerbera pilloselloides*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
146	*Tenrhynea phylicifolia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
147	*Veronica peregrina*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
148	*Polygala virgata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
149	*Rubus laciniatus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.
150	*Oenothera roea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
151	*Euryops tysonii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
152	*Cucumis zeyheri*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
153	*Gunnera perpense*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
154	*Hypochaeris glabra*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
155	*Malva neglecta*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	r	.
156	*Salvia repens*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.

3.3 Descriptions of the different plant communities of the Glencoe study site

3.3.1 *Schoenoplectus corymbosus – Juncus effusus* wetland community

Figure 3.3: A sample plot picture and the location of plant community 1.

This is the smallest plant community represented by one relevé on the study site. This is an unusual or uncommon phenomenon, however, Goetze *et al.*, (2008) recorded two relevés for one sub-community in their study, while Behr & Bredenkamp (1988) and Bredenkamp & Bezuidenhout (1990) identified two relevés with two plant species as a community within a Grassland Biome. This community is made up of three wetlands species (*Schoenoplectus corymbosus*, *Juncus effusus* and *Cyperus marginatus*). *Juncus effusus* is the only species from this community that occurs in more than one relevé, as the other two species were exclusive to this community (Relevé G51).

The community is found at an altitude of 1 824 m.a.s.l, on the east facing side of the study site, just below some forest patches of the *Leucosidea sericea* species. The visual estimated tree cover, shrub cover, grass cover, rockiness was 0%, with forbs covering 100%.

No signs of livestock or trampling were observed and there were no signs of fire that had recently taken place. Signs of erosion were observed on the upper slope in a form of head cut erosion, which normally occurs in wetlands areas (**Figure 3.3**). Clay loam soil type was recorded in this community. Some signs of flooding were observed on this wetland vegetation due to the heavy rains that had recently occurred before the surveys were undertaken (**Figure 3.3**). The area is easily accessible to both livestock and wildlife since the slopes are represented by valley bottoms for this community.

Species from species Group A is characteristic to this community (**Table 3.1**) and is represented by three forb species that are listed below, with *Schoenoplectus corymbosus* being the most dominant:

Schoenoplectus corymbosus ***Juncus effusus***

Cyperus marginatus

No alien plant species were recorded for this plant community.

3.3.2 *Eragrostis chloromelas – Scirpus ficinioides* open grassland

Figure 3.4: A sample plot picture and the location of plant community 2.

This is the largest plant community on the study site. It is represented by 58 relevés, which are a mixture of trees, open grasslands, and wetlands (**Figure 3.4**). This community is made up of seven species of which two are grass species and is dominated by forbs species from five different genera. This community is a clear indication that the Glencoe study site is a relatively homogenous area that falls within a grassland biome represented by one broad vegetation type.

This community is found at altitudes that range from 1 740 m.a.s.l to 1 916 m.a.s.l at an average of 1 810 m.a.s.l. The visual estimated herb cover ranges from 0% to 99% with an average of 28%. The visual estimated grass cover ranges from 1% to 100% with an average of 74%. The visual estimated rockiness cover percentage ranges from 0% to 80% with an average of 12%.

Signs of livestock and wildlife grazing were observed in this plant community through occurrence of both wildlife and livestock droppings. Further visual observations of cattle, horses, sheep, and mountain reedbuck were recorded in 36 out of the 58 relevés. Moderate signs of overgrazing were observed in twelve relevés on the study site. Ten out of the 58 relevés had signs of slight erosion, with two relevés having moderate signs and 46 relevés with no signs of erosion. This community is dominated by sandy loam soil type recorded in 38 relevés, followed by the loam soil type recorded in 11 relevés, and lastly the sandy soil type recorded in nine relevés. There is only one relevé out of the 58 relevés that had signs of fire that might have occurred in the previous year.

Seventeen out of the 58 relevés are not easily accessible to livestock, more especially cattle, as they are on steep mid-slopes. However, wildlife such as the mountain reedbuck can access the area. The other 41 relevés are easily accessible to both livestock and wildlife, as these relevés slopes range from valley bottom to foot slopes. In terms of the aspect, ten relevés are North-westerly facing, nine are westerly facing, five are south facing, 13 are south-westerly facing, four are north-easterly facing, seven relevés are north facing, five relevés are south-easterly facing and five relevés are easterly facing slopes.

Species from species group B (**Table 3.1**) is characteristic to this plant community and is inclusive of seven different plant species that are listed below, with *Eragrostis chloromelas* being the most dominant:

Eragrostis chloromelas	***Scirpus ficinioides***
Helichrysum auriomiten	***Lobelia erinus***
Fuirena hirsuta	***Felicia muricata***
Setaria incrassate -	

No alien plant species were recorded in this community.

3.3.3 Eragrostis chloromelas – Scirpus ficinioides - Pennisetum thumbergii wetland.

Figure 3.5: A sample plot picture and the location of sub-community 2.1.

This community is characterised as a wetland type (**Figure 3.5**) and is made up of 14 different plant species of which five of them are grasses, one tree species, and one shrub species. Seven forb species dominate this sub-community. It is also important to note that *Scirpus ficinioides* species was also recorded across all 14 relevés of this community, however, this species was grouped under community 2 (**Table 3.1**) as characteristic to plant community 2. Four relevés were sampled for this sub-community.

This community is found at altitudes that range from 1 818 m.a.s.l to 1 861 m.a.s.l at an average of 1 846 m.a.s.l. The visual estimated tree cover ranges from 0% to 4% with an average of 1%. The estimated shrub cover ranges from 0% to 10% with an average of 2,5%. The visual estimated herb cover ranges from 65% to 99% with an average of 82,8%. The visual estimated grass cover ranges from 1% to 40% with an average of 24%. The visual estimated rockiness cover percentage is 0% across all four relevés.

Signs of livestock were recorded in this plant community as occurrence of both cattle and sheep droppings. Further visual observations of cattle were recorded on two of the four relevés. Signs of overgrazing were recorded in two of the relevés. Slight to moderate signs of soil erosion were recorded on two relevés as result of animal trampling. Sandy loam, and loam soil types are the two soil types that occur across all four relevés, with loam soils dominating and occurring on three out of four relevés. There were no signs of fire across all four relevés for this sub-community. The area is easily accessible to both livestock and wildlife as the slope ranges from valley bottom to foot slopes. In terms of aspect, two of the four relevés are south-westerly facing, whereas the other two are north facing.

Species from species group C (**Table 3.1**) are characteristic to this sub-community and include 14 different plant species that are listed below, with *Pennisetum thunbergii* being the most dominant:

Pennisetum thunbergii	***Senecio glaberrimus***
Populus canescens	***Helichrysum splendidum***
Bolboschoenus maritimus	***Arundinella nepalensis***
Abrus laevigatus	***Fingerhuthia africana***
Senecio lividus	***Epilobium ciliatum***
Rumex salicifolius	***Bromus catharticus***
Pennisetum sphacelatum	***Ranunculus acris***

There were only two alien plant species recorded in one of the four relevés that were sampled for this community, namely *Populus canescens* and *Bromus catharticus* (Henderson, 2001; Van Oudtshoorn, 2012).

3.3.4 *Eragrostis chloromelas – Scirpus ficinioides – Microchloa caffra* open grassland.

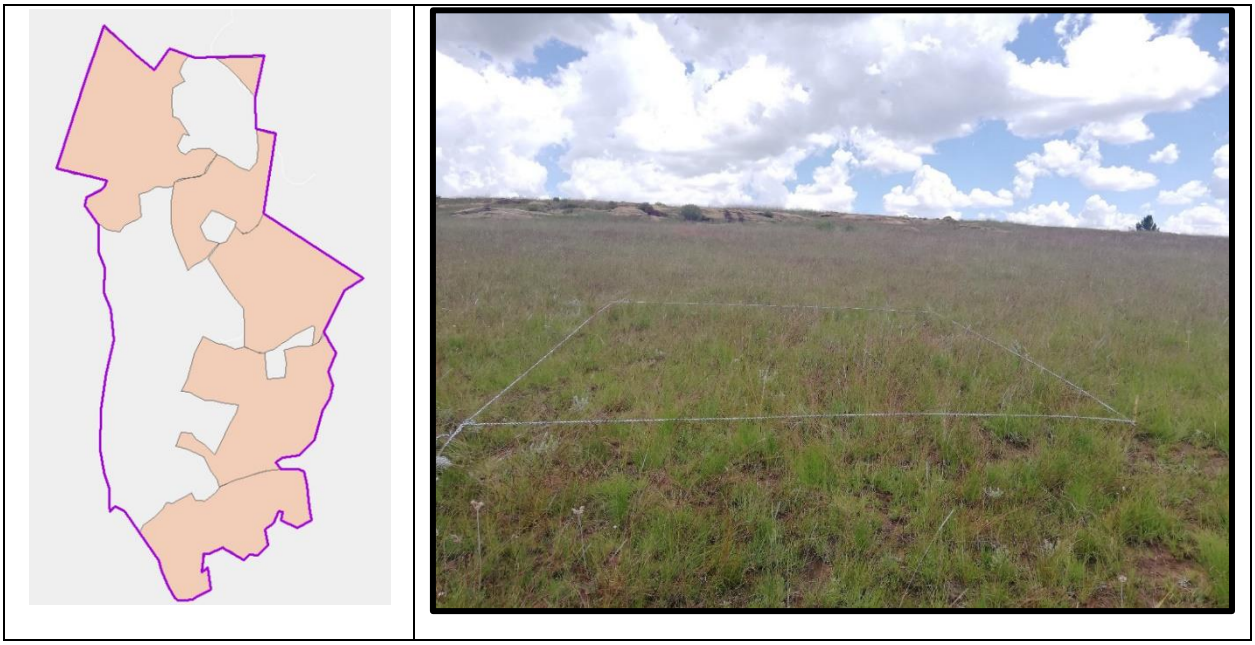


Figure 3.6: A sample plot picture and the location of sub-community 2.2.

This community is represented by 48 relevés that are a mixture of grass and forb species (**Figure 3.6).** This community is made up of 12 plant species, of which three of them are forbs with nine dominating grass species. *Microchloa caffra*, *Eragrostis capensis*, *Loudetia simplex*, *Themeda triandra* and *Elionurus muticus* are the most dominant grass species across the entire sub-community.

This community is found at altitudes that range from 1 740 m.a.s.l to 1 916 m.a.s.l at an average of 1 763 m.a.s.l. The estimated shrub cover through visual observation ranges from 0% to 68% with an average of 2%. The estimated herb cover through visual observation ranges from 0% to 94% with an average of 22%. The estimated grass cover ranges from 5% to 100% with an average

of 79%. The estimated rockiness cover percentage through visual observation ranges from 0% to 80% with an average of 14%.

Signs of livestock and wildlife grazing were recorded in this sub-community through occurrence of both wildlife and livestock droppings. Further visual observation of cattle, horses, sheep, and mountain reedbuck were recorded in 29 of the 48 relevés. Moderate signs of overgrazing were observed in nine of the relevés. Eight of the 48 relevés had signs of slight erosion, with one relevé showing moderate signs and 39 relevés with no signs of erosion. This community is dominated by the sandy loam soil type as recorded in 35 relevés, followed by the sandy soil type in seven relevés, and loam soil type in six relevés. There is only one out of the 48 relevés that had signs of fire that might have occurred in the previous year.

Sixteen out of the 48 relevés are not easily accessible to livestock, more especially by cattle, as they are located on steep mid-slopes. However, wildlife such as small antelopes can access these areas. The other 32 relevés are easily accessible to both livestock and wildlife, as their slopes range from valley bottom to foot slopes. In terms of the aspect, eight relevés are north westerly facing, eight are westerly facing, four are south facing, 11 are south-westerly facing, three are north-easterly facing, four are north facing, five are south-easterly facing and five are on easterly facing slopes.

Species from species group D (**Table 3.1**) are characteristic to sub-community 2.2 and include 12 different plant species that are listed below:

Microchloa caffra	***Eragrostis capensis***
Loudetia simplex	***Themeda triandra***
Harpocloa falx	***Elionurus muticus***
Trachypogon spicatus	***Tristachya leucothrix***
Koeleria capensis	***Artemisia stelleriana***
Helichrysum pallidum	***Sebaea filiformis***

No alien plants, no tree and shrub species were recorded in this sub-community.

3.3.5 *Eragrostis curvula* variant community.

Figure 3.7: A sample plot picture and the location of variant community 2.2.1.

This community is classified as a variant community 2.2.1 and is represented by 16 relevés. This community is made up of 15 different plant species, of which three of them are grass species, and one tree species (**Figure 3.7**). The community is dominated by 11 forb species. *Eragrostis curvula* and *Searsia divinorum* are species that are also prominent in variant 2.2.3 (**Table 3.1**). Community 2.2.1 is located in rocky areas of the study site.

This community is found at altitudes that range from 1 766 m.a.s.l to 1 916 m.a.s.l at an average of 1 851 m.a.s.l. The estimated tree cover based on visual observation ranges from 0% to 15% with an average of 2%. The estimated herb cover ranges from 0,5% to 47% with an average of 19%. The visual estimated grass cover ranges from 53% to 98% with an average of 81%. The visual estimated rockiness cover percentage ranges from 0% to 48% with an average of 12%.

Signs of livestock and wildlife grazing were recorded in this variant community through the occurrence of both wildlife and livestock droppings. Further visual observations of cattle, and mountain reedbuck were made in 12 out of the 16 relevés. Slightly signs of overgrazing were

recorded in two of the relevés. As a result, two out of the 16 relevés had signs of slight erosion that do not pose any threat at this stage. This community is dominated by sandy loam soil types recorded in 13 relevés, followed by the loam soil type in three relevés, and sandy soil recorded in only one relevé. There were no signs of recent fires in all 16 relevés.

Three out of the 16 relevés are not easily accessible to livestock more especially by cattle, as they are located on steep mid-slopes. However, wildlife such as mountain reedbuck can access the area. The other 13 relevés are easily accessible to both livestock and wildlife, as their slopes range from valley bottom to foot slopes. In terms of aspect, three relevés are north-westerly facing, one westerly facing, three south facing, six south-westerly facing, one north-easterly facing, one relevé is north facing and one relevé is on an easterly facing slope.

Species from species group E (**Table 3.1**) are characteristic to this community. Fifteen different plant species that are listed below dominated by the *Eragrostis curvula* were recorded:

Eragrostis curvula
Leersia hexandra
Helichrysum nudifolium
Scleria angusta
Cyperus obstusiflorus
Cyperus semitrifidus
Haplocarpa scaposa
Helichrysum cephaloideum
Helichrysum chionosphaerum
Eragrostis racemosa
Searsia divaricata
Chrysocoma oblongifolia
Senecio ulopterus
Hypoxis acuminata
Crassula vaginata

3.3.6 *Eragrostis plana* variant community.

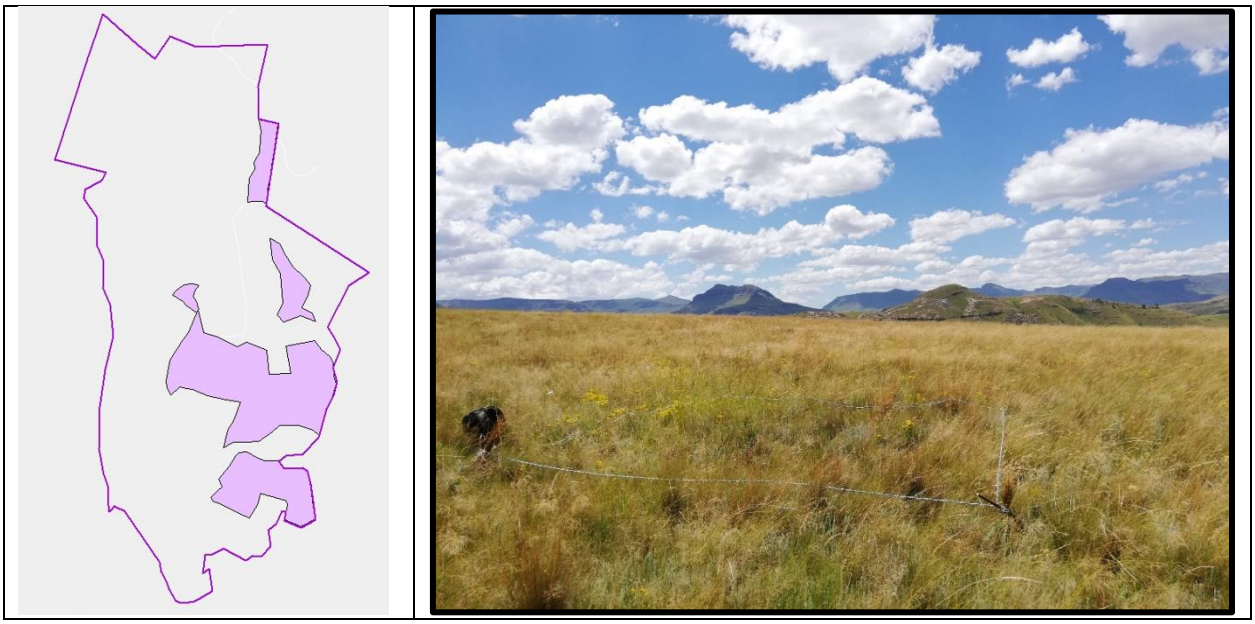


Figure 3.8: A sample plot picture and the location of variant community 2.2.2.

This community is made up of four species represented by three grasses and only one shrub, *Erica arborea.* Nine relevés represent this community (**Table 3.1**). It is found at altitudes that range from 1 745 m.a.s.l to 1 908 m.a.s.l at an average of 1 856 m.a.s.l. The estimated shrub cover through visual observation ranges from 1% to 6% with an average of 0,7%. The visual estimated grass cover ranges from 20% to 100% with an average of 81,1%. The visual estimated rockiness ranges from 2% to 33% with an average of 5,8%.

Signs of livestock were recorded in this plant community through occurrence of both cattle and sheep droppings. Further visual observations of sheep were made in one out of nine relevés. Slight signs of overgrazing were recorded in two of the relevés through occurrence of bare patches within. Slight signs of soil erosion were recorded on two relevés. Sandy loam, loam, and sandy soils occur across all nine relevés. There were no signs of fire for this variant community.

The area is easily accessible to both livestock and wildlife as the slope for all nine relevés ranges from valley bottom to foot slopes. In terms of aspect, out of the nine relevés, two are on westerly

facing slope, one on a south-easterly facing slope, one easterly facing, two are south-easterly facing, two north facing, and one north-westerly facing slope.

Species from species group F (**Table 3.1**) are characteristic to this community and include only 4 species that are listed below, with *Eragrostis plana* being the most dominant:

Eragrostis plana	***Panicum schinzii***
Setaria sphacelate var. sphacelata	***Erica arborea***

No alien plant species were recorded for this plant community across the nine sampled relevés.

3.3.7 *Leucosidea sericea* variant community.

Figure 3.9: A sample plot picture and the location of variant community 2.2.3.

This community is classified as a variant community 2.2.3 and is represented by 31 relevés which are a mixture of trees, herbaceous and shrub vegetation (**Figure 3.9**). Five different plant species that include two trees, one shrub, and two forb species.

This community is found at altitudes that range from 1 740 m.a.s.l to 1 908 m.a.s.l at an average of 1 511 m.a.s.l. The estimated tree cover based on visual observations ranges from 0% to 84% with an average of 10%. The estimated shrub cover ranges from 0% to 68% with an average of 5%. The visual estimated herb cover ranges from 0% to 94% with an average of 21%. The visual estimated rockiness cover percentage ranges from 0% to 80% with an average of 17%.

Signs of livestock were recorded on this variant community as indicated by the occurrence of both wildlife and livestock droppings. Further visual observation of cattle, horses, sheep, and mountain reedbuck were made in 15 of the 31 relevés. Moderate signs of overgrazing were recorded in seven of the relevés. Six out of the 31 relevés had signs of slight erosion, with one relevé that recorded moderate signs of erosion and 24 relevés with no signs of erosion. This community is dominated by the sandy loam soil type that was recorded in 20 relevés, with loam soil recorded in four relevés, and sandy soil recorded in seven relevés. There were no signs of fire across all five relevés for this community.

Fourteen out of the 31 relevés are not easily accessible to livestock more especially cattle, as they are on relatively steep slopes. However, wildlife such as small antelopes can access the area. The other 17 relevés are easily accessible to both livestock and wildlife, as their slopes range from valley bottom to foot slopes. In terms of aspect, six relevés are north-westerly facing, six are westerly facing, three are south facing, six are south-westerly facing, two are north-easterly facing, three relevés are north facing, four are easterly facing and one is on a south-easterly facing slope.

Species from species group G (**Table 3.1**) are characteristic to this community and include five different species that are listed below, with *Leucosidea sericea* being the most dominant tree species:

Leucosidea sericea ***Sebaea sedoides***

Rosa rubiginosa ***Artemisia pontica***

Wahlenbergia krebsii

Rosa rubiginosa is the only alien plant species that was recorded on one of the 31 relevés that were sampled (Henderson, 2001).

3.3.8 *Cymbopogon caesius* variant community.

Figure 3.10: A sample plot picture and the location of variant community 2.2.4.

This community is classified as a variant community 2.2.4 and is represented by 21 relevés, which are a mixture of trees, open grasslands, and wetlands (**Figure 3.10**). This community is made up of 17 different plant species, of which five of them are grass species, two tree species, two shrub species, and dominated by eight forb plants species.

This community is found at altitudes that range from 1 740 m.a.s.l to 1 889 m.a.s.l at an average of 1 821 m.a.s.l. The visual estimated tree cover ranges from 0% to 84% with an average of 14%. The estimated shrub cover ranges from 0% to 68% with an average of 6%. The visual estimated herb cover ranges from 0,5% to 94% with an average of 17%. The visual estimated grass cover ranges from 20% to 96% with an average of 74%. The visual estimated rockiness cover percentage ranges from 0% to 60% with an average of 18%.

Signs of livestock were recorded in this variant community as both wildlife and livestock droppings occurred. Further visual observations of cattle, horses and mountain reedbuck were made in ten of the 21 relevés. Moderate signs of overgrazing were recorded in five of the relevés on this site. Four out of the 21 relevés had signs of slight erosion, with one relevé with moderate erosion and 16 relevés with no signs of erosion. This variant community is dominated by the sandy loam soil type recorded in 15 relevés, with loam and sandy soils recorded in three relevés, respectively. There were no signs of fire across all five relevés for this community.

Twelve out of the 21 relevés are not easily accessible to livestock more especially by cattle, as they are located on relatively steep slopes. However, wildlife such as small antelopes can access the area. The other nine relevés are easily accessible to both livestock and wildlife, as they are represented by valley bottom and foot slopes. In terms of aspect, five relevés are north-westerly facing, five westerly facing, three south facing, three south-westerly facing, two north-easterly facing, one north facing, one south-easterly facing and one easterly facing slope.

Species from species group H (**Table 3.1**) are characteristic to this variant community with 17 different species were recorded as listed below dominated by *Cymbopogon caesius*:

Cymbopogon caesius
Berkheya purpurea
Mexmuellera macattleanii
Crassula alba
Hypericum lalandii
Helichrysum glumaceum
Garuleum sonchifolium
Athrixia angustissina
Trifolium dubium
Andropogon appendiculatus
Eleocharis dregeana
Cymbopogon pospischilii
Hyparrhenia hirta
Robinia pseudoacacia
Asparagus officinalis
Buddleja salviifolia
Helichrysum stoechas

Robinia pseudoacacia is the only alien plant species recorded in this variant community in one of the twenty-one relevés that were sampled (Henderson, 2001).

3.3.9 *Eragrostis chloromelas – Scirpus ficinioides – Carex cognata* disturbed shrubland.

Figure 3.11: A sample plot picture and the location of sub-community 2.3.

This community is classified as sub-community 2.3 of the study site. It is represented by one shrub dominated relevé, two relevés of wetland type and two relevés of disturbed vegetation (**Figure 3.11**). The disturbed vegetation looks like an island on the study site and has signs of an ancient livestock kraal, hence it shows signs of disturbance. This sub-community is made up of 14 different plant species, of which three are grass species, one tree and three shrub species and dominated by seven forb species.

This community is found at altitudes that range from 1 818 m.a.s.l to 1 889 m.a.s.l at an average of 1 848 m.a.s.l. The visual estimated tree cover ranges from 0% to 40% with an average of 8%. The estimated shrub cover ranges from 0% to 37% with an average of 7,8%. The visual estimated herb cover ranges from 10% to 93% with an average of 42%. The visual estimated grass cover ranges from 10% to 99% with an average of 56%. The visual estimated rockiness cover percentage ranges from 0% to 18% with an average of 3,7%.

Signs of livestock were recorded as a result of occurrences of both wildlife and livestock droppings. Further visual observations of cattle and sheep were recorded in three out of five relevés. Moderate signs of overgrazing were recorded in three of the relevés, more especially on the two relevés that are being used for livestock kraaling. Moderate signs of soil erosion were recorded in one relevé (wetland type) as a result of animal trampling leading to bare soils. Sandy loam, sandy, clay loam and loam soil types are the three soil types that occurring across all five relevés. There were no signs of fire across all four relevés for this community.

The area is easily accessible to both livestock and wildlife, because the relevés are located on the valley bottom slopes and foot slopes, with only one relevé located on a moderate mid-slope. In terms of the aspect, two of the five relevés are south facing, one is westerly facing, one is north facing and another one is on a north-easterly facing slope.

Species from species Group I (**Table 3.1**) are characteristic to this sub-community and include 14 different plant species that are listed below and dominated by *Carex cognata*:

Carex cognata	***Portulaca oleracea***
Schkuhria pinnata	***Panicum natalense***
Tagetes minuta	***Dactylis glomerata***
Chenopodium album	***Enneapogon scoparius***
Senecio squalidus	***Amaranthus blitum***
Atriplex prostrata boucher	***Pinus taeda***
Cyperus subsquarrosus	***Melica decumbus***

Pinus taeda is an alien plant species that was recorded for this plant community on one of the five relevés that were sampled (Henderson, 2001). *Tagetes minuta* and *Schkuhria pinnata* are weed species also recorded. These weed species are primarily found on cultivated and disturbed land (Henderson, 2001). They are also found in arable crops, vegetables, pastures, and orchards as well as abandoned cultivation, at the roadside, rubbish dumps and animal enclosures (Henderson, 2001). The occurrence of these species is evidence to the above-mentioned statement regarding the relevés that represent disturbed vegetation. *Dactylis glomerata* is a grass species that is a

perennial and tufted that is found on disturbed soils of the grassland and fynbos biomes (Van Oudtshoorn, 2012).

3.4 The vegetation classification for Reedsdell Study site

A total of 125 different plant species for the Reedsdell study site (**Appendix 7**) were recorded with two major plant communities (**Figure 3.12**), three sub-communities and four variant communities (**Figure 3.13**) were classified (**Table 3.2**).

1. *Leucosidea sericea – Rosa rubiginosa* woodland community.
1.1 *Leucosidea sericea – Rosa rubiginosa - Cymbopogon caesius* open grassland.
    1.1.1 *Myosotis sylvatica* variant community.
2. *Loudetia simplex – Themeda triandra* open grassland.
2.1. *Loudetia simplex – Themeda triandra - Scirpus ficinioides* wetland community.
2.2. *Loudetia simplex – Themeda triandra - Tristachya leucothrix* open grassland.
    2.2.1 *Eragrostis racemosa* variant community.
    2.2.2 *Senecio ulopterus* variant community.
    2.2.3 *Erica hillburttii* variant community.

Species from species Group J are companion species with no significance based on their partial occurrences on the relevés. These species were moved to the bottom of the Table where they were listed in sequence as per the different community groupings.

Loudetia simplex, Themeda triandra, Eragrostis chloromelas, Lobelia erinus, Eragrostis capensis, Elionurus muticus, Eragrostis curvula and *Helichrysum auriomitens* are the most common species that occurs in most of the relevés (**Table 3.2**). Two of these species, *Lobelia erinus* and *Helichrysum auriomitens* are forbs while the rest are grasses.

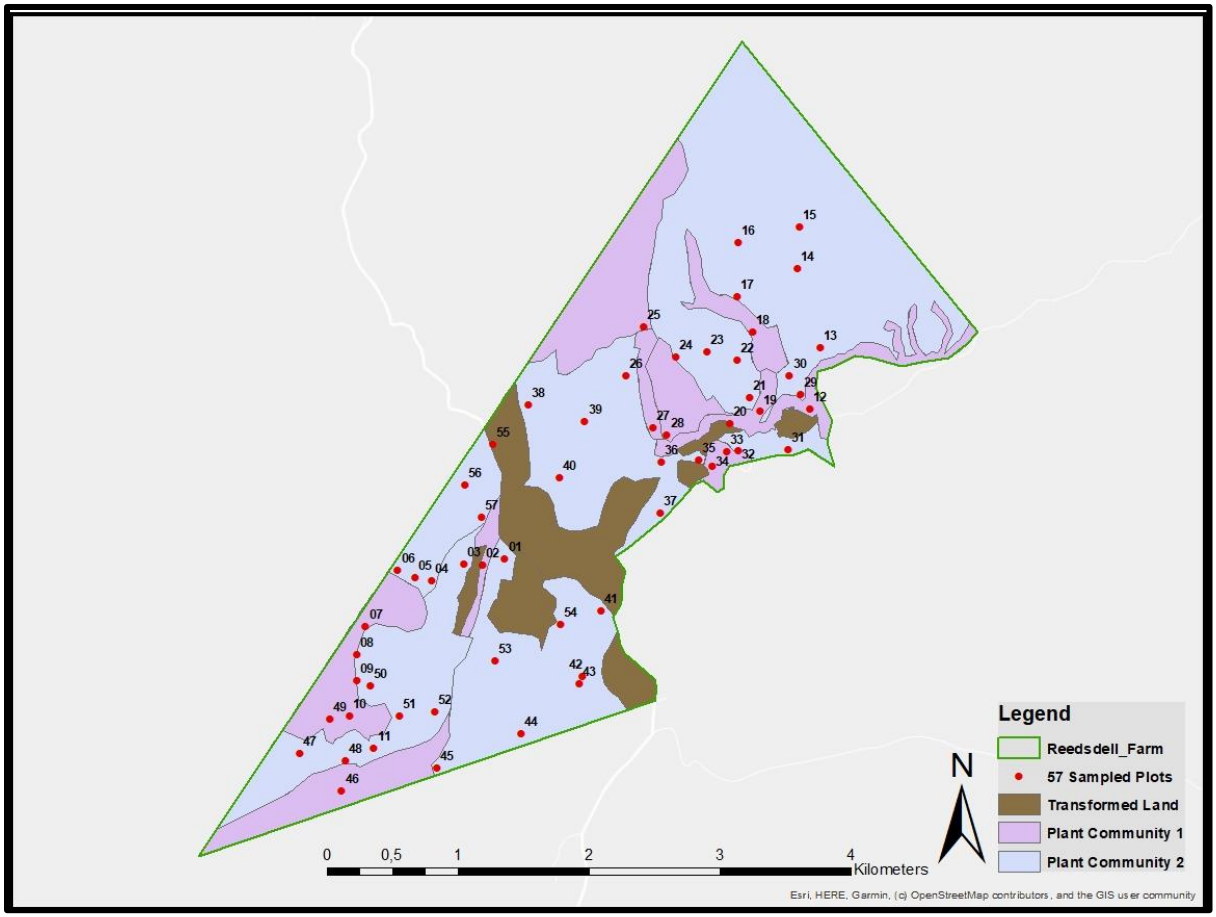


Figure 3.12: Output map indicating major plant communities in the Reedsdell study site.

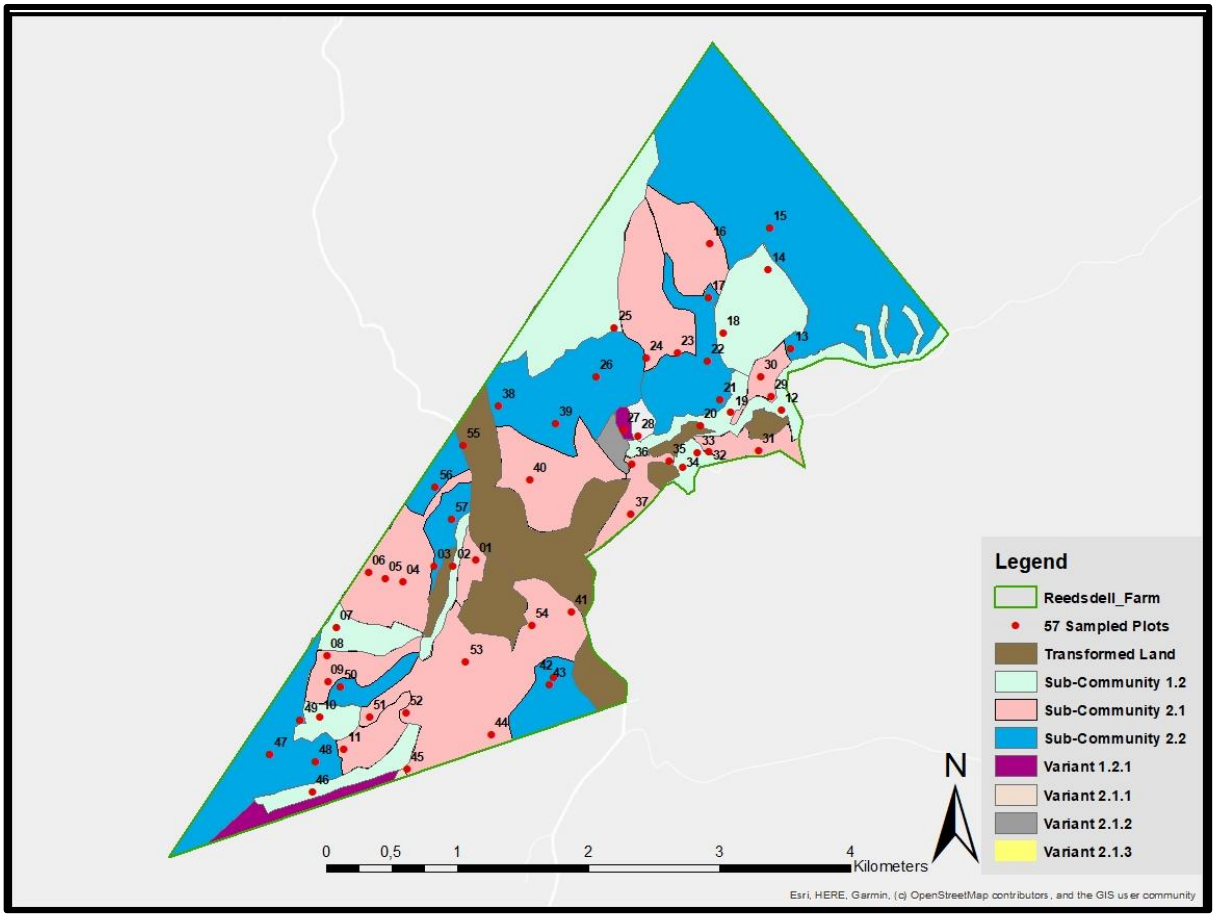


Figure 3.13: Output map indicating sub-communities and variants in the Reedsdell study site.

Table 3.2: The phytosociological Table of the Reedsdell study site.

	Relevés 57	2 7	2 0	1 4	1 0	2 5	2 9	4 6	3 3	7	1 8	3 4	1 9	2 8	4 4	5 4	4	4 0	3 0	3 6	3 5	3 1	4 1	5 1	1 2	1 9	3 7	2 4	5 3	5 1	4 6	1 5	2 3	1 6	3 8	2 2	2 6	1 3	3 3	3 9	4 7	2 1	4 2	5 0	5 7	3 8	1 7	4 3	1 5	4 8	5 6	4 9	5 5
	Species 125																																																						
	Community	**1**													**2**																																									
	Sub-Community	**1.2**													**2.1**																											**2.2**														
	Variants	**1.2.1**													**2.1.1**																											**2.1.2**													**2.1.3**				
	Species Group A- Diagnostic species of the *Leucosidea sericea - Rosa rubiginosa* Community 1																																																					
1	*Leucosidea sericea*	.	5	.	3	.	4	3	.	5	.	.	.	.	.	.	.	.	.	+	.	3	.	.	.	.	.	3	.	.	.	4	3	3	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
2	*Rosa rubiginosa*	.	+	3	.	5	r	+	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	*Miscanthus capensis*	.	2	.	.	.	1	.	.	.	4	3	.	4	+	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4	*Mexmuellera macowanii*	3	.	.	.	.	.	.	+	.	.	4	4	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	*Schoenoplectus corymbosus*	.	3	.	.	.	+	.	3	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6	*Carex cognata*	4	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	*Helichrysum glumaceum*	.	2	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	2	1	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
8	*Selago densiflorus*	.	.	2	1	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.
9	*Myosotis semiaplexicaulis*	.	+	.	.	1	+	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	*Searsia divaricata*	.	+	.	+	+	+	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.
11	*Bromus catharticus*	.	.	.	.	+	+	2	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Species Group B- Diagnostic species of the Leucosidea sericea - Rosa rubiginosa - *Cymbopogon caesius* Sub-Community 1.2																																																					
12	*Cymbopogon caesius*	.	.	.	.	.	+	.	.	.	+	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	4	.	.	+	.	.	.
13	*Fingerhuthia africana*	.	.	.	.	.	.	.	.	.	.	.	2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	*Helichrysum italicum*	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
15	*Pelargonium lichenoides*	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	*Crassula vaginata*	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
17	*Gunnera perpense*	.	.	.	.	.	r	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18	*Erica reunionensis*	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
	Species Group C- Diagnostic species of the *Senecio squalidus* Variant 1.2.1																																																					
19	*Myosotis sylvatica*	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20	*Senecio squalidus*	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
21	*Helichrysum halicum*	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22	*Felicia muricata*	.	.	.	.	1	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.
23	*Asparagus officinalis*	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24	*Cotula socialis*	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25	*Salix fragilis*	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	*Bidens pilosa*	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Species Group D- Diagnostic species of the *Loudetia simplex - Themeda triandra* Community 2																																																					
27	*Loudetia simplex*	.	1	.	.	.	.	.	.	.	.	.	+	.	.	.	.	2	2	2	4	2	5	.	.	2	.	1	5	2	5	2	+	4	2	3	.	.	2	3	2	.	2	2	+	2	4	1	5	+	+	2	1	.	3	3	.	5
28	*Themeda triandra*	.	.	.	.	.	+	r	.	r	2	.	.	+	1	.	.	.	.	+	+	.	.	+	.	+	.	4	+	+	+	+	2	+	2	4	.	4	4	+	4	3	2	2	.	5	+	+	2	3	4	.	5	4	+	4	.	+
29	*Eragrostis chloromelas*	.	3	.	4	+	.	5	1	2	.	+	.	.	.	.	.	5	.	1	+	4	4	2	4	4	4	3	2	.	+	+	3	3	.	.	.	.	.	+	2	1	.	.	.	+	+	.	.	.	.	.	+	2	2

30	*Elionurus muticus*	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	2	.	.	.	.	+	.	.	+	.	.	+	2	+	.	2	1	.	2	4	5	1	1	2	.	.	3	.	4	3	.	+	.	1	4	.	4	4
31	*Stiburus alopecuroides*	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	5	.	.	+	.	4	.	.	3	.	.
32	*Helichrysum auriomitens*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	3	3	.	2	.	2	.	4	.	1	.	+	.	.	.	.	+	2	+	+	.	.	1	.	3	+	.	+	+	.	.	.	.	1	.	+
33	*Eragrostis capensis*	.	.	.	1	.	.	.	.	.	+	+	1	.	.	.	.	3	.	.	+	.	+	.	2	+	.	1	.	+	+	+	2	+	.	1	+	.	1	+	+	.	.	2	.	+	+	.	.	+	+	1	+	.	+	+	+	+
34	*Eragrostis curvula*	.	1	1	.	+	.	.	+	.	r	.	+	+	.	.	.	2	+	+	.	3	+	.	2	.	.	.	1	.	.	.	.	+	2	.	+	+	.	.	+	1	.	.	1	.	.	.	.	.	.	+	.	.	.	+	.	+
35	*Lobelia erinus*	.	.	.	.	+	.	.	+	.	.	.	.	.	+	.	1	.	+	+	.	+	+	+	.	2	.	.	.	+	.	+	.	2	.	.	+	.	.	.	1	+	.	.	+	+	+	2	+	.	+	.	.	.	.	+	+	.
36	*Trachypogon spicatus*	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	4	+	.	+	+	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	+	+	.	.	.	4	.	.	+	+	1	+	.	.	.	.	.	+	.
37	*Hypoxis acuminata*	.	+	.	.	+	.	.	.	2	.	.	.	r	.	.	.	2	+	2	.	.	+	.	.	.	.	+	1	+	.	.	2	.	+	1	+	+	1	.	+	r	1	+	.	.	1	.	.	.	.	.	.	+	.	.	.	.
	Species Group E- Diagnostic species of the Loudetia simplex - *Themeda triandra - Scirpus ficinioides* Sub-community 2.1																																																									
38	*Scirpus ficinioides*	.	.	.	.	.	+	.	.	.	.	2	.	.	.	.	4	.	.	2	.	.	.	.	3	.	.	.	.	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	+
41	*Juncus effusus*	.	.	.	.	.	.	.	.	.	.	.	+	2	.	5	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
39	*Eragrostis plana*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	4	.	1	.	.	.	.	+	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
40	*Ficinia nodosa*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42	*Lobelia Flaccida*	.	.	1	.	.	.	.	.	.	.	.	+	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
43	*Pennisetum sphacelatum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
44	*Cyperus semitrifidus*	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	2	.	.	.	.	.	2	.	.	.	+	.	1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.
45	*Pycreus macranthus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
46	*Helichrysum aureum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	2	.	.	.	.	+	.	.	r	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	1	.	.	.	.
47	*Sebaea sedoides*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	+	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	.	.	+	.	.	+	+	r	.	.	.	.	+	+	.
48	*Paspalum dilatatum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49	*Eleocharis dregeana*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
50	*Panicum schinzii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
51	*Setaria sphacelata var. sphacelata*	.	+	.	.	.	.	2	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
52	*Oxalis smithiana*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
	Species Group F- Diagnostic species of the *Loudetia simplex - Themeda triandra - Tristachya leucothrix* Sub-community 2.2																																																									
53	*Tristachya leucothrix*	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	4	1	.	2	2	.	.	.	.	+	1	2	+	+	+	+	3	2	+	3	+	.	.	+
54	*Harpocloa falx*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	r	+	+	.	.	.	.	+	.	.	2	.	.	+	.	r	.	.	.	+	.	.	+	1	.	.	.	.	1	.
55	*Heteropogon contortus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	1	.	.	3	1	.	.	.	+	.	.	+	.	.	.	+	.	2	.	+	.	.	.
56	*Wahlenbergia krebsii*	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	r	.	.	.	.	+	.	.	2	.	.	.	.	.	+	.	.	+	.	.	+	.	.
57	*Erica arborea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	1	.	.	+	.	.	.	.	.	.	+	.	.	.
58	*Nassella tussock*	.	.	.	.	.	+	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	1	.	.	1	.	+	.	.	.	.	.	.	2	.	.	.	.
59	*Microchloa caffra*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	+	.	.	4	+	.	+	+	.	.	.	.	.	.	.	.	.	.
	Species Group G- Diagnostic species of the *Eragrostis racemosa* Variant 2.2.1																																																									
60	*Eragrostis racemosa*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	+	.	3	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
61	*Miscanthus junceus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.
62	*Hypochaeris radicata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.
63	*Helichrysum stoechas*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
64	*Oxalis obliquifolia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	+	1	.
65	*Koeleria capensis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
66	*Pycreus nitidus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Species Group H- Diagnostic species of the *Senecio ulopterus* Variant 2.2.2																																																									
67	*Senecio ulopterus*	.	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
68	*Helichrysum chionosphaerum*	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.

69	*Artemisia stelleriana*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
70	*Nemesia denticulata*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
71	*Haplocarpha scaposa*	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Species Group I- Diagnostic species of the *Erica Hillburttii* Variant 2.2.3																																																									
72	*Erica hillburttii*	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.
73	*Panicum ecklonii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	1	1	.	.	.	.	.	.
74	*Senecio harveianus*	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
75	*Dianthus mooiensis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
76	*Leersia hexandra*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	+	.	.	+	.	+
77	*Helichrysum inornatum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	+	.
78	*Helichrysum pallidum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.	.	.	.	.	.	.
	Species Group J - Companion species																																																									
79	*Berkheya onopordifolia*	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
80	*Berkheya purpurea*	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
81	*Ranunculus multifidus*	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
82	*Hypoxis hirsuta*	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
83	*Artemisia annua*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
84	*Delosperma carterae*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
85	*Melica decumbus*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
86	*Bryonia alba*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
87	*Geranium sylvaticum*	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
88	*Harveya speciosa*	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
89	*Malva neglecta*	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
90	*Rhynchospora corymbosa*	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
91	*Artemisia pontica*	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
92	*Panicum natalense*	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
93	*Senecio heliopsis*	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
94	*Setaria incrassata*	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
95	*Merximuellera dura*	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
96	*Rubus laciniatus*	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
97	*Tephrosia grandiflora*	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
98	*Fuirena hirsuta*	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
99	*Passerina montana*	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
100	*Dianthus crenatus*	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
101	*Agrostis lachnantha*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
102	*Pennisetum thunbergii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
103	*Wahlenbergia planiflora*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
104	*Aristea woodii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
105	*Hypochaeris glabra*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
106	*Senecio inaequidens*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
107	*Taraxacum officinale*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
108	*Tagetes minuta*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
109	*Andropogon appendiculatus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
110	*Cyperus obstusiflorus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
111	*Scleria angusta*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	r	+	.	.	.	.	.	.

112	*Cyperus filiformis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
113	*Cheilanthes feei*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
114	*Oenothera rosea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
115	*Solanum nigrum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
116	*Argyrolobium tuberosum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	+	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.
117	*Lampranthus deltoides*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
118	*Helichrysum splendidum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
119	*Nidorella undulata*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
120	*Buddleja salviifolia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
121	*Cotula hispida*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
122	*Gerbera piloselloides*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	r	.	.	.	.	.	.	.	.
123	*Hypoxis rigidula*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
124	*Hypoxis argentea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
125	*Selago galpinii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.

3.5 Descriptions of the different plant communities of Reedsdell study site

3.5.1 *Leucosidea sericea – Rosa rubiginosa* woodland community

Figure 3.14: A sample plot picture and the location of plant Community 1.

This is the first community with woody plants recorded as small patches within the Reedsdell study site. This community is made up of three grass species, four forb species, and four woody species (**Figure 3.14**). It is represented by riverine vegetation and mostly found along the drainage lines and along the rivers across the entire study site.

This community is found at altitudes that ranges from 1 823 m.a.s.l to 2 031 m.a.s.l at an average of 1 899 m.a.s.l. The visual estimated tree cover ranges from 0% to 91% with an average of 36%. The estimated shrub cover ranges from 0% to 17% with an average of 4%. Visually estimated herb cover ranges from 1% to 94% with an average of 30%. Visually estimated grass cover ranges from 3% to 99% with an average of 60%. Visually estimated rockiness cover percentage ranges from 0% to 47% with an average of 4%.

Signs of livestock and trampling were recorded in nine out of the 14 relevés as droppings from cattle and sheep. Signs of erosion were recorded in five relevés, where three relevés had moderate

and two relevés had slight erosion. No signs of recent fires were observed across all 14 relevés. Sandy loam, loam, and sandy soil types were recorded across the 14 relevés, with sandy loam and sandy soils in five relevés, loam soils recorded on four relevés and sandy soil type recorded on five relevés.

All relevés are accessible to both livestock and wildlife, although four relevés were located on relatively steep mid-slopes. A river crossing located in the centre of the property is a challenge more especially to humans rather than animals as there are no designated bridges for crossing. Crossing the river to get to the other portions of the study site bare footed could be dangerous during heavy rainy seasons. In terms of aspect, five of the 14 relevés are south facing, one is north-westerly, north-easterly, easterly, and westerly facing respectively, and two are south-easterly facing.

Species from species Group A (**Table 3.2**) are characteristic to this community and include eleven species that are listed below with *Leucosidea sericea* being the most dominant:

Leucosidea sericea
Miscanthus capensis
Schoenoplectus corymbosus
Helichrysum glumaceum
Myosotis semiaplexicaulis
Bromus catharticus
Rosa rubiginosa
Mexmuellera macattleanii
Carex cognata
Selago densiflorus
Searsia divaricata

Rosa rubiginosa and *Bromus catharticus* are the two alien plant species that were recorded within the fourteen relevés (Henderson, 2001; Van Oudtshoorn, 2012).

3.5.2 *Leucosidea sericea – Rosa rubiginosa - Cymbopogon caesius* open grassland

Figure 3.15: A sample plot picture and the location of sub-community 1.2.

This community is made up of twelve relevés and is classified as sub-community 1.2. The twelve relevés are represented by two grass species, one shrub species and four dominating forb species were surveyed (**Figure 3.15**). It is found at altitudes that ranges from 1 823 m.a.s.l to 2 031 m.a.s.l at an average of 1 908 m.a.s.l. The estimated shrub cover based on visual observation ranges from 0% to 19% with an average of 6%. The visual estimated herb cover ranges from 1% to 94% with an average of 40%. The estimated grass cover ranges from 3% to 99% with an average of 59%. The visual estimated rockiness cover percentage ranges from 0% to 47% with an average of 41%.

Signs of livestock were recorded in eight out of the 12 relevés and both cattle and sheep droppings and trampling occurred. Moderate signs of overgrazing were recorded in five of the relevés. Two out of 12 relevés had signs of slight erosion, with three relevés showing moderate signs and seven relevés with no signs of erosion. Constant monitoring needs to be undertaken to ensure that the slightly eroded areas do not expand further, more especially, along the riverbanks and wet areas as these areas are the most susceptible to erosion. Livestock trampling is the major cause of erosion on the site and occurs when animals frequent the area to drink water. This community recorded

three soil types, sandy loam, loam, and sandy soils. Sandy loam soil was recorded on four relevés, loam soil was recorded in four relevés and sandy soil was also recorded on four relevés. No signs of fires in this sub-community.

One relevé is located within a foot slope, four are located within a mid-slope and seven are located within a valley bottom slope. In terms of aspect, north-easterly, easterly, and north-westerly facing aspects were recorded on three relevés, a south facing aspect was recorded in four relevés, a north facing recorded in three relevés, and south easterly was recorded in two relevés.

Species from species Group B (**Table 3.2**) are characteristic to this sub-community and include seven different species that are listed below, with *Cymbopogon caesius* being the most dominant:

Cymbopogon caesius
Helichrysum italicum
Crassula vaginata
Erica reunionensis
Fingerhuthia africana
Pelargonium lichenoides
Gunnera perpense

No alien plant species were recorded in this community.

3.5.3 *Myosotis sylvatica* variant community.

Figure 3.16: A sample plot picture and the location of variant community 1.2.1.

This community is classified as variant community 1.2.1 and is made up of eight species of which one of them is woody, one a shrub, and there are six dominant forb species. Five relevés were surveyed for this variant community. It is found at altitudes that ranges from 1 891 m.a.s.l to 2 031 m.a.s.l at an average of 1 862 m.a.s.l. The estimated tree cover through visual observation ranges from 45% to 91% with an average of 31%. The estimated shrub cover ranges from 2% to 19% with an average of 6%. Visually estimated herb cover ranges from 7% to 78% with an average of 66%. Visually estimated rockiness cover ranges from 0% to 47% with an average of 11%.

Signs of livestock were recorded through the occurrence of both cattle and sheep droppings on three relevés. Slight signs of overgrazing were recorded in two of the relevés. Sandy, and loam soil types are the two main soil types that occur across this variant community, with loam soils dominating as recorded on three out the five relevés. There were no signs of fire across all five relevés. The area is accessible to both livestock and wildlife as the slope for all five relevés ranges from valley bottom to mid-slope. In terms of aspect, two out of the five relevés are south facing, and one relevé is north, north-easterly, and easterly facing.

Species from species Group C (**Table 3.2**) are characteristics of this variant community and inclusive of eight different plant species that are listed below, with *Myosotis sylvatica* being the most dominant:

Myosotis sylvatica	***Senecio squalidus***
Helichrysum halicum	***Felicia muricata***
Asparagus officinalis	***Cotulla socialis***
Salix fragilis	

Salix fragilis is the only alien plant species recorded.

3.5.4 *Loudetia simplex – Themeda triandra* open grassland.

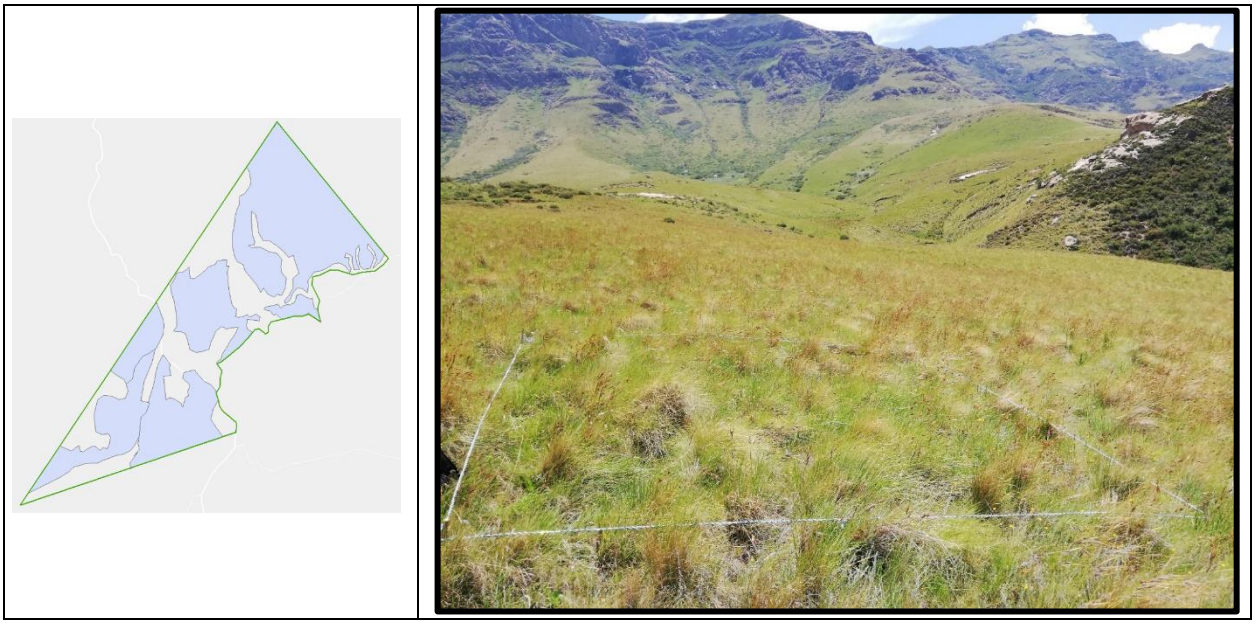


Figure 3.17: A sample plot picture and the location of plant community 2.

This is classified as community 2 from the classification result (**Table 3.2**). Forty-two relevés were sampled for this community made up of a total of 11 species, of which three are forb species and is dominated by eight grass species. It is found at altitudes that ranges from 1 824 m.a.s.l to 2 108 m.a.s.l at an average of 1 908 m.a.s.l. with one relevé sampled at the highest peak of 2 108 m.a.s.l.

The visually estimated shrub cover ranges from 0% to 33% with an average of 2%. The herb cover ranges from 0,2% to 98% with an average of 19%. The visual estimated grass cover ranges from 2% to 99% with an average of 83%. The visual estimated rockiness cover percentage ranges from 0% to 85% with an average of 6%.

Signs of livestock and wildlife grazing were recorded on this community through occurrence of both wildlife and livestock droppings. Further visual observation of cattle, sheep, and mountain reedbuck were recorded within close proximity of 29 out of 42 relevés, with mountain reedbuck spotted on only three relevés. Moderate signs of overgrazing were recorded in seven of the relevés on the study site. Five out of the 42 relevés had signs of slight erosion, with two relevés with moderate signs of erosion. Most of the erosion occurs along the wetlands, riverbanks, and rockiness areas as sheet erosion. This community is dominated by sandy loam soil type, and it was recorded in 30 relevés, followed by the sandy soil type recorded in 7 relevés, and lastly the loam soil type recorded in four relevés. No signs of recent fire were recorded across this entire plant community.

Seventeen out of 42 relevés are not easily accessible to human beings but are moderately accessible to livestock and wildlife, more especially sheep and mountain reedbuck. The other 25 relevés are easily accessible to both livestock, wildlife, and humans, as these relevés are located at the valley bottoms to the foot slopes. In terms of aspect, six relevés are south-easterly facing, seven are easterly facing, four are westerly facing, eight are south facing, eight are north-easterly facing, two relevés are south-westerly facing, four relevés are north facing and eight relevés are easterly facing.

Species from species Group D (**Table 3.2**) are characteristic to this community and include the eleven different plant species that are listed below with *Loudetia simplex* being the most dominant grass:

Loudetia simplex	***Themeda triandra***
Eragrostis chloromelas	***Elionurus muticus***
Stiburus alopecuroides	***Helichrysum auriomitens***

Eragrostis capensis ***Eragrostis curvula***

Lobelia erinus ***Trachypogon spicatus***

Hypoxis acuminata

No alien plant species were recorded on this Community.

3.5.5 *Loudetia simplex – Themeda triandra - Scirpus ficinioides* wetland community.

Figure 3.18: A sample plot picture and the location of sub-community 2.1.

This community is represented by 25 relevés, which are a mixture of grass and various forb species (**Figure 3.20**). It is made up of 15 different plant species, of which four are grasses, and dominated by 11 forbs species. This community occurs mostly along the drainage lines of the study site where artificial dams are generally located. These artificial dams are being used as a water source for livestock as livestock grazing is the primary land use activity.

This community is found at altitudes that ranges from 1 816 m.a.s.l to 2 012 m.a.s.l at an average of 1 893 m.a.s.l. The estimated herb cover based on visual observations ranges from 0,2% to 98% with an average of 53%. Visually estimated grass cover ranges from 2% to 99% with an average

of 77%. Visually estimated rockiness cover percentage ranges from 0% to 85% with an average of 6%.

Signs of livestock were recorded through occurrence of both livestock droppings and trampling. Further visual observations of cattle, and sheep were made in 18 out of the 25 relevés. Slight signs of overgrazing were recorded in five of the relevés. Two out of the 25 relevés had signs of moderate erosion and three had signs of slight erosion. This community is dominated by a sandy loam soil type and was recorded in 17 relevés, followed by the clay loam soil type recorded in five relevés, and lastly, the loam soil type recorded in three relevé. There were no signs of recent fires recorded in this sub-community.

Seven out of the 25 relevés are not easily accessible, while the other 18 relevés are easily accessible to both livestock and wildlife, as the relevés are located on slopes that range from valley bottoms to foot slopes. In terms of aspect, two relevés are south-easterly facing, seven are north-easterly, one is south-westerly facing, two are south facing, four are north facing, five are easterly facing, and four relevés are westerly facing.

Species from species Group E (**Table 3.2**) are characteristic to this sub-community. Fifteen different plant species that are listed below were recorded and dominated by the *Scirpus ficinioides*:

Scirpus ficinioides
Ficinia nodosa
Lobelia flaccida
Cyperus semitrifidus
Helichrysum aureum
Paspalum dilatatum
Panicum schinzii
Oxalis smithiana
Eragrostis plana
Juncus effusus
Pennisetum sphacelatum
Pycreus macranthus
Sebaea sedoides
Eleocharis dregeana
Setaria sphacelata var. sphacelata

Paspalum dilatatum is the only alien plant species that was recorded on this sub-community.

3.5.6 *Loudetia simplex – Themeda triandra - Tristachya leucothrix* open grassland.

Figure 3.19: A sample plot picture and the location of sub-community 2.2.

This community is classified as sub-community 2.2 and is made up of seven plant species, mainly grasses (five), one shrub, and one forb species. Eighteen relevés were surveyed for this sub-community and representative of open grassland vegetation (**Figure 3.19**). This community is found at altitudes that ranges from 1 830 m.a.s.l to 2 108 m.a.s.l at an average of 1 824 m.a.s.l. The estimated shrub cover based on visual observation ranges from 0% to 20% with an average of 2%. The visual estimated herb cover ranges from 1% to 47% with an average of 11%. The visual estimated grass cover ranges from 20% to 99% with an average of 88%. The visual estimated rockiness ranges from 0% to 30% with an average of 5%.

Signs of livestock and wildlife grazing were recorded through the occurrence of cattle, sheep, and wildlife droppings in 11 of the 18 relevés, with mountain reedbuck spotted on two of the 18 relevés. Slight signs of overgrazing were recorded on four relevés and slight signs of soil erosion on three relevés, and a moderate sign in one relevés, as a result of trampling. Sandy loam soil type occurs

on 13 relevés, loam soil type occurs on two relevés and sandy soil type occurs on three relevés. There were no signs of fire in this sub-community.

Ten out of the 18 relevés are located on mid-slopes and eight are on foot slopes. In terms of the aspect, five relevés are on south-easterly facing, five relevés on south facing, four relevés on easterly facing with north-westerly, south-westerly, north-easterly, and easterly facing aspects each recorded on four relevés.

Species from species Group F (**Table 3.2**) are characteristic to this sub-community and seven species that are listed below were recorded, with *Tristachya leucothrix* being the most dominant:

Tristachya leucothrix
Heteropogon contortus
Erica arborea
Microchloa caffra
Harpocloa falx
Wahlenbergia krebsii
Nassella tussock

Nassella tenuissima is the only alien plant species recorded in this sub-community.

3.5.7 *Eragrostis racemosa* variant community.

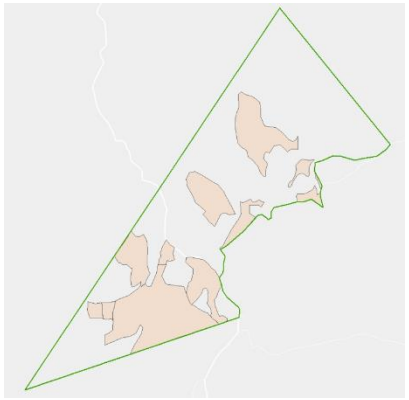


Figure 3.20: A sample plot picture and the location of variant community 2.2.1.

This community is classified as variant community 2.2.1 and is characterised by an open grassland vegetation of undulating landscapes (**Figure 3.20**). It is made up of seven plant species of which four are forb species and three of them are grass species. Nineteen relevés represent this community.

This community is found at altitudes that range from 1 816 m.a.s.l to 2 012 m.a.s.l at an average of 1 897 m.a.s.l. The visual estimated herb cover ranges from 0,2% to 98% with an average of 19%. The visual estimated grass cover ranges from 33% to 99% with an average of 81%. The visual estimated rockiness cover percentage ranges from 0% to 85% with an average of 8%.

Signs of the presence of livestock were recorded in this plant community as both cattle and sheep droppings occurred. Cattle were visually spotted grazing in 12 out of the 19 relevés and sheep in two out of the 19 relevés. Slight to moderate signs of soil erosion were recorded on four relevés for this variant community. Sandy loam is the dominant soil type and was recorded in 14 relevés, followed by the sandy soil type recorded in four relevés with loam soil type being recorded in one relevé. There were no signs of fire in this variant community.

Although some of the relevés were at high-altitude, they are accessible to both livestock and wildlife. Five relevés were recorded at steep mid-slopes, six were recorded at valley bottoms and eight were recorded on foot slopes. In terms of aspect, one relevé was south-westerly, three relevés were south facing, four were north-easterly facing, three were westerly facing, four were north facing and another four were easterly facing.

Species from species group G (**Table 3.2**) are characteristic to this variant community and inclusive of seven different plant species listed below, with *Eragrostis racemosa* being the most dominant:

Eragrostis racemosa	***Miscanthus juncus***
Hypochaeris radicata	***Helichrysum stoechas***

Oxalis obliquifolia ***Koeleria capensis***

Pycreus nitidus

No alien plant species were recorded in this variant community.

3.3.8 *Senecio ulopterus* variant community.

Figure 3.21: A sample plot picture and the location of variant community 2.2.2.

This variant community is represented by five relevés. It is characterised by a relatively good herbaceous layer (**Figure 3.21**) that is made up of five different plant species of which four are forb species with only one shrub species (*Artemisia stelleriana)*. This community is found at altitudes that ranges from 1 854 m.a.s.l to 2 003 m.a.s.l at an average of 1 931 m.a.s.l. Signs of livestock were recorded through the occurrence of livestock droppings, both from cattle and sheep on three relevés. Moderate signs of erosion were recorded in one relevé, and there were no signs of recent fires across the entire variant community. This community is dominated by a sandy loam soil type that was recorded in four out of the five relevés, with loam soil type recorded in only one relevé. Four relevés were in mid-slopes and one relevé was in a foot slope. In terms of aspect, two relevés are south-easterly facing, one easterly facing, one north-easterly and one south facing.

Species from species group H (**Table 3.2**) are characteristic to this variant community and is inclusive of five different species that are listed below, with *Senecio ulopterus* being the most dominant:

Senecio ulopterus	***Helichrysum chionosphaerum***
Artemisia stelleriana	***Nemesia denticulata***
Haplocarpha scapose	

No alien plant species were recorded in this variant community.

3.5.9 *Erica hillburttii* variant community.

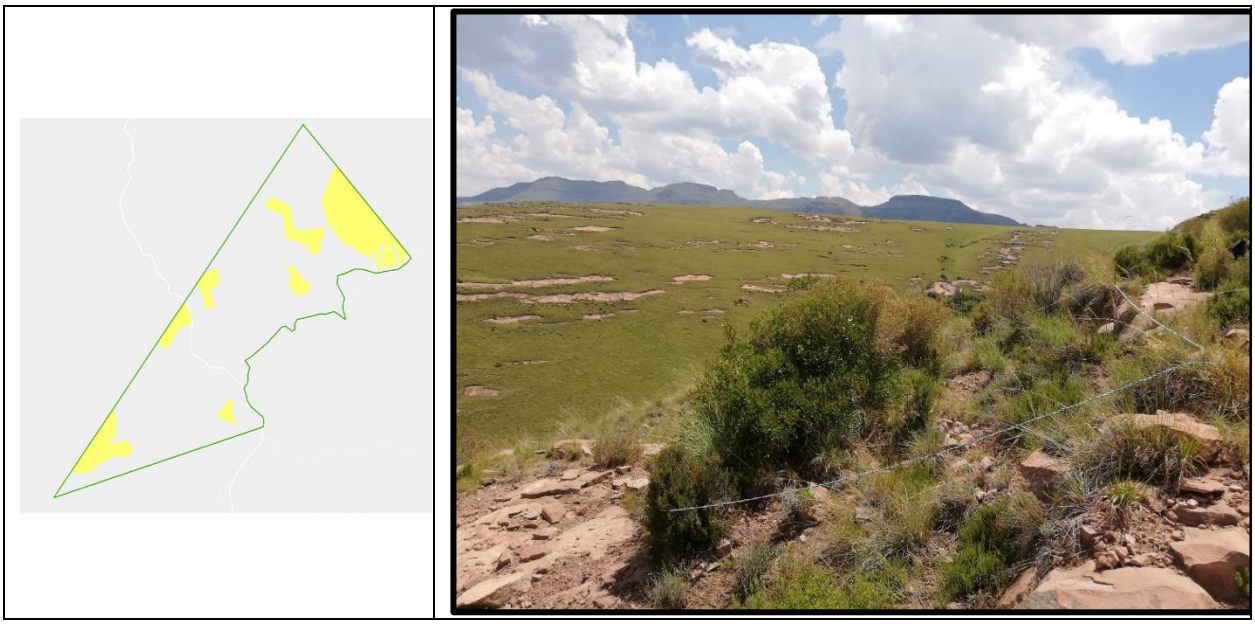


Figure 3.22: A sample plot picture and the location of variant community 2.2.3.

This community is represented by 13 relevés and is characterised by shrubland vegetation (**Figure 3.22**). It is made up of seven different species of which two are grass species, four are forb species and there is one shrub species.

This community is found at altitudes that range from 1 830 m.a.s.l to 2 108 m.a.s.l at an average of 1 920 m.a.s.l. Signs of livestock and wildlife were recorded on nine relevés through occurrence of both wildlife and livestock droppings. Further visual observations of cattle and mountain reedbuck were recorded on two relevés. Signs of slight soil erosion were recorded. This community is dominated by a sandy loam soil type recorded in nine relevés, followed by the sandy soil type recorded in three relevés, and lastly the sandy soil type recorded in one relevé. There were no signs of recent fires across the entire variant community.

Six relevés are located in mid-slopes and seven relevés are in the foot slopes of the variant community. In terms of aspect, three relevés are south facing, one is south-westerly facing, three are south-easterly facing, four are easterly facing, one is westerly facing, and one is north-easterly facing.

Species from species group I (**Table 3.2**) is characteristic to this plant community. Seven different plant species listed below were recorded, with *Erica hillburttii* being the most dominant:

Erica hillburttii
Senecio harveianus
Leersia hexandra
Helichrysum pallidum
Panicum ecklonii
Dianthus mooiensis
Helichrysum inornatum

No alien plant species was recorded in this plant community.

In terms of top ten species that were recorded on both study sites, 68% of *Eragrostis chloromelas* were recorded at Glencoe study site, while Reedsdell study site recorded 53%. Three species were not shared by both study sites (**Figure 3.23**).

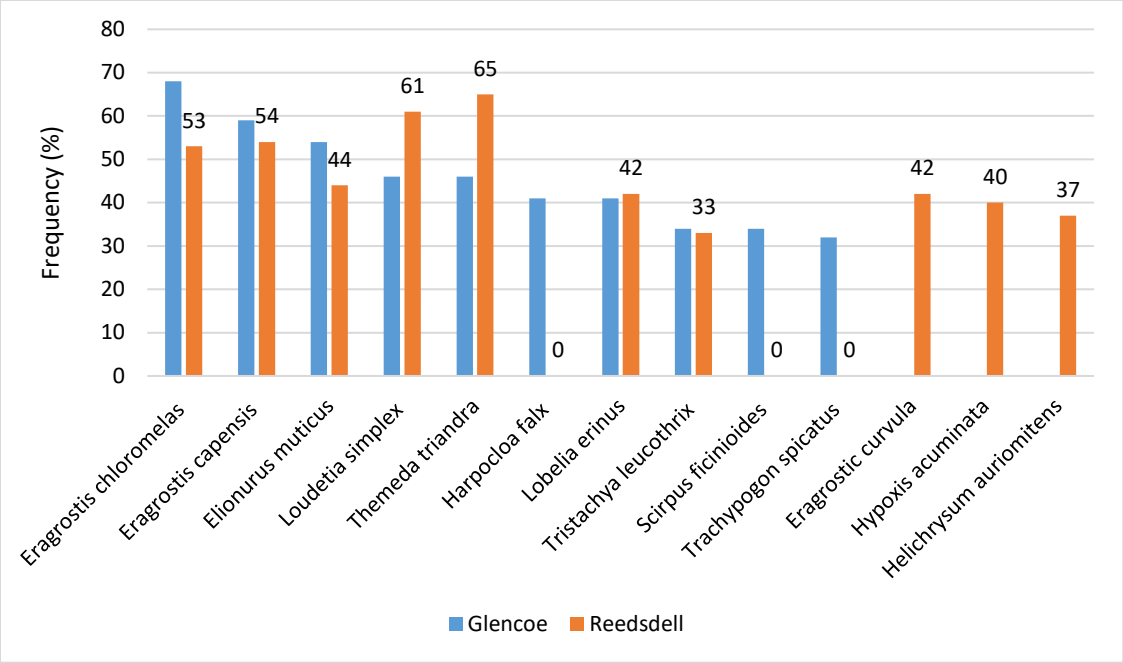


Figure 3.23: Frequency data of top 10 species in the Glencoe and Reedsdell study sites.

3.6 Description of woody vegetation for Glencoe & Reedsdell study sites

In Glencoe study site, *Leucosidea sericea* and *Rosa rubiginosa* are the only two species that were recorded at all three different height classes, the Lower, Medium, and the Upper (**Appendix 8**). In the Reedsdell study site, *Leucosidea sericea* is the only species that was recorded at all three different height classes (Lower, Medium, and Upper) (**Appendix 8**). In the Glencoe study site, the Lower height class which represents the shrubs community is the most dominant class at a frequency of 80% followed by the Upper height class at 11% and the Medium height class at 9%. The Reedsdell study site is dominated by the Lower height class, followed by the Medium height class and the Upper height class at 62%, 20%, 18%, respectively (**Figure 3.24**).

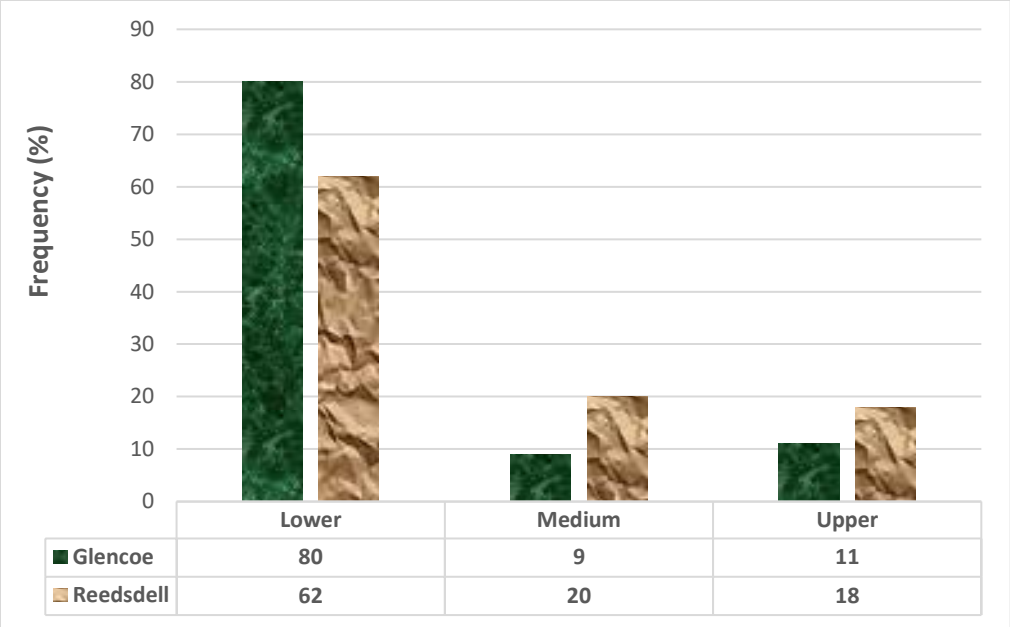


Figure 3.24: Frequency of woody species recorded under the three height classes in the Glencoe and Reedsdell study sites.

Brown (1997) stated that, the evaluation of available woody species in the veld is imperative to determine the veld type and condition. For this reason, the woody species composition together with their densities were studied to provide the information on the presence and absence of woody vegetation in the study areas, even though the study areas are within a Grassland Biome (Brown & Bredenkamp, 2003). As a result, 19 different woody species out of 156 total plant species were recorded for the Glencoe study site (**Appendix 6**), recorded on 29 out of the 56 sample plots. Whereas 15 different woody species out of 125 total plant species were recorded for the Reedsdell study site (**Appendix 7**) recorded on 31 out of the 57 sample plots. The woody species data recorded at each sample plot from both study sites were identified and recorded in the data collection sheet (**Appendix 8**). The recorded data included the species name, the number of species and classified according to three height classes: Lower, Medium, and Upper (**Appendix 8**).

There are four alien woody species recorded in the Glencoe study site. These species are: *Robinia pontica, Rosa rubiginosa, Populus canescens, Pinus taeda*. *Rosa rubiginosa.* They were recorded in five sample plots. *Tagetes minuta* is a weed that was recorded in two sample plots. This weed

species occurs in disturbed areas and was recorded in sample plots that were located in areas that are used for livestock kraaling. *Robinia pontica* is the alien tree species that was recorded falling under the Upper height class in Glencoe (**Figure 3.25a**), while *Salix fragilis*, *Rosa rubiginosa* and *Rubus laciniatus* were recorded in the Reedsdell study site. *Rosa rubiginosa* is the most dominant alien plant species in Reedsdell as it was recorded in six sample plots, followed by the *Rubus laciniatus* recorded in two sample plots, with *Salix fragilis* recorded in one sample plot. *Salix fragilis* falls within the Upper height class for the Reedsdell study site. This alien tree species was recorded along the river habitats, and it creates forest patches within these areas (**Figure 3.25b**).

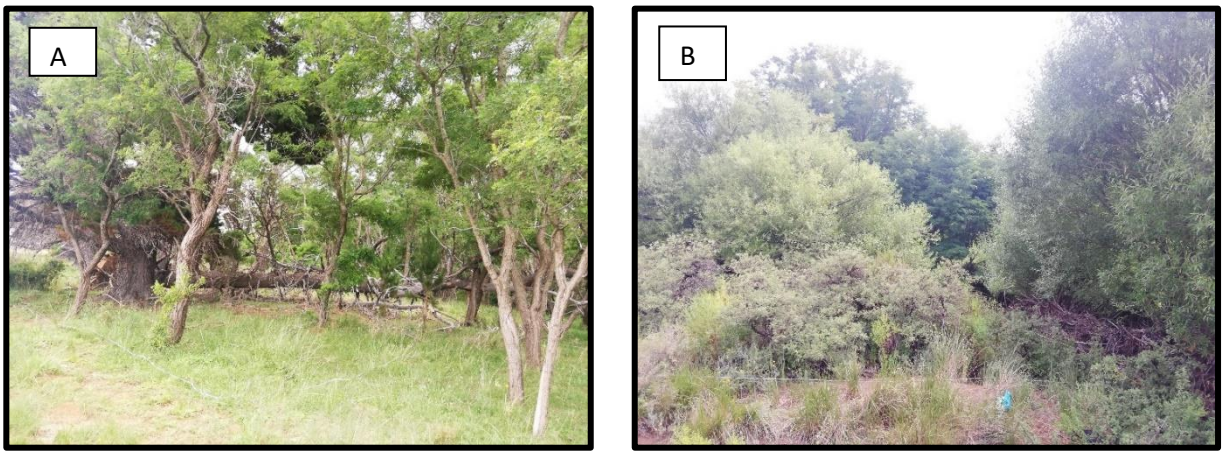


Figure 3.25: Alien woody species at Glencoe (A) and Reedsdell (B) study sites.

For the Glencoe study site, the 19 recorded woody species belong to 11 plant families, namely: Fabaceae (3), Asteraceae (3), Asparagaceae (1), Scrophulanaceae (1), Rosaceae (4), Ebenaceae (1), Ericaceae (2), Pinaceae (1), Salicaceae (1), Oleaceae (1) and Anacardiaceae (1) (**Table 3.3).**

For the Reedsdell study site, the 15 recorded woody species belong to nine families namely, Asteraceae (2), Asparagaceae (1), Scrophulanaceae (2), Rosaceae (3), Ericaceae (2), Salicaceae (1), Anacardiaceae (1), Thymelaeoideae (1), and Solanaceae (1) (**Table 3.3**).

Table 3.3: A list of plant families and different plant species recorded at Glencoe & Reedsdell study sites.

No	Family	Glencoe study site	Reedsdell study site
1	Anacardiaceae	*Searsia divaricate*	*Searsia divaricate*
2	Asparagaceae	*Asparagus officinalis*	*Asparagus officinalis*
3	Asteraceae	*Artemisia pontica* *Chrysocoma oblongifolia* *Tagetes minuta*	*Artemisia annua* *Artemisia pontica*
4	Ebenaceae	*Diospyros lycioides*	
5	Ericaceae	*Erica arborea* *Erica reunionensis*	*Erica arborea* *Erica hillburttii* *Erica reunionensis*
6	Fabaceae	*Abrus laevigatus* *Lotononis galpini* *Robinia pseudoacacia*	
7	Oleaceae	*Olea europaea*	
8	Pinaceae	*Pinus taeda*	
9	Rosaceae	*Cliffortia paucistaminea* *Leucosidea sericea* *Rosa rubiginosa* *Rubus laciniatus*	*Leucosidea sericea* *Rosa rubiginosa* *Rubus laciniatus*
10	Salicaceae	*Populus canescens*	*Salix fragilis*
11	Scrophulanaceae	*Buddleja salviifolia*	*Buddleja salviifolia* *Selago densiflorus*
12	Solanaceae		*Solanum nigrum*
13	Thymelaeoideae		*Passerina montana*

3.7 Discussion

3.7.1 Vegetation classification and description

Although the various assessments and results confirm that both study sites are homogeneous and are dominated by open grassland vegetation. Six structural vegetation units were classified on the Glencoe study site and five on the Reedsdell study site. These structural vegetation units are woodlands, shrublands, grasslands and wetlands for Glencoe, and are woodlands, shrublands, grasslands, forb vegetation and wetland vegetation for Reedsdell study site (**Table 3.4**).

Table 3.4: A representation of the vegetation structures identified at Glencoe and Reedsdell study sites.

Structural Vegetation Type	Glencoe Study site	Reedsdell study site
Wetland	Community 1 Sub-community 2.1	Sub-community 2.2
Grassland	Community 2 Sub-community 2.2 Variant 2.2.2	Community 2 Sub-community 1.1 Sub-community 2.1 Variant 2.2.1
Disturbed Shrubland	Sub-community 2.3	
Rocky outcrops	Variant 2.2.1	
Woodland	Variant 2.2.3	Community 1
Riverine	Variant 2.2.4	
Disturbed Grassland		Variant 1.1.1 Variant 2.2.2
Shrubland		Variant 2.2.3

The study area is represented by grassland vegetation and dominated by herbaceous species with the presence of trees and shrubs on a small scale. There are numerous wetlands and seeps, which are representative of the Eastern Cape Drakensburg Strategic Water Source Area. Some smaller rivers originate from the high-altitude mountain in the Reedsdell study site. Although the study sites are still a Grassland Biome and in relatively good condition, there has been a slightly transformation on the vegetation communities as result of deteriorations associated with soil loss, alien plant species invasion, encroaching indigenous species, construction of artificial dams, and some moderate signs of overgrazing due to continuous grazing (Roux & Opperman, 1982).

The two vegetation types identified by Mucina & Rutherford (2006) for the study area (Lesotho Basalt Highlands and Southern Darkensberg Highlands Grasslands) are still evident and prominent on the study area. This is because, steeply sloping mountainous areas on and below the summit of the great escarpment supporting dense grassland on slopes sometimes with a dwarf-shrubby component and dwarf shrubland on exposed rocky areas were observed on the study area for the

Southern Drakensberg Highlands Grasslands, while features of many plateaus and high ridges of mountains separated by often deep valleys, with closed , short grassland in many areas of the study area were observed for the Lesotho Basalt Highlands Grasslands vegetation type (Mucina & Rutherford, 2006).

In terms of species diversity and evenness, seven of the top ten species were common on both study sites (**Figure 3.23**). These common species are made up of six grasses and only one forb. Although these species are common on both study sites, they differ in terms of their abundance, as a result Glencoe study site is dominated by *Eragrostis chloromelas* (68%) while Reedsdell is dominated by *Themeda triandra* (65%). Only three species (*Harpocloa falx, Scirpus ficinioides,* and *Trachypogon spicatus*) were recorded at the Glencoe study site, but not in Reedsdell. At Reedsdell another three species (*Eragrostis curvula, Hypoxis acuminata* and *Helichrysum auriomitens*) were recorded, but not in Glencoe study site (**Figure 3.23**).

In terms of species diversity, Glencoe study site recorded a high diversity index (*H'* = 2.271817), as well as Reedsdell study site (*H'* = 2.280248). Although the Pearson Correlation coefficient (*r)* results technically indicate a positive correlation, the two study sites indicate a weak relationship in terms of species diversity (r = .2174, P-Value = .475555), and not significant at $p < .05$ (Chi-Square Test Calculator, 2018). The results implies that the study area supports a wide range of species, resulting in better ecosystem functions such as productivity, nutrient cycling and increased resilience to threat. This also indicates that the area has stable communities of plant species. The diversity of species supports the inclusion of study sites as one of the North Eastern Cape Grasslands priority areas as well as the fact that the study area is located within a Strategic Water Source Area, which has got a high rainfall. High rainfall areas allow for more species growth as compared to low rainfall areas. The results of the species evenness indicates that there is an evenly distribution of species across all plant communities (E_H'= 0.986638 – Glencoe and E_H'= 0.990299 - Reedsdell) (Shannon Diversity Index Calculator, 2018). This means that the top ten species abundances in all the different plant communities is similar.

Grass species genus: *Eragrostis* was dominant throughout the Glencoe study site together with various herbaceous species (**Table 3.1**), particularly, the *Eragrostis chloromelas* occurring in 40 out of 59 relevés. This species is classified as an increaser II in terms of the ecological status and occurs abundantly in areas that are being overgrazed (Van Oudtshoorn, 2012). It is commonly found in open grassland regions and is a relatively palatable grass during its early stages in the growing season, but becomes unpalatable at a later stage. The presence of livestock in the study area is one of the contributing factors to the moderate signs of overgrazing that were observed in the area. Although overgrazing doesn't seem to be occurring on a large scale, there is a need to undertake constant veld condition assessments and adhering to the correct stocking rate to prevent serious signs of overgrazing that may lead to denuded areas making soils susceptible to erosion.

The grass species (*Loudetia simplex, Themeda triandra and Eragrostis species*) were the dominant species throughout the Reedsdell study site together with various forb species (**Table 3.2**). *Themeda triandra* species was recorded in 37 out of the 57 sample plots. This species is one of the indicator species for a good veld. It is classified as a Decreaser species according to the ecological status of the grasses. Decreaser grass species are palatable, and they become abundant in a good veld condition, but they decrease in a poor veld condition as result of either overgrazing or under-grazing (Van Oudtshoorn, 2012).

According to Måren, *et. al.,* (2015), south facing slopes tend to receive extra sunlight and become more xeric and warmer, providing more support to drought-resistant floral species and less conducive for tree species growth. Whereas north facing slopes tend to keep moisture and are cold and humid, supporting moisture-preference floral species. The north facing slopes on both study sites had more water flows, wetland and moisture compared to the south facing slopes. The abundance of flower species was recorded on north facing slopes during data collection and the grass species recorded on the north facing slopes had a dark green colour while the south facing slopes grass species had a light green colour.

Loam soils are the most dominant soil type on both study sites followed by sandy soils. Loam soils were found mostly in the wet areas near rivers and wetlands and had dark green grasses. While

sandy soils were mostly found on the rocky outcrop areas and had numerous bare patches with small rocks particles. Loam soils had good vegetation cover compared to sandy soils on both study sites but had some signs of erosion more especially along the wetlands and rivers, it also had a dark brown colour around the wetland areas. Most of the woodland vegetation was recorded on loam soils along the drainage lines and mountain valleys.

3.7.2 Environmental threats

3.7.2.1 Soil erosion

Erosion doesn't seem to be a major environmental threat on both study sites at this stage. However, constant monitoring needs to be undertaken to ensure that the slightly eroded areas do not expand further, more especially, along the wetland areas as these areas are the most affected by erosion. Livestock trampling, which results in bare soils is a major cause of erosion on the study area, and this occurs in areas where animals frequently drink water.

3.7.2.2 Alien plants

Alien and invasive species are one of the greatest, and fastest growing threats to biodiversity and ecosystem services in South Africa. Both study sites do not host extensive areas of alien species. However, management should consider undertaking monitoring of these species through alignment to available resources and effective monitoring methods that are in line with the Alien Plant Control regulations. The monitoring of these species should include but not be limited to; ongoing invasive plant mapping that prioritises key infestations along water courses, drainage lines and upper catchment areas. *Robinia pontica, Rosa rubiginosa, Populus canescens, Pinus taeda* are alien plant species recorded within the Glencoe study site, while *Salix fragilis, Rosa rubiginosa* and *Rubus laciniatus* are alien plant species recorded within the Reedsdell study site.

Pinus taeda, Populus canescens, and Salix fragilis are classified as a NEMBA category 2 species.

Category 2 Listed Invasive Species are those species listed by notice in terms of section 70(1)(a) of the Act as species that require a permit to carry out a restricted activity within an area specified in the notice or an area specified in the permit (RSA, 2004). A landowner on whose land a Category 2 Listed Invasive Species occurs or person in possession of a permit must ensure that the specimens of the species do not spread outside the land, or the area specified in the notice or permit (RSA, 2004).

Robinia Pseudoacacia, Rosa rubiginosa, and Rubus laciniatus are category 1b. Prohibited/exempted if in possession or under control – a person in control of a Category 1b Listed Invasive Species must control the listed invasive species in compliance with sections 75(1), (2) and (3) of NEMBA (RSA, 2004). Both study sites should prioritise clearing category 1b alien plants species as these species are prohibited and must be controlled as part of compliance with the NEMBA Act. These species partially occur in the study area and do not cause a major impact currently. But their abundance needs to be kept under control and to form part of the management plan.

Both study sites should prioritise clearing category 1b alien plants species as these species are prohibited and must be controlled as part of compliance with the NEMBA Act. These species partially occur in the study area and do not cause a major impact currently. But their abundance needs to be kept under control and to form part of the management plan.

3.7.2.3 Grazing

Signs of over-grazing by livestock were observed on both study sites. It is therefore imperative that suitable grazing practices are implemented to ensure the functioning of a livestock farm business that is compatible with biodiversity conservation principles. Grazing should be used to maintain grassland productivity and ecological integrity. Rangeland management should be undertaken based on the guiding principles of adaptive management, where decision making is aimed at achieving the best outcome. The overall long-term stocking rate for the study sites should not exceed its ecological carrying capacity. Furthermore, stocking rates should be adjusted based

on the veld condition and annual climatic conditions. It is recommended that grazing plans should be developed and implemented according to ecological principles and known best practices that are consistent with biodiversity conservation, to allow for an appropriate rotational livestock grazing system.

3.7.3 Woody vegetation

The presence of moderate woody vegetation contributes to the production of a good herbaceous layer, enhances nutrient cycling, and supports grass species that can thrive under shade (Kent, 2012). For veld management purposes, it is important to monitor the density of woody species because an increase in their density will have the opposite effect on the above-mentioned benefits.

The Glencoe study site is dominated by species within the Lower height class as 14 out of the 19 woody species were recorded under this height class (**Appendix 8**). Upper height class has the second largest number of woody species (5) followed by the Medium height class (3). Whereas Reedsdell is dominated by species within the Lower height class with 13 out of the 15 woody species falling under this height class (**Appendix 8**). Medium height class is the second largest class (5) and the Upper height class (4) is the least dominant.

Searsia divaricata and *Leucosidea sericea* species are the most dominant woody species and were recorded in 14 sample plots in the Glencoe study site, while in the Reedsdell study site *Leucosidea sericea* species is the most dominant woody species as it was recorded on 13 relevés (**Appendix 8**). *Searsia divaricata* was mostly recorded along the rocky outcrop areas of the study site, its occurrence in the area aligns with Moffett (2007)'s description that this species grows among rocky outcrops and cliff bases. According to Boon (2010), *Searsia divaricata* has a medicinal value of curing coughs and colds. Leaves of the species are crushed, dried, and used as an inhalant to cure common colds and coughs. Furthermore, in the Sesotho culture, the plant is used as one of the several plants that are believed to bring rain during the traditional rain making ceremonies (Boon, 2010). In terms of the CITES conservation status, this plant species is classified as a Least Concerned species (Moffett, 2007).

Leucosidea sericea's common English name is 'Old wood', which comes from the old, aged look of the tree stem and is used to initiate fires as it burns slowly (Boon, 2010). Adumu (2012) identified *Leucosidea sericea* as one of the 13 medicinal tree species that are used traditionally to treat helminthiasis. It occurs in high-altitude areas from 1 000 m.a.s.l to over 2 000 m.a.s.l along the riverbanks, wooded and rocky ridges within the open grassland vegetation (Adumu, 2012). Similarly, to the *Searsia divaricate,* this species is also classified as a Least Concerned under the CITES (Adumu, 2012). Based on the visual observations in this region, *Leucosidea sericea* is becoming an indigenous encroacher species as it tends to become denser in certain areas, which may transform the Grassland Biome into wooden areas. Currently, the species is not posing a threat to this ecosystem, however, it is imperative to monitor its density and distribution to avoid bush encroachment.

Populus canescens, Abrus laevigatus, Chrysocoma oblongifolia, Robinia pontica, Pinus taeda, Cliffortia paucistaminea, Lotononis galpini and Rubus laciniatus are the least dominant woody species and they were only recorded in one sample plot within Glencoe study site (**Appendix 8**), while *Artemisia annua, Artemisia pontica, Asparagus officinalis, Buddleja salviifolia, Passerina montana, Salix fragilis and Solanum nigrum* are the least dominant woody species in the Reedsdell study site as these species were also recorded on one sample plot (**Appendix 8**).

3.8 Conclusion

Two major plant communities, with three sub-communities and four variant communities were successfully classified for the Glencoe study site, which makes up to nine different communities. Similarly, two major plant communities were classified for the Reedsdell study site, with three sub-communities and four variant communities. This makes up a total of 18 different plant communities classified for the study area. The study area falls within the grassland biome and is relatively homogeneous with a well-developed herbaceous layer and few woody species, which is a characteristic of a Grassland Biome. Grassland vegetation, wetland vegetation, woodland vegetation are common communities within the two study sites. Disturbed shrubland vegetation,

rocky outcrop vegetation and riverine communities only occurs at the Glencoe study site, while disturbed grassland, and shrub-land vegetation only occur at Reedsdell study site. The woodland vegetation is limited to the drainage lines and the rocky areas of both study sites.

The majority (~60%) of the tree species recorded as alien plant species were dominated by *Rosa rubiginosa*. Management intervention needs to be implemented as part of monitoring the alien plant species, although they do not seem to have a major impact on the study area as their distribution is relatively small. However, close monitoring is required to ensure that these species do not spread increasingly in the study area.

Although the erosion was also estimated as being on a small scale and may not require remedial intervention at this stage, these areas need to be monitored from time to time to ensure they do not expand. Soil erosion control measures should be implemented to minimise the erosion threat into the biodiversity where and when necessary or determined by management. Most eroded areas were along the riverbanks and the wet lower lying areas of the study areas.

The infield assessments and classification results correlate with the desktop assessments (study site delineation – **Figure 2.6 and 2.7**) that were undertaken prior to the actual data collection in field as part of initial planning and preparations. Furthermore, the results are evident that the study area is indeed located within a grassland biome and within a Strategic Water Source Area. The description of plant communities in the study area is of fundamental importance for devising sound farming management practices and conservation strategies.

It is important to note that grazing and fire are inter-related forces that may have a large impact on rangeland conditions. Therefore, when developing grazing and fire management strategies for the study area, fire and grazing should be used to maintain grassland productivity and ecological integrity, while rangeland management should be undertaken based on the guiding principles of adaptive management. The overall long-term stocking rate of the study area should not exceed its ecological carrying capacity. Burning should be undertaken with consideration to the biodiversity conservation requirements of the sites and the need to protect rare and threatened species, grazing

and burning regimes on the properties must not threaten the biodiversity or ecological function of the reserve, nor lead to habitat degradation.

Chapter 4: Veld Condition Assessment

4.1 Introduction

Trollope, Trollope, & Bosch (1990) state that, "the veld condition is the veld's state of health in terms of its ecological status, resistance to soil erosion as well as the potential for producing forage for sustained optimum livestock production". Tainton (1999) identified three main objectives of undertaking the veld condition assessment:

- "Evaluating the impacts of management activities on veld condition and monitoring the change in vegetation over time".
- "Determining the condition of the veld in terms of different plant communities occurring in an area".
- "Evaluating the condition of the veld for the purpose of taking informed ecologically based decisions for management interventions".

The process of assessing the condition of the veld includes the determination of condition scores based on composition of grass species, and the classification of the species in accordance with their response to grazing (Voster, 1982; Van Oudtshoorn, 2012). It is, therefore, vital to undertake veld condition assessment procedures to determine conditions of each classified plant community as each has its own potential in terms of the grass production and grazing capacity (Brown, 1997; Tainton, 1999; Bothma, 2002; Van Oudtshoorn, 2012). According to Visser, Van Hoven, & Theron (1996); Brown *et al.,* (2013*),* the process of veld condition assessment allows for the most effective and improved management of the classified and identified plant communities in an area.

Conditions such as the availability of water, grazing and browsing patterns, soil type and condition, climate, length of growing season, stocking rate and management style are factors that contribute greatly to the change in veld condition of a given area. It is for these reasons that the veld condition assessment remains one of the most effective and important management tools which should be

undertaken on a regular basis to obtain information on whether the condition of the veld is improving or deteriorating.

One of the objectives of this study was to determine the veld condition of the two study sites that are in the process of being formally declared as Protected Areas through the Biodiversity Stewardship Programme of the Eastern Cape Parks and Tourism Agency. A step-point method was implemented as part of data collection to determine the grass species composition. The recorded grass species were grouped into ecological classes as identified by Van Oudtshoorn (2012) according to their Ecological Index Method (Foran, Tainton, & Booysen, 1978; Voster, 1982; Smit,1989).

Decreasers, Increasers I, II, III and Invaders were used to calculate the veld condition scores for each of the identified plant communities. The step-point data was loaded on an Excel spreadsheet for both study sites, from where the veld condition scores were calculated (**Appendix 10 for Glencoe and Appendix 11 for Reedsdell**) (Brown, 1997). A veld condition index (VCI) that is lower than 40% represents a poor condition, a veld condition score that ranges between 40% and 60% represents a moderate veld condition and a VCI higher than 60% represents a veld that is in a good condition (Bothma, 2002). The composition formula below was used to determine the species composition for each plant community (**Appendix 10 and 11**).

$$\text{Composition (\%)} = \frac{\text{No. of hits} + \text{No. of Misses}}{\text{Total no. of points}}\ x\ 100$$

The resultant species composition percentages were multiplied by the relative index values assigned to the different ecological groupings as: Ten (10) for Decreasers, Seven (7) for Increaser I, Four (4) for Increaser II and One (1) for Increaser III and invaders/forbs (Van Oudtshoorn, 2012). The VCI for the different plant communities was calculated using the formula below for both study sites (**Appendix 10 and 11**), and their results were averaged to calculate the overall veld condition indices for each of them:

$$\text{VCI} = \frac{(\%\text{D x } 10) + (\%\text{I}_1 \text{ x } 10) + (\%\text{I}_2 \text{ x } 10) + (\%\text{I}_3 \text{ x } 10)}{1\ 000} x\ 100$$

Where:

'VCI' stands for Veld Condition Index

'D' stands for Decreaser

'$I_{1,2,3}$' stands for Increaser I, II and III

The overall condition of both study sites was determined through calculating the proportional contribution of each plant community to the total study area. Rainfall is the environmental variable that was used to calculate the Grazing Capacity (GC) for both study sites. The mean annual rainfall for the Glencoe study site is 715 mm, while that for the Reedsdell study site is 848 mm. Therefore, the below formula was used to calculate the GC (Danckwerts 1989):

$$GC = -0.03 + (0.00289\ x\ X_1) + (X_2 - 419.7)\ x\ 0.000633$$

Where:

'GC' stands for Grazing Capacity (LAU/ha)

'X_1' stands for Veld condition Index (%)

'X_2' stands for Mean Annual Rainfall (mm/year)

4.2 The Glencoe study site

The overall veld condition index of the Glencoe study site is 49%, which indicates a veld condition that is in a moderate condition. Increaser II species are the most dominant species within the study site with a relatively abundance of *Eragrostis* species. These species occur in areas that are over utilised (Van Oudtshoorn, 2012). Additionally, an overall total of 43 different grass species recorded in the Glencoe study site through the step point surveys as part of the veld condition assessment. These grass species are made up of 9 Decreaser species, 10 Increaser I, 14 Increaser II species, five Increaser III species and five Invader species (**Appendix 9**).

4.3.1 *Schoenoplectus corymbosus – Juncus effusus* wetland community

This community is dominated by Increaser II species with a frequency percentage of 48%, followed by the Decreaser species at 28%, Increaser I at 13%, while the Increaser III has a frequency of 11% (**Figure 4.1**). Overall, this plant community had a 57% veld condition index, which indicates that this community is in an average condition. The domination by Increaser II species indicates that this community is over utilised.

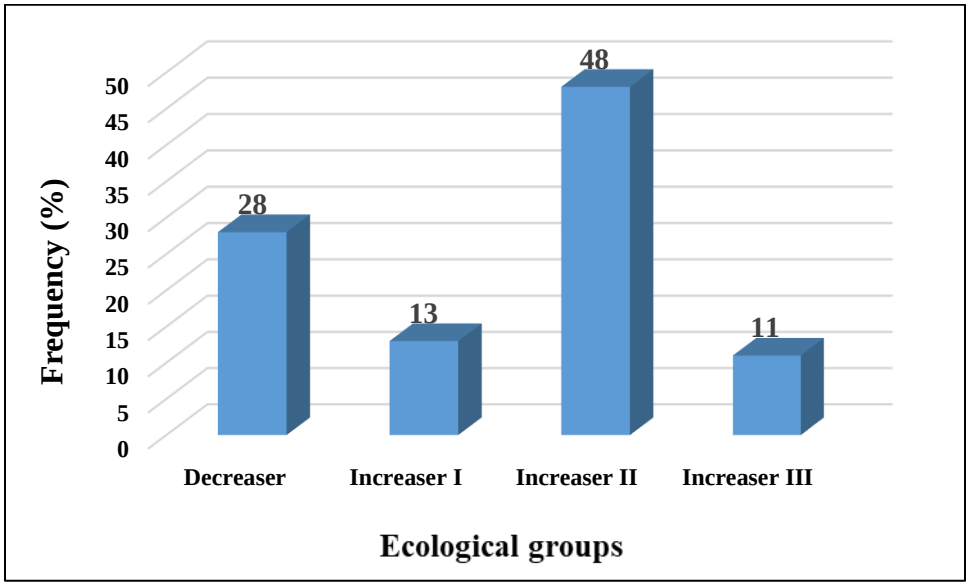


Figure 4.1: Frequencies for the ecological groups for plant community 1

4.3.2 *Eragrostis chloromelas – Scirpus ficinioides* open grassland.

This community is dominated by Increaser II species with a frequency percentage of 51,4%, followed by the Increaser III species at 18,8% frequency percentage, and by Increaser I species at 17,1%, while the Decreaser species are at 12,7% (**Figure 4.2**). Overall, this plant community had a 47% veld condition index, which indicates that it is in an average condition. Increaser II species indicates a veld that is over utilised.

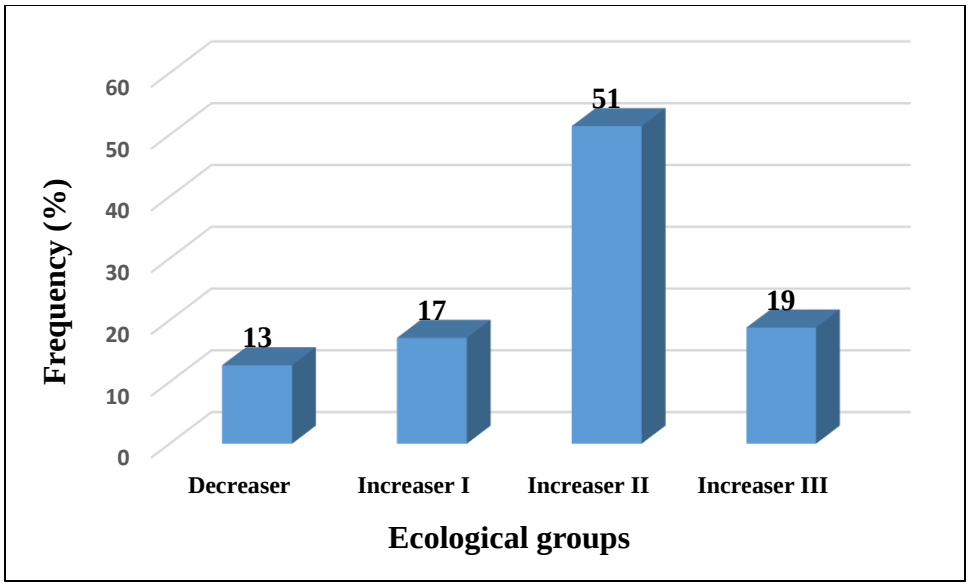


Figure 4.2: Frequencies for the ecological groups for plant community 2

4.3.3 *Eragrostis chloromelas – Scirpus ficinioides–Pennisetum thunbergii* wetland

This community is dominated by Increaser II species with a frequency percentage of 64,4%, followed by the Increaser III species at 14%, and Decreaser species at 12,4%, while the Increaser I species is the lowest at 9,6% (**Figure 4.3**). Overall, this plant community had a 46% veld condition index, which indicates that this community is in an average condition with signs of over utilisation due to the dominance of Increaser II species.

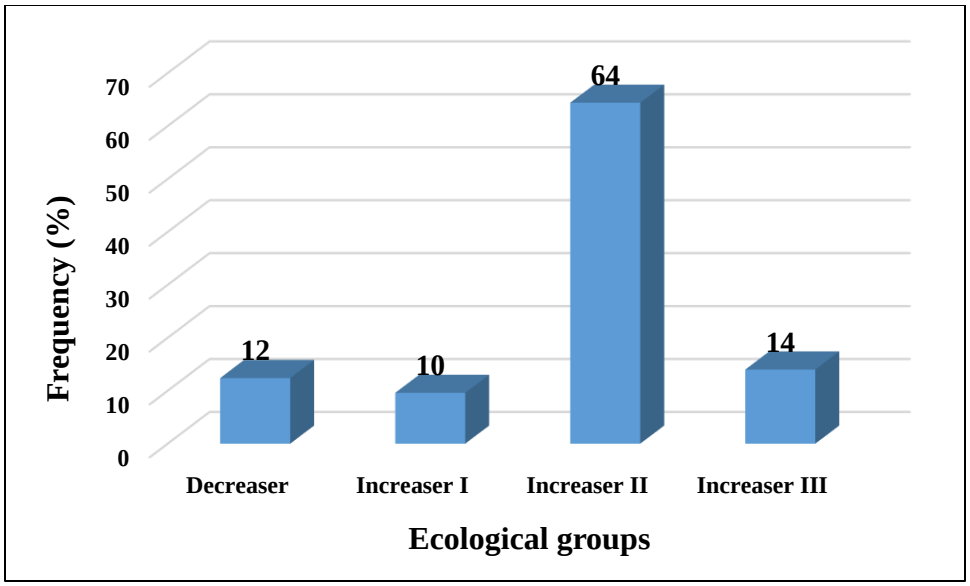


Figure 4.3: Frequencies for the ecological groups for sub-community 2.1

4.3.4 *Eragrostis chloromelas – Scirpus ficinioides–Microchloa caffra* open grassland.

This community is dominated by Increaser II species with a frequency percentage of 46,1%, followed by the Increaser I species at 20,8%, Increaser III species at 19,4%, and Decreaser species at 13,7% (**Figure 4.4**). Overall, this plant community had a 49% veld condition index, which indicates a condition that is average. This is another over utilised plant community as it is dominated by Increaser II species.

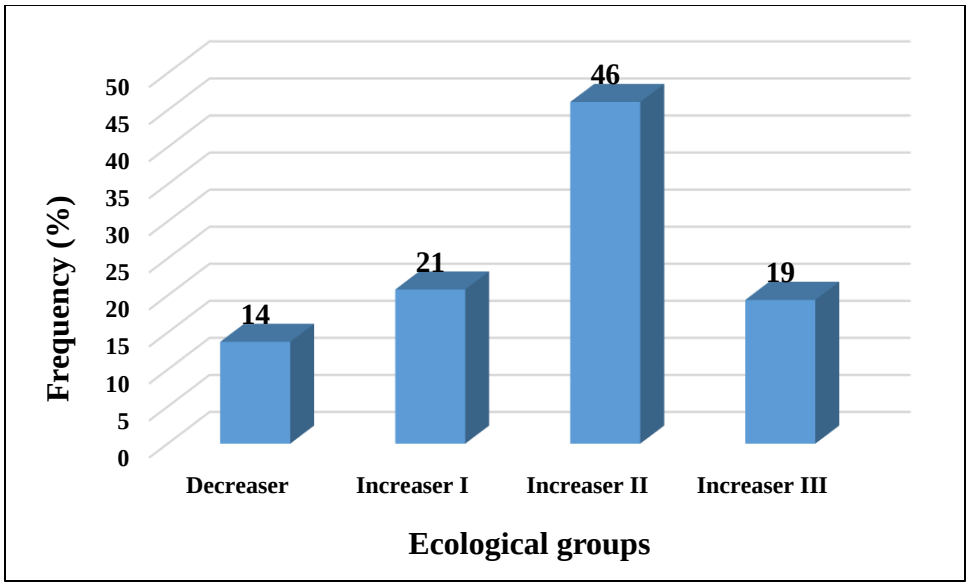


Figure 4.4: Frequencies for the ecological groups for sub-community 2.2

4.3.5 *Eragrostis curvula* variant community on rocky outcrops

This is another sub-community that is dominated by Increaser II species, which indicates a veld that is over utilised. The frequency percentage of Increaser II species is 55,6%, followed by the Increaser I species at 22%, Increaser III species at 19,2%, while the Decreasers are at 3,2% (**Figure 4.5**). Overall, this variant community has a 43% veld condition index, which indicates that it is in an average condition.

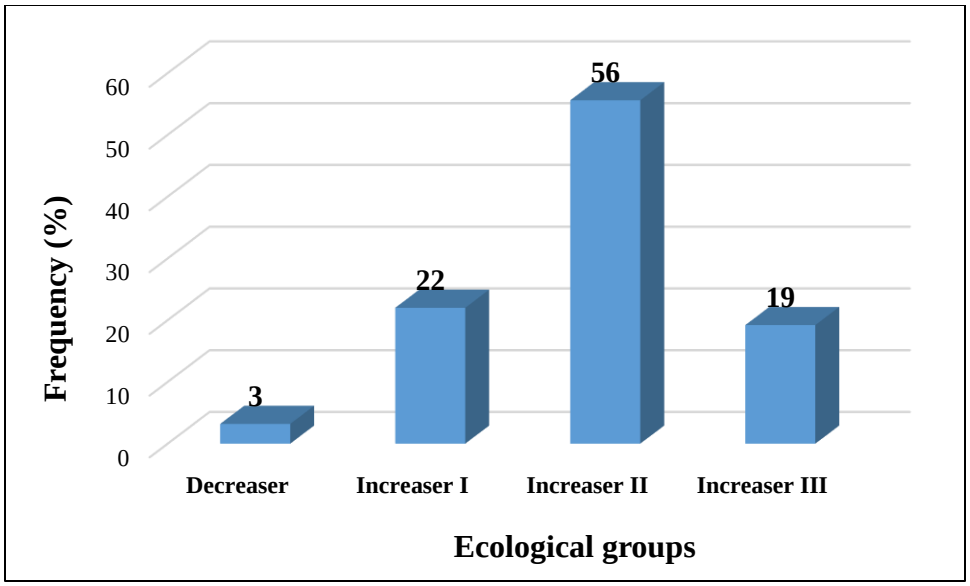


Figure 4.5: Frequencies for the ecological groups for variant community 2.2.1

4.3.6 *Eragrostis plana* variant community in open grasslands

This community is also dominated by Increaser II species with a frequency percentage of 54,9%, followed by the Increaser III species at 20,7%, Decreaser species at 12,7%, while the Increaser I species recorded a 11,7% (**Figure 4.6**). Veld over utilisation is indicated by the dominance of Increaser II species for the variant community. Overall, this plant community resulted in a 45% veld condition index, which indicates that this variant community is in an average condition.

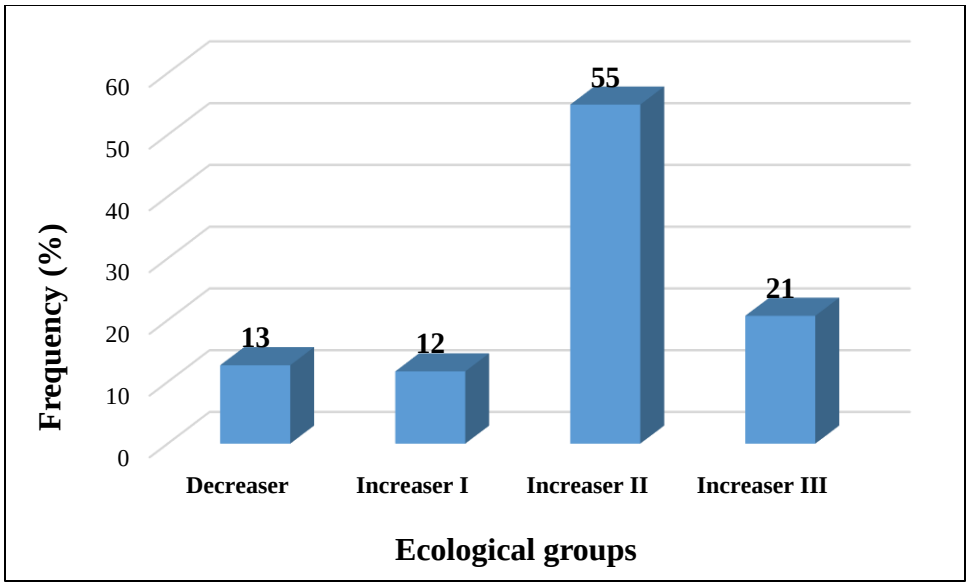


Figure 4.6: Frequencies for the ecological groups in variant community 2.2.2

4.3.7 *Leucosidea sericea* variant community in woodlands communities

This community is dominated by Increaser II species with a frequency percentage of 39,5%, followed by the Increaser I species at 21,9%, and Decreaser species at 20,4%, and Increaser III species at 18,2% (**Figure 4.7**). Overall, this plant community had a 53% veld condition index, which indicates that it is in an average condition with signs of over utilisation as result of the dominating Increaser II species.

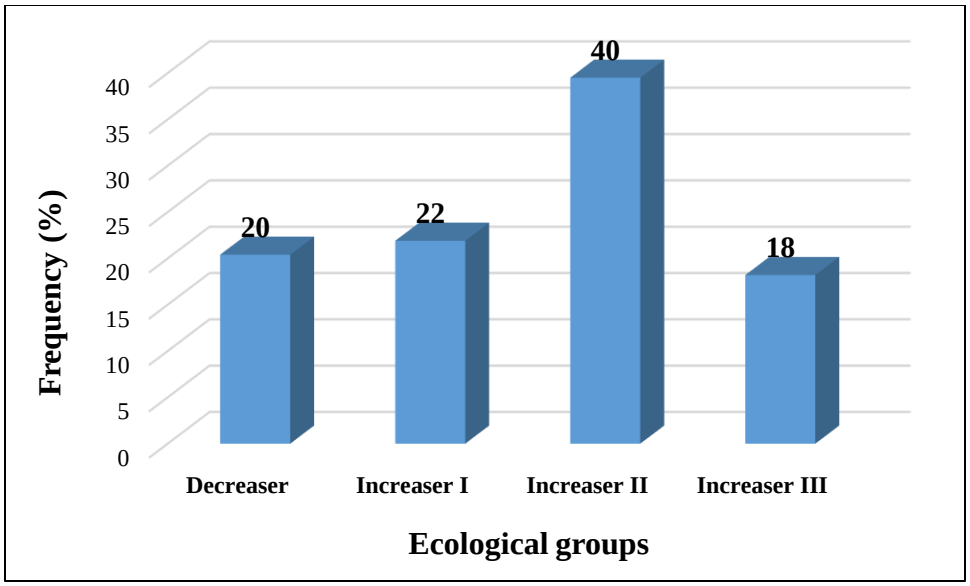


Figure 4.7: Frequencies for the ecological groups for variant community 2.2.3

4.3.8 *Cymbopogon caesius* variant community in riverine communities

This community is dominated by Increaser II species with a frequency percentage of 35,1%, followed by the Increaser I species at 24,9%, and Decreaser species at 22,4%, while the Increaser III species recorded 17,6% (**Figure 4.8**). The results of this variant community indicates that the veld is over utilised as it is dominated by the Increaser II species. The veld condition index is 56%, which is for a veld that is in an average condition.

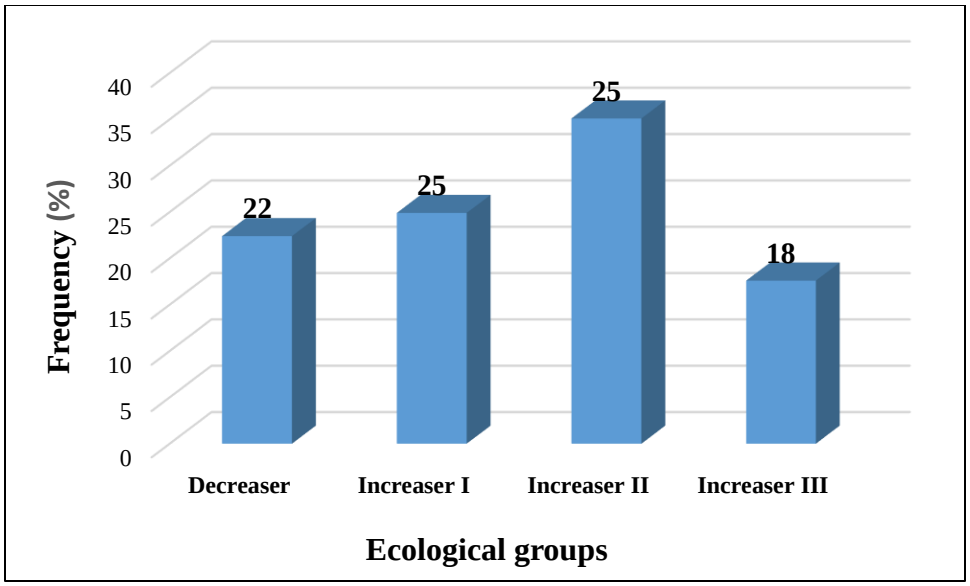


Figure 4.8: Frequencies for the ecological groups for variant community 2.2.4

4.3.9 *Eragrostis chloromelas – Scirpus ficinioides– Carex cognata* disturbed shrubland

This community recorded the highest frequency percentage for Increaser II species of 72,2%, followed by the Increaser III species at 15,8%, Increaser I species at 6,4%, and the Decreaser species at 5,6% (**Figure 4.9**). Increaser II grass species dominate a veld that is over utilised. The veld condition index for this sub-community is 41%, which indicates a veld that is in an average condition.

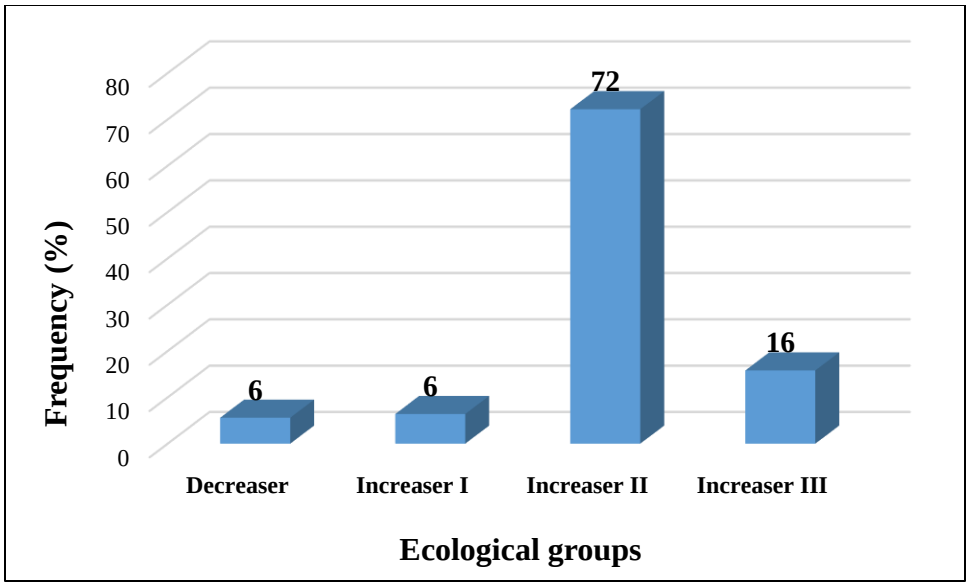


Figure 4.9: Frequencies for the ecological groups in sub-community 2.3

4.3 The Reedsdell study site

The overall veld condition of the Reedsdell study site is 48%, which indicates a veld condition that is moderate. Similarly, to Glencoe study sites, Increaser II species are the most dominant species within the Reedsdell study site with a relatively abundance of *Eragrostis* species. These species occur in areas that are over utilised (Van Oudtshoorn, 2012). Furthermore, Reedsdell study site an overall total of 35 different grass species were recorded that are made up of nine Decreaser species, seven Increaser I, ten Increaser II species, three Increaser III species and four Invader species (**Appendix 10**).

4.4.1 *Leucosidea sericea – Rosa rubiginosa* woodland vegetation.

This community recorded a high frequency percentage for Increaser II species of 45,1%, followed by the Increaser III species with a frequency percentage of 24,2%, followed by Decreaser species at 16,2%, while the Increaser I are the lowest at a frequency percentage of 14,5% **(Figure 4.10**). Plant community 1 indicates that this community is over utilised since it is dominated by Increaser

II species. The veld condition index for the variant community is 47%, which indicates a veld that is in an average condition.

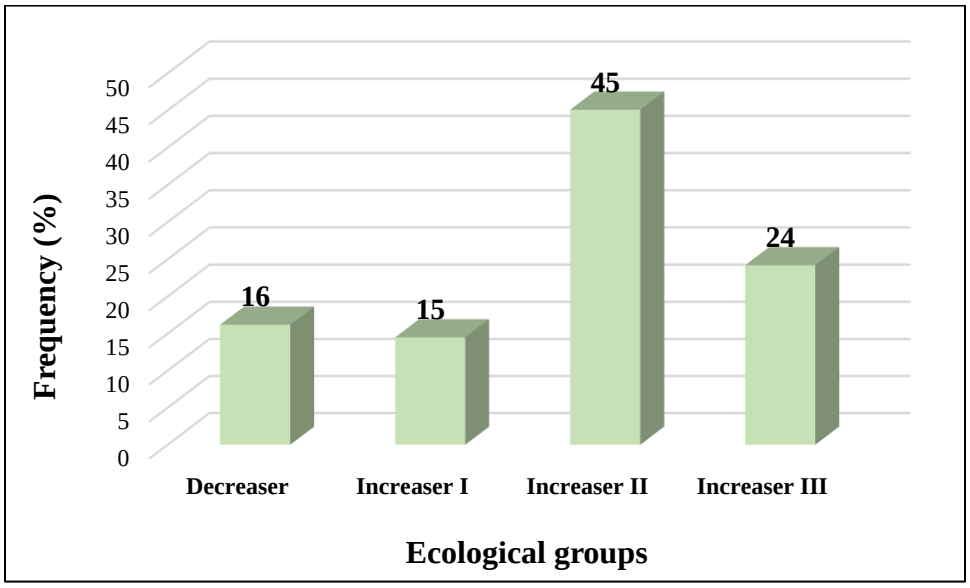


Figure 4.10: Frequencies for the ecological groups in community 1

4.4.2 *Leucosidea sericea – Rosa rubiginosa* - *Cymbopogon caesius* Open Grassland.

Similarly, this community is dominated by Increaser II species with a frequency percentage of 46,4%, followed by the Increaser III species at 23,8%, followed by Decreaser species at 16.0%, while the Increaser I species are the lowest at a frequency percentage of 13,6% (**Figure 4.11**). Overall, this plant community had a 46% veld condition index, which indicates that this community is in an average condition. The domination by Increaser II species indicates that this community is over utilised.

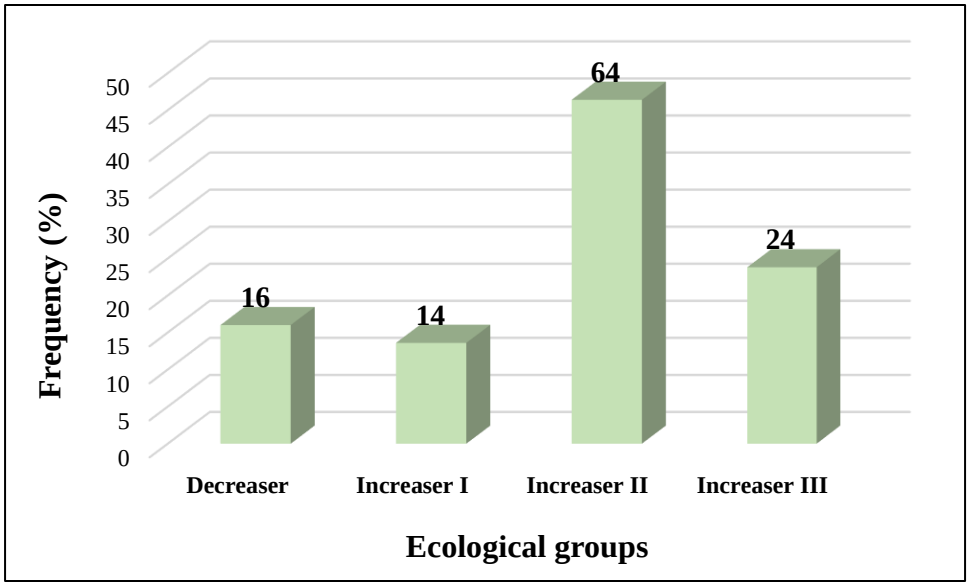


Figure 4.11: Frequencies for the ecological groups in sub-community 1.1

4.4.3 *Myosotis sylvatica* variant community.

This community is also dominated by Increaser II species at a frequency percentage of 47,8%, followed by the Increaser II species at 23,2%, followed by Decreaser species at 17,2%, while the Increaser I species was recorded as a lowest species with a frequency percentage of 11,8% (**Figure 4.12**). Overall, this plant community had a 47% veld condition index, which indicates a veld that is in an average condition. Increaser II species indicates a veld that is over utilised.

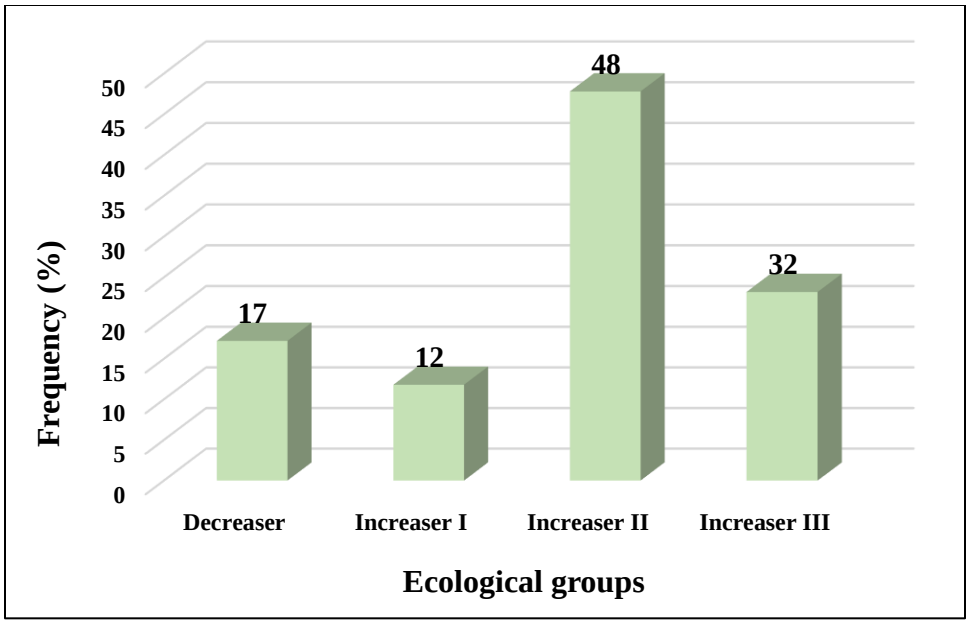


Figure 4.12: Frequencies for the ecological groups in variant community 1.1.1

4.4.4 *Loudetia simplex – Themeda triandra* open grassland vegetation**.**

This community recorded the highest frequency percentage for Increaser II species of 46,8%, followed by the Increaser III species at 24,9%, Followed by Decreaser species at 16,4%, while the Increaser I species are the lowest species at a frequency percentage of 11,8% (**Figure 4.13**). This plant community had a veld condition index of 46%, which indicates that this community is in an average condition. This community is over utilised as it is dominated by Increaser II species.

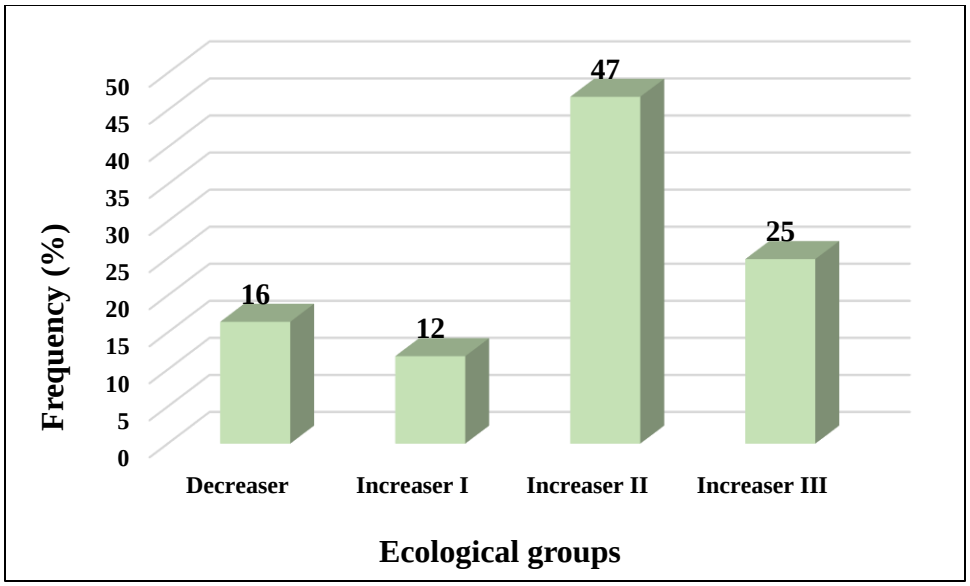


Figure 4.13 Frequencies for the ecological groups in community 2

4.4.5 *Loudetia simplex – Themeda triandra - Scirpus ficinioides* wetland vegetation.

This is another plant community that is dominated by Increaser II species at frequency percentage of 54,1%, followed by the Increaser III species at 20.0%, followed by Decreaser species at 15,6%, and the Increaser I species at a frequency percentage of 10,6% (**Figure 4.14**). The abundance of increaser II grasses within community 2 indicates that the veld is over utilised. This plant community had a 47% veld condition index, which indicates that this community is in an average condition.

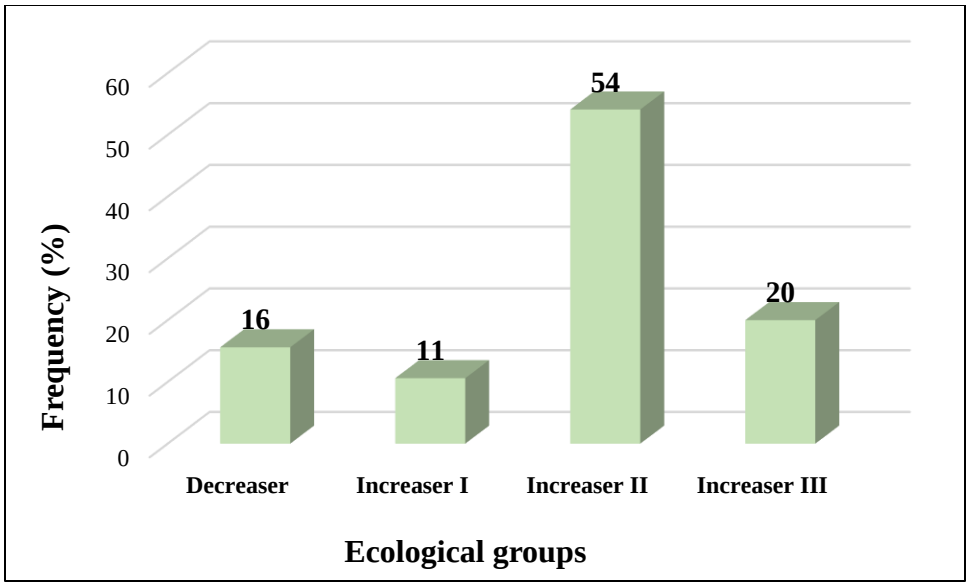


Figure 4.14: Frequencies for the ecological groups in sub-community 2.1

4.4.6 *Loudetia simplex – Themeda triandra - Tristachya leucothrix* open grassland vegetation.

This community also recorded the highest frequency percentage of 13,9% for Increaser II species, followed by the Increaser III species at 32.0%, Followed by Decreaser species at 19,5%, and the Increaser I species at a frequency percentage of 13,9% (**Figure 4.15**). The abundance of Increaser II species indicates that the veld is over utilised. This plant community had a veld condition index of 46%, which indicates that this community is in an average condition.

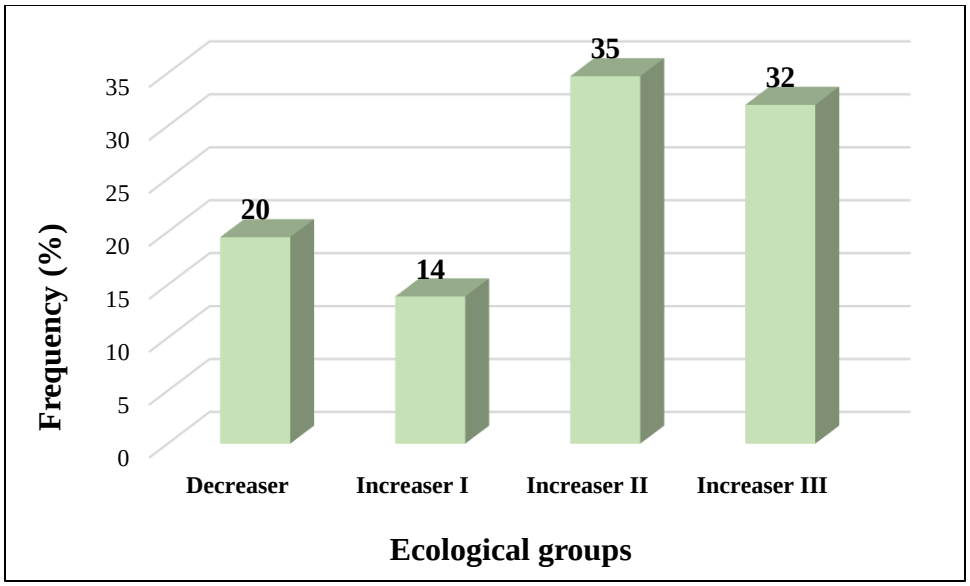


Figure 4.15: Frequencies for the ecological groups in sub-community 2.2.

4.4.7 *Eragrostis racemosa* variant community

This is another community that is dominated by Increaser II species at a frequency percentage of 60,2%, followed by the Increaser III species at 19,6%, followed by Decreaser species at 11,5%, while the Increaser I species are the lowest species at a frequency percentage of 8,9% (**Figure 4.16**). The abundance of Increaser II species in this variant community indicates that the veld is over utilised. This plant community had a veld condition index of 44%, which indicates that this community is in an average condition.

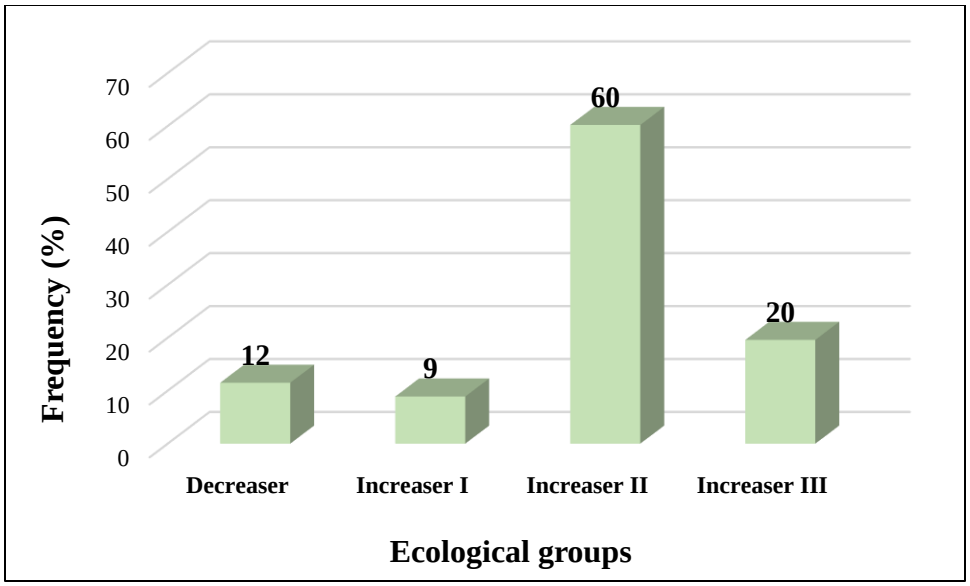


Figure 4.16: Frequencies for the ecological groups in variant community 2.2.1

4.4.8 *Senecio ulopterus* variant community.

This community recorded a highest frequency percentage of 37,4% for Increaser II species, followed by the Decreaser species at 24,7%, followed by Increaser III species at 22,6%, and the Increaser I species at a frequency percentage of 15,4% (**Figure 4.17**). This community indicates signs of over utilisation due to the abundance of increaser II species. This plant community had an overall veld condition index of 53%, which indicates that this community is in an average condition.

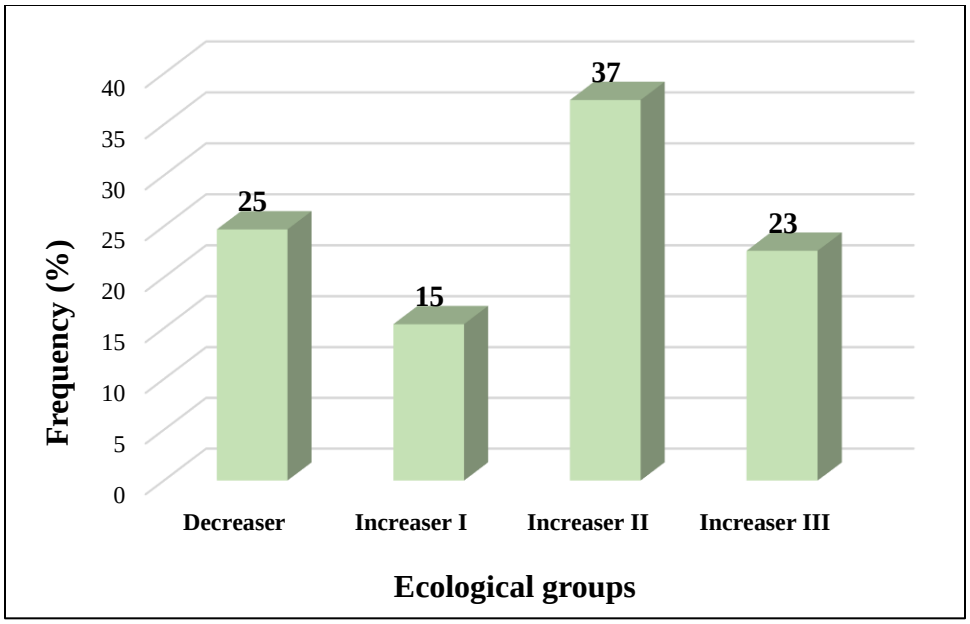


Figure 4.17: Frequencies for the ecological groups in variant community 2.2.2

4.4.9 *Erica hillburttii* variant community.

This is another community that is dominated by Increaser II species at a frequency percentage of 32,4%, followed by the Increaser III species at 29,3%, followed by Decreaser species at 21,8%, while the Increaser I species recorded a lowest frequency percentage of 16,7% (**Figure 4.18**). The results of this community indicate that the veld is over utilised based on the abundance of Increaser II species. This plant community had a 49% veld condition index, which indicates that this community is in an average condition.

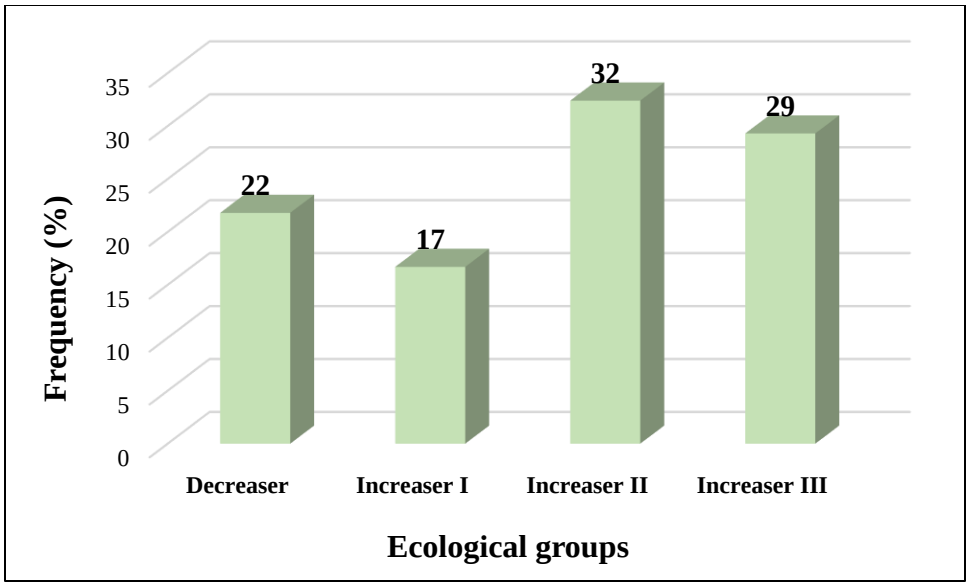


Figure 4.18: Frequencies for the ecological groups in variant community 2.2.3.

4.4 Discussions

4.4.1 Veld condition

On the Glencoe study site, Increaser II species are the most dominant grass species with an overall frequency percentage of 52%, Decreaser species recorded a low frequency percentage of 15%. In the same way, Reedsdell study site, is also dominated by Increaser II species with an overall frequency percentage of 45%, while the Increaser I species has the lowest frequency percentage of 15%. The abundance of Increaser II species within both study sites indicates that the study area is moderately over utilised as Increaser II species becomes abundant in a veld that is being overgrazed (Van Oudtshoorn, 2012). The low frequency percentage of Decreaser grass species at both study sites may be associated with continuous grazing leading to dominant Increaser II species.

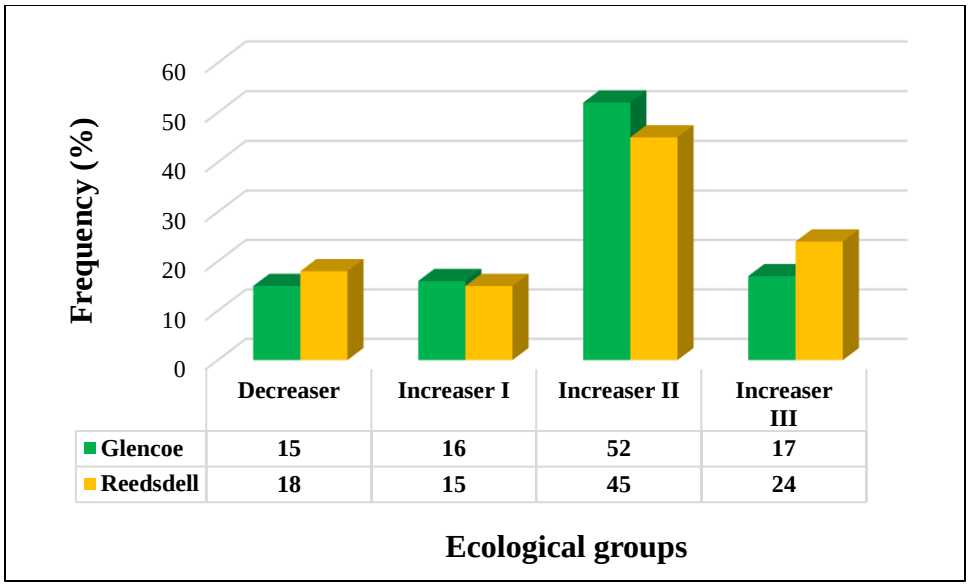


Figure 4.19: Overall frequencies of the Ecological groups for the study area.

The veld condition indices of both study sites are at moderate levels of 49% and 48%, respectively (Bothma, 2002). There is only a difference of 1% between the two study sites. Increaser II species recorded the highest percentage across all identified plant communities on both study sites at 52% and 45%, respectively. These species increase in a veld that is being overgrazed, implying that Glencoe and Reedsdell are being over utilised at moderate level.

In the Glencoe study site, plant community 1, variant community 2.2.3 and variant community 2.2.4 had the highest veld condition (over 50%) compared to the rest of the plant communities which had less than 50%. These communities were found on moist areas along wetlands (community 1) and water seepages (variant community 2.2.3 & 2.2.4). Wet areas tend to have good vegetation cover as compared to dry areas. Additionally, these communities were dominated by loam soils (community 1) as well as sandy loam soils (variant community 2.2.3 & 2.2.4). According to Dubbin (2001) loam and sandy loam soils are made of a mixture of different grades such as silt and clay and are mostly found on moist areas which makes conditions favourable for grass species, hence these communities occurring in these areas had a higher veld condition score. At the Reedsdell study site, variant community 2.2.2 had the highest veld condition (53%)

compared to the rest of the other plant communities which had a score of less than 50%. In the same way, this community was found in a moist area along the drainage lines with numerous water seepages and was dominated by sandy loam soils. The dominance of sandy loam soils is evident that these soils create favourable conditions for grass species as all communities with higher score were dominated by sandy loam soil on both study sites.

4.4.2 Grazing value, plant succession and palatability.

For the Glencoe study site, the overall site is dominated by 40% species with an average grazing value followed by 30% species with low grazing value, 23% species with high grazing value, and 7% of species with an unknown grazing value. Whereas for the Reedsdell study site, the overall site is dominated by 37% species with a low grazing value, followed by 31% species with an average grazing value, 8% species with high grazing value, and 8,6% of unknown grazing value (**Figure 4.20**).

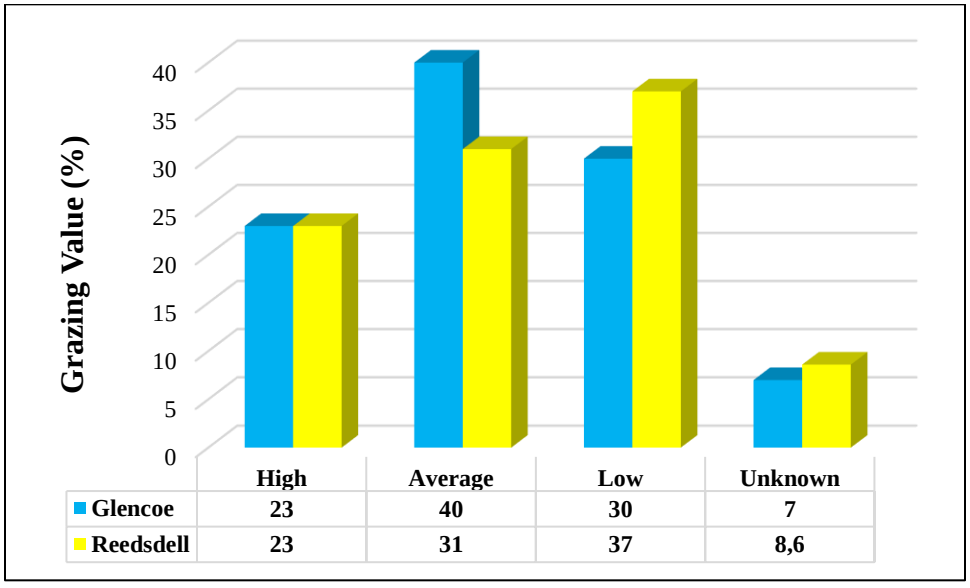


Figure 4.20: Grazing value percentages of the study area.

The Glencoe study site is dominated by climax species in terms of the plant succession with an overall percentage of 51,2%, followed by pioneer species with an overall percentage of 16,3%,

and subclimax and climax species making up 11,6%, (**Figure 4.21**). Species that have an unknown plant succession classification had an overall percentage of 9,3%. The Reedsdell study site is dominated by climax species with an overall percentage of 51,4%. Followed by subclimax and climax species at 14,3%, with pioneer, subclimax and 'unknown' at 11,4% each (**Figure 4.21**).

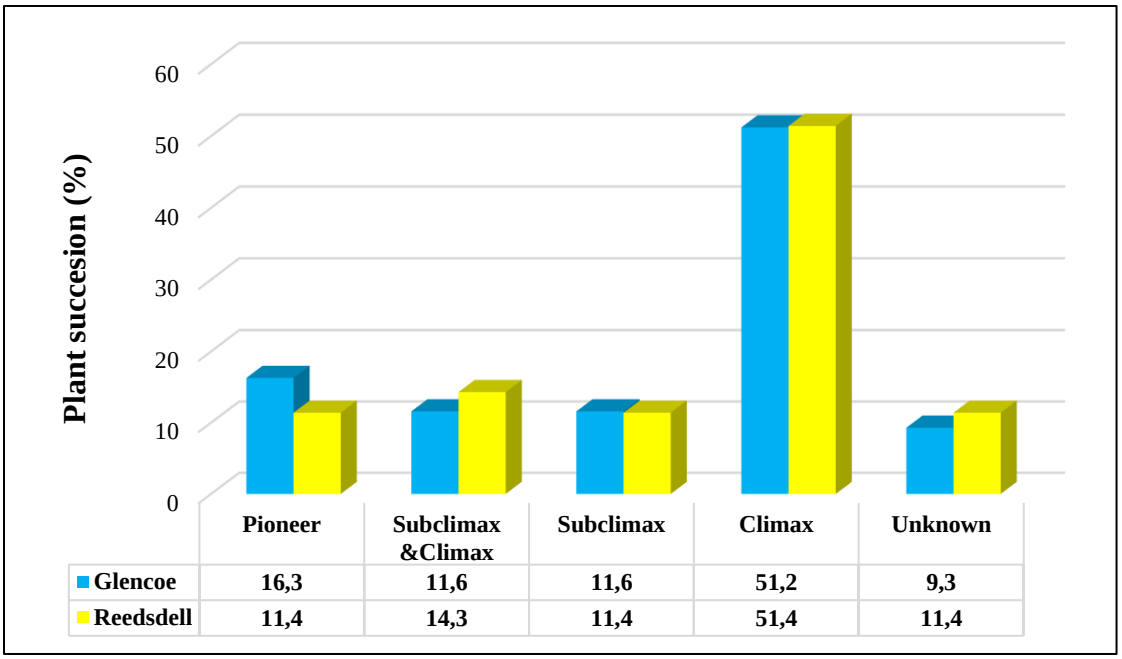


Figure 4.21: Plant succession percentages of the study area.

In terms of the palatability of the recorded grass species, the Glencoe study site is dominated by grass species with low or poor palatability (34,9%), followed by species with moderate palatability (30,2%), and highly palatable species (27,9%). Grass species that have an unknown palatability classification had an overall percentage of 6,98% on the study site (**Figure 4.22**). Similarly, the Reedsdell study site is also dominated by grass species of poor palatability with an overall percentage of 37,1%, followed by species that are moderately palatable at 28,6%, and species that are highly palatable at 25,7% (**Figure 4.22**). Grass species that have an unknown palatability classification had an overall percentage of 8,57%.

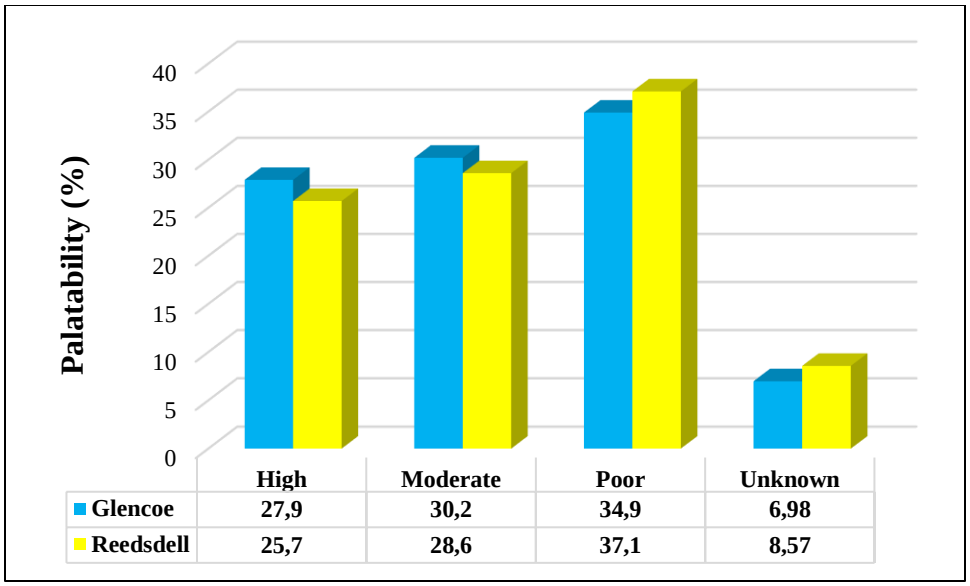


Figure 4.22: Palatability percentages of the study area.

4.5 Conclusion

The overall results of the veld condition indicates that both study sites are in average condition and recorded 49% for Glencoe and 48% for Reedsdell. This means that effective livestock management intervention needs to be implemented to ensure that the veld condition is improved from an average to a good condition. A correct stocking rate should be adhered to, based on the GC calculations results of 0,30 LAU/ha for the Glencoe study site and 0,38 LAU/ha for the Reedsdell study site.

Glencoe and Reedsdell study sites are dominated by Increaser II species with an average percentage of 52% for the Glencoe study site and an average percentage of 45% for the Reedsdell study site. These results indicate that both study sites are over utilised as Increaser II species are species that increase in a veld that is over utilised. Therefore, a correct stocking rate for livestock grazing should be applied by the management of the study sites. Overstocking may lead to crusting and trampling of soil and remove the vegetation of the veld, result in reduced production rate, decrease soil fertility, and promotes soil erosion.

The Glencoe study site is dominated by species with an average grazing value at an average percentage of 40%, while Reedsdell study site is dominated by species with a poor grazing value at an average percentage of 37%. This means that both study sites are dominated by unpalatable grass species, which are the species that are not favourable to grazers. This finding is supported by the results of the palatability of the veld for both study sites as they are both dominated by species which are poorly palatable or non-palatable (Glencoe 34,9% and Reedsdell 37,1%). Adequate rangeland initiatives should be implemented on the study area to improve the veld condition.

In terms of the plant succession, both study sites are dominated by climax species at an average percentage of 51,2% for the Glencoe study site and 51,4% for the Reedsdell study site. These are the perennial species that have an ability to outcompete most of other species in a veld. The abundance of climax species on the study area indicates that the veld of the study area is below natural condition.

The dominance of species with an average grazing value correlate with the overall veld condition of the study areas as well as the high number of Increaser II species recorded for both sites. The abundance of climax species indicates that with effective and improved veld management, the veld condition could be improved since climax species are strong perennial plants adapted to normal optimal growth conditions. The veld over utilisation has led to study area being dominated by the poorly palatable species as livestock tend to frequently graze the palatable species first before the unpalatable species.

It is important to note that grazing and fire are inter-related forces that may have large impacts on rangeland conditions. Therefore, when developing grazing and fire management strategies for the study area, fire and grazing should be used to maintain grassland productivity and ecological integrity. Rangeland management should be undertaken based on the guiding principles of adaptive management, where decision making is aimed at achieving the best outcome based on current understanding, the overall long-term stocking rate of the study area should not exceed its ecological carrying capacity. Veld burning should be undertaken with consideration of the biodiversity conservation requirements of each site and the need to protect rare and threatened

species. Grazing and burning regimes must not threaten the biodiversity or ecological function of these areas, nor lead to habitat degradation.

There were no records of the historical veld condition assessments data for both study sites that could be compared against this study. This study serves as basis for the two sites as it provides the first veld condition assessment data. Management should employ veld condition assessments on a regular basis and compare the veld condition scores with the findings of this study to prevent veld deterioration and to identify damage to the veld in advance.

It is important that veld management plans for rangeland management are developed and implemented accordingly along with the protected area management plans to ensure that the biodiversity of the study area is not compromised as the study sites are in a process of being declared as protected areas through the Biodiversity Stewardship Programme.

Chapter 5: Biodiversity Site Assessment

5.1 Introduction

As part of the Eastern Cape Parks and Tourism Agency's guidelines and procedures to assess if the biodiversity value occurring in a particular property qualifies a property to be declared as a protected area and under which category. Both desktop and field verifications were undertaken as part of assessing the biodiversity value of the Glencoe and Reedsdell study sites during the raining season from December 2020 to March 2021 because species are easily identifying during this period. One of the study's objectives was to conduct Biodiversity Site Assessments to determine the conservation importance of the two study sites. The BSAT is used to identify management considerations and interventions necessary for sites declaration, to inform the preferred protection status and to guide the Land Inclusion and Planning Committee decision-making process.

The biodiversity site assessment tool was developed by the group of Ecologists from the ECPTA and was employed to collect field data. The data collected was populated into an Excel spreadsheet for scoring purposes. The different scoring for each assessed section of the tool was allocated accordingly as part of determining the property's eligibility to be declared as a protected area as well as determining the protection status for which each study site may qualify. A maximum score of 4 at each category means that a site qualifies for a Nature Reserve status, maximum score of 3 at each category qualifies for a Protected Environment status, and a score of 2 and 1 means that a site does not qualify to be declared as a formally protected area but can be assigned a management agreement or a conservation area status. The maximum overall score for all categories is 30. Therefore, a maximum overall total score of 30 means that a site qualifies for a Nature Reserve status, a total score of between 25 to 29, qualifies it for a Protected Environment status, a total score of between 20 to 25 qualifies it for a Biodiversity Agreement status and a total score of between 10 and 20 indicates that a site qualifies for a Conservation Area status.

In terms of the Biodiversity Plans, if a property falls within a Critical Biodiversity Area (CBA-1) it qualifies for a score of 2,5, CBA-2 qualifies it for a score of 2 and CBA 3 qualifies it for a score of 0 in accordance with the Eastern Cape Biodiversity Conservation Plan.

In terms of the Habitats that occur on the property, a vegetation types layer was used. If the vegetation type ecosystem threat status is critically endangered or endangered, it qualifies for a score of 4; if it vulnerable it qualifies for a score of 2; and if it is least threatened qualifies for a score of 0. If the vegetation type ecosystem protected level in the province is not protected, it qualifies for a score of 4, if moderately protected it qualifies for a core of 2 and if the vegetation type is well protected it qualifies for a score of 0. The vegetation type abundance percentage in the property is scored according to percentages. If the vegetation type abundance target in the property is more than 5% it qualifies for a score of 4; if it between 1-5% it qualifies for a score of 2; and if it less than 1% it qualifies for a score of 0.

In terms of the species found in the property and in accordance with the Red List Status, if the species is critically endangered or endangered it qualifies for a score of 4; if the species is vulnerable it qualifies for a score of 2; and if the species is least threatened it qualifies for a score of 0. In terms of the species population size occurrence in the property, significant populations size qualifies for a score of 1, minor species population size qualifies for a score of 0,5 and unconfirmed species population size qualifies for a score of 0,25.

In terms of the Ecological processes, for the property size of more than 50 000 ha, that particular property qualifies for a score of 4, the property size of between 10 000 ha to 50 000 ha qualifies for a score of 3, a property size of between 1 000 ha to 10 000 ha qualifies for a score of 2 and the property size of less than 1 000 ha qualifies for a score of 0. In terms of the property resilience to climate change due to its location, a resilience rating of between 8-10 qualifies it for a score of 8-10, rating between 5-7 qualifies for a score of 2, rating between 3-4 qualifies for a score of 1 and rating between 0-2 qualifies for a score of 0.

In terms of the Ecosystem Goods and Services, if the property's significance is of a country-wide or provincial level, it qualifies for a score of 3, if is of landscape significance it qualifies for a score of 2, if is of a local significance it qualifies for a score of 1 and if none it qualifies for a score of 0. In terms of the Eastern Cape Protected Area Expansion Strategy (ECPAES), if the property falls within the ECPAES priority area category, it gets rated as a high ECPAES priority, if the property falls within the ECPAES high value area category, it gets rated as a moderate ECPAES priority and if the property falls outside of the ECPAES, it rates as a low ECPAES priority.

Both study sites are located within the Witteberg range in the Senqu Local Municipality, but they are slightly different in terms of their extent because Glencoe covers an area of ~1 089,44-ha, whereas Reedsdell covers ~1158,14-ha. It is also important to note that the primary land use of both study sites is livestock farming (sheep and cattle) and the produce of green feed for winter grazing on a very small scale. The land use of these study sites is very similar to the adjacent properties and across the region as the region is a working agricultural landscape.

5.2 Biodiversity site assessment results discussion for Glencoe and Reedsdell study sites.

In terms of the average scoring, both Glencoe and Reedsdell qualify for a Biodiversity Agreement category. Glencoe study site qualifies for a Biodiversity Agreement in terms of the habitats, whereas Reedsdell study site qualifies for a Conservation Area category (**Figure 5.1**). Both study sites qualify for a Conservation Area category in terms of the species (for both floral and faunal species) that occurs. Glencoe study site qualifies for a Conservation Agreement category in terms of the ecological processes, whereas Reedsdell study site qualifies for a Protected Environment Category. Both study sites qualify for a Biodiversity Agreement in terms of the ecosystem goods and services (**Figure 5.1**). Where 'NR' means Nature Reserve category, 'PE' means Protected Environment, 'BA' means Biodiversity Agreement and 'CA' means Conservation Agreement in figures 5.1, 5.2 and 5.3.

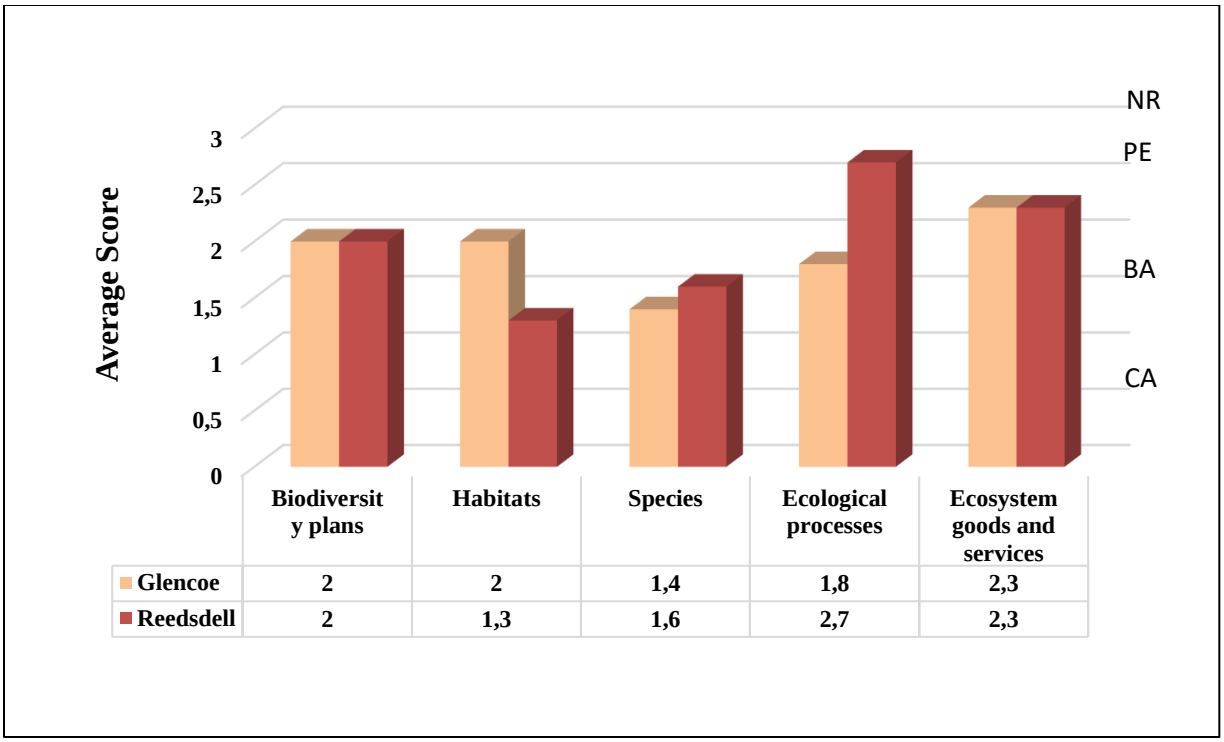
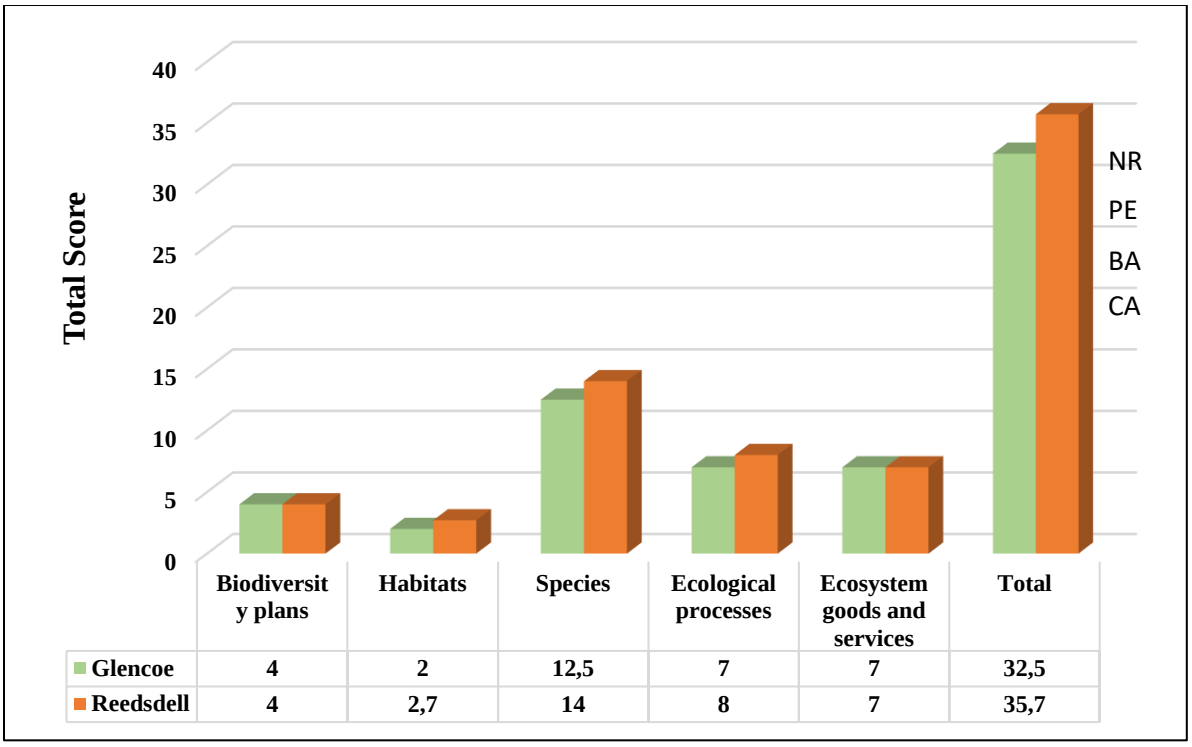


Figure 5.1: Average scores for the different categories at Glencoe and Reedsdell study sites.

In terms of the overall total scoring for properties biodiversity value eligibility for protected area category, inclusion into the Biodiversity Stewardship Programme and declaration as a protected area in accordance with the NEM:PAA Act. Both study sites qualify for a Nature Reserve status (**Figure 5.2**).



	Biodiversity plans	Habitats	Species	Ecological processes	Ecosystem goods and services	Total
Glencoe	4	2	12,5	7	7	32,5
Reedsdell	4	2,7	14	8	7	35,7

Figure 5.2: Overall total scoring results for Glencoe and Reedsdell study sites.

In terms of the Maximum score, both Glencoe and Reedsdell study areas qualify for a Biodiversity Agreement category for the biodiversity plans scoring. Glencoe study site qualifies for a Biodiversity Agreement in terms of its habitats, whereas Reedsdell study site qualifies for a Conservation Area category. Glencoe study site qualifies for a Biodiversity Agreement in terms of the species, whereas Reedsdell study site qualifies for a Nature Reserve category. Both study areas qualify for a Nature Reserve category for ecological processes and both properties qualify for a Protected Environment category for the ecosystem goods and services (**Figure 5.3**).

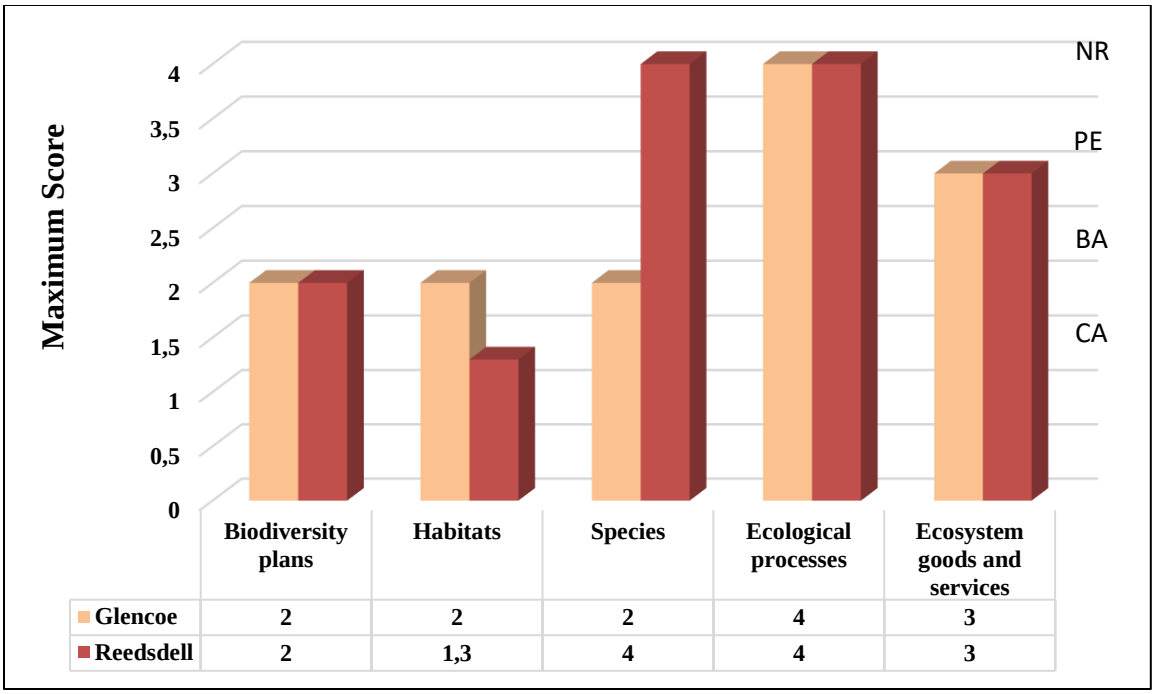


Figure 5.3: Maximum scoring results for different categories at Glencoe and Reedsdell study sites.

5.3 Discussion

5.3.1 Systematic biodiversity plans

In terms of the Systematic Biodiversity Plans (SBP), the Eastern Cape Biodiversity Conservation Plan (ECBCP), Berliner & Desmet (2007) used an integrative systematic conservation planning approach to identify the minimum spatial requirements to maintain and support biodiversity and ecological infrastructure. The plan identifies important areas for biodiversity conservation and provides for associated land use management guidelines to inform decision making.

Glencoe and Reedsdell study sites are located within areas identified as a Critical Biodiversity Area-2 (CBA-2) due to their importance as an ecological corridor and the fine-scale analyses indicated the vegetation to be threatened (**Figures 5.4 and 5.5**) The study area falls within the planning domain of several important landscape-level biodiversity conservation initiatives which seek to expand and link key Protected Areas and ecological corridors across the region. Given the

high altitude, the region supports the largest extent of C3 grasslands in South Africa, almost none of which is found in the current existing protected areas in the Eastern Cape Province (Skowno, *et.al.*, 2012).

In terms of the EIA Regulations of the National Environmental Management Act (No. 107 of 1998), various activities require Environmental Authorisation before they may commence. The implication of this is that if any of the activities listed in the EIA Regulations are proposed in a CBA, they may be subjected to either a basic assessment or a full scoping and EIA process.

Both study sites are located within the Eastern Cape Protected Area Expansion Strategy (North Eastern Cape Grasslands Priority Area). Most importantly, they fall within the Eastern Cape Drakensburg Strategic Water Source Area, and within the National Fresh Water Priority Area (**Figures 2.4**).

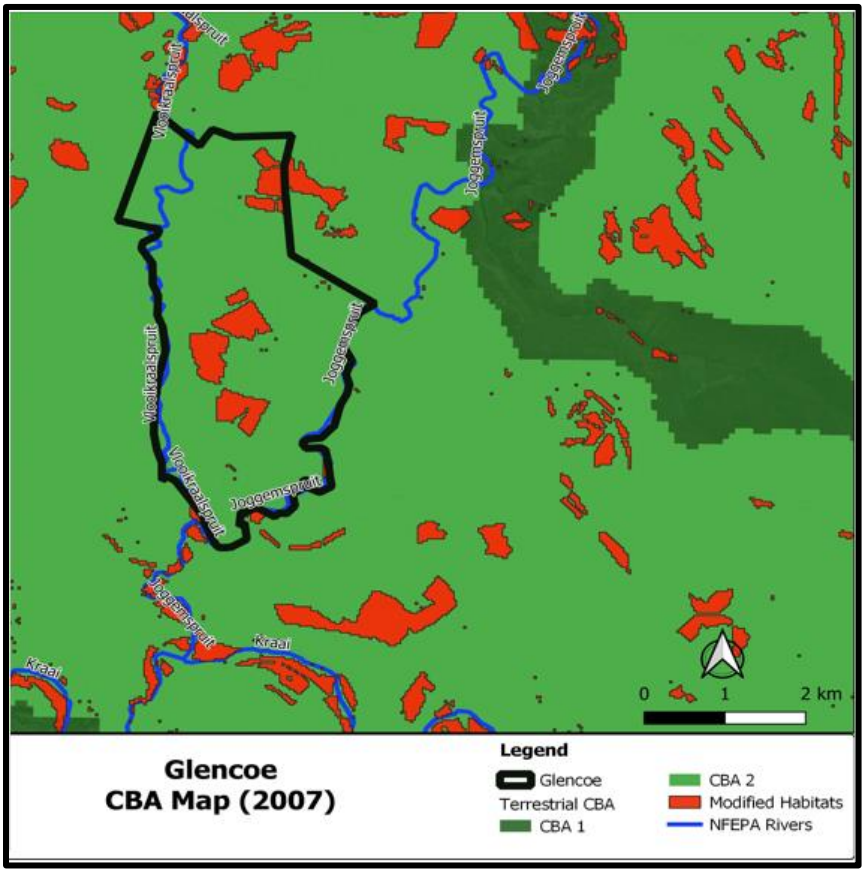


Figure 5.4: Map showing the CBAs layers of the Glencoe study site.

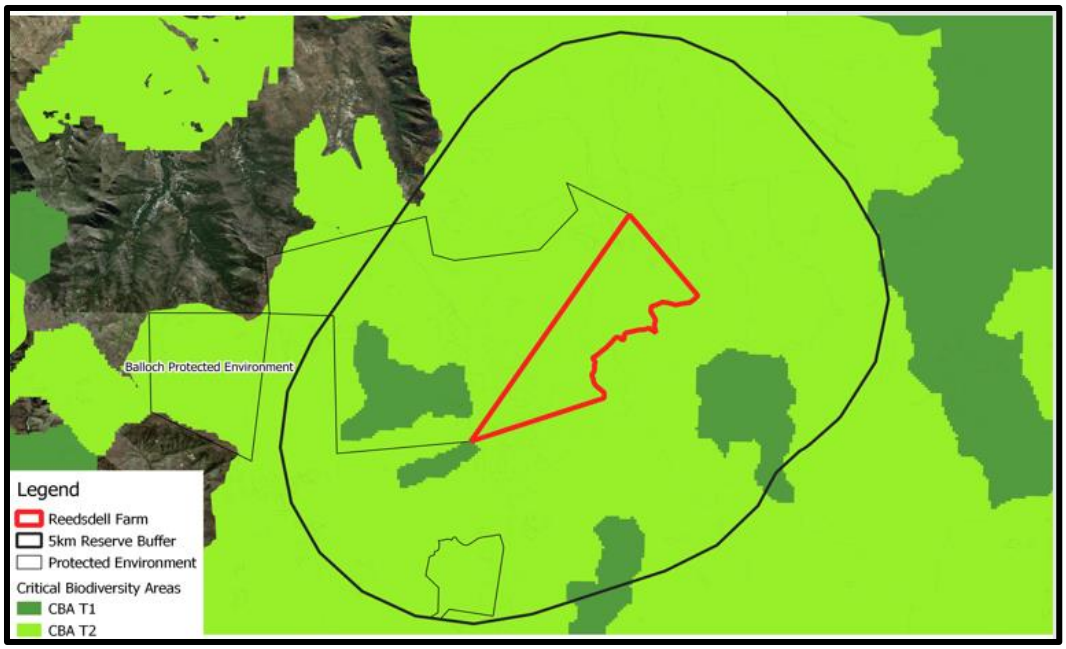


Figure 5.5: Map showing the CBAs layers of the Reedsdell study site.

According to the biodiversity site assessment tool that was undertaken through desktop exercise and infield verification, both study sites scored 2 in terms of the CBA's as they both falls within the CBA-1 and 2 for the NFEPA as they also fall within the priority catchment FEPA (**Appendix 12 and 13**).

5.3.2 Vegetation types / habitat

The Southern Drakensberg Highland Grasslands covers both Glencoe and Reedsdell study sites (**Figure 2.2**). This vegetation type is poorly protected in the Eastern Cape Province and is least threatened because about 92% of it is still intact in the province (Mucina, & Rutherford, 2006). The Lesotho Highlands Basalt Grasslands covers only the Reedsdell study site (**Figure 2.2**). This vegetation type is also poorly protected in the province and is least threatened (Mucina, & Rutherford, 2006). Therefore, Glencoe study site covers one vegetation type, whereas Reedsdell study site covers two vegetation types (**Table 5.1**).

Table 5.1: Vegetation types found in Glencoe and Reedsdell study sites and their protection targets in the Eastern Cape Province based on Mucina & Rutherford (2006).

Property Name	Vegetation type	Hectares intact	Total area in the EC (ha)	% of veg in EC on site	EC* Biodiversity Target ha	% of EC Target ha	% of Biodiversity target on site	% of PA target on site
Glencoe	Southern Drakensberg Highland Grassland	~976.47	~575029	~0.17	~155258	~83839	~0.63	~1.16
Reedsdell	Southern Drakensberg Highland Grassland	~777,05	~575029	~0,14	~155258	~83839	~0.50	~0,93
Reedsdell	Lesotho Highland Basalt Grassland	~299,53	~355033	~0,08	~95859,00	~51764	~0,31	~0,58

* EC – Eastern Cape ** ha – hectare

In terms of the Eastern Cape Ecosystem Threat Status, the Southern Drakensberg Highland Grasslands vegetation type is categorised as a Least Threatened vegetation type of which this category equates to 0 in terms of the ECPTA's biodiversity value scoring status (**Appendix 12 and 13**). In terms of the Eastern Cape Ecosystem Protection Level, the Southern Drakensburg Highland Grasslands is categorised as a not protected vegetation type with a score of 4 in terms of the ECPTA's biodiversity value scoring status, which is the maximum score, and a similar score for both study sites. In terms of the Southern Drakensberg Highland Grasslands vegetation type occurrence percentage within the Glencoe study site, out of the ~1089,44-ha total extent of the property: 7.5% (~81,56-ha) has been transformed as result of cropping for winter feeds, buildings, and dams, and 89% (~976,47-ha) of the vegetation type is still intact. The ~976,47-ha intact, contributes ~1,16-ha towards the Eastern Cape Protected Area network in terms of the vegetation's percentage target on site. This equates to a scoring of between 1-5% in terms of the ECPTA's biodiversity value scoring status (**Appendix 12**). Whereas for the Reedsdell study site, in terms of the Southern Drakensberg Highland Grasslands vegetation type occurrence percentage within the property, out of the ~1158,14-ha total extent of the property, ~81,56-ha has been transformed due to cropping for winter feeds, buildings, and dams, and ~777,05-ha of the vegetation type is still intact (**Table 5.1**). The ~777,05-ha intact, contributes ~0,93-ha towards the Eastern Cape Protected Area network in terms of the Southern Drakensberg Highlands Grasslands vegetation type protected area contribution percentage of the target on site. This equates to a scoring of less than 1% in terms of the ECPTA's biodiversity value scoring status (**Appendix 12**).

Furthermore, Reedsdell study site has two vegetation types, therefore, in terms of the Eastern Cape Ecosystem Threat Status, the Lesotho Highland Basalt Grasslands is categorised as a least threatened vegetation type, of which this category equates to a 0 score in terms of the ECPTA's biodiversity value scoring status. In terms of the Eastern Cape Ecosystem Protection Level, the Lesotho Highland Basalt Grasslands is categorised as a poorly protected vegetation type and scores 4 in terms of the ECPTA's biodiversity value scoring status (**Appendix 12**). In terms of the Lesotho Highland Basalt Grasslands vegetation type occurrence percentage (0,08%) within the property, out of the ~1158,14-ha total extent of the property, 0 ha has been transformed, and

~299.53-ha of this vegetation type is still intact (**Table 5.1**). The ~299,53-ha intact, contributes ~0,58-ha towards the Eastern Cape Protected Area network in terms of the vegetation's percentage target on site. This equates to a scoring of less than 1% in terms of the ECPTA's biodiversity value scoring status (**Appendix 12**).

5.3.3 Fauna and flora

Species of special concern (Critical Endangered, Endangered, Vulnerable and Least Threatened) in accordance with the species Red List Status were verified in the field and from the landowner's species records. Nine similar species of special concern were recorded from both Glencoe and Reedsdell study sites, and they were recorded accordingly on the ECPTA's Biodiversity assessment scoring tool (**Appendix 12 and 13**). These nine species are listed in **Table 5.2** below together with their Red Data Listing status.

Table 5.2: A list of nine species of special concern recorded at Glencoe and Reedsdell study sites.

Species name	Red List Status	Scoring
Blue Crane (*Anthropoides paradisea)*	Vulnerable	2
Bearded Vulture (*Gypaetus barbatus)*	Critical endangered	4
Mountain Reedbuck (*Redunca fulvorufula)*	Endangered	4
Verreaux's eagle (*Aquila verreauxii)*	Vulnerable	2
Cape Vulture (*Gyps coprotheres)*	Vulnerable	2
Denhams Bustard (*Neotis denhami)*	Vulnerable	2
Secretary Bird (*Sagittarius serpentarius)*	Vulnerable	2
Grey Crowned Crane (*Balearica regulorum)*	Vulnerable	2
Erica hillburttii (Unknown)	Critical Endangered	4

A total of nine species of special concern were recorded on both study sites. Out of the nine species, six species (*Anthropoides paradisea, Aquila verreauxii, Gyps coprotheres, Neotis denhami, Sagittarius serpentarius,* and *Balearica regulorum)* are Vulnerable species according to the Red

List Status and they were recorded on both study sites. This equates to a score of 2 in terms of the ECPTA's biodiversity value scoring status.

Two Critically endangered species (*Gypaetus barbatus* and *Erica hillburttii)* were recorded on both study sites according to the Red List Status. Critically endangered species equates to a score of 4 in terms of the ECPTA's biodiversity value scoring status. Lastly, one Endangered species (*Redunca fulvorufula)* was recorded on both study sites. Similarly, to the Critically endangered species, the Endangered species equates to a score of 4 in terms of the ECPTA's biodiversity value scoring status.

Both Glencoe and Reedsdell study sites are dominated by Vulnerable species, followed by Critically endangered species and the Endangered species. The presence of species of special concern on the study area echoes the need for inclusion of both study sites under formally protected areas to ensure that these species are conserved.

5.3.4 Ecological processes

In terms of the study area size, Glencoe is in extent of ~1089,44-ha and Reedsdell is in extent of ~1158,14-ha, both study areas hectarage falls within a category of between 1 000 – 10 000-ha according to the scoring sheet. This category equates to a score of 2 in terms of the ECPTA's biodiversity value scoring status. In terms of the property connectivity, both Glencoe and Reedsdell fall within the critical Protected Areas link and within the landscape / national corridor categories. These two categories score between 4 and 2,5 in terms of the ECPTA's biodiversity value scoring status (**Appendix 12 and 13**). In terms of habitat heterogeneity, Glencoe covers one vegetation type for the Ecosystem Threat Status. This category scores 0 in terms of the ECPTA's biodiversity value scoring status, whereas Reedsdell covers two vegetation types which fall within the habitat type 2 to 3 category for the Ecosystem Threat Status. This category equates to a score of 1 in terms of the ECPTA's biodiversity value scoring status. In terms of the property's resilience to climate change, Glencoe falls between categories 3 and 4. This category equates to a score of 1 in terms of the ECPTA's biodiversity value scoring status (**Appendix 12**), whereas Reedsdell falls

between categories 5 and 7. This category equates to a score of 2 in terms of the ECPTA's biodiversity value scoring status (**Appendix 2**).

5.3.5 Ecosystem goods and services

Glencoe and Reedsdell study sites are located within a National Strategic Water Source Area, thereby providing an invaluable yield in essential ecological goods to a broader community (**Figure 2.4**). The high-quality grazing for livestock and wildlife provided by the natural ecosystem should be maintained in a good veld condition. Both study sites are mostly untransformed, and they indicate strong climate change resilience at the landscape level. They contribute to food security and the agricultural economy, and they host several San Bushman paintings and other artefacts of interest. The superlative mountainous landscape characterised by sandstone formations and steep basalt cliffs holds a high aesthetic appeal and forms an important contribution to the scenic beauty of the place of the region for the Reedsdell study site.

In terms of the provisioning services, both study sites contribute significantly to the country-wide and provincial level of water provision importance as they fall within the Eastern Cape Drakensburg Strategic Water Source Area. This category equates to a score of 3 in terms of the ECPTA's biodiversity value scoring status. In terms of the regulation services, the significance of both study sites falls within the landscape category. This category scores a 2 in terms of the ECPTA's biodiversity value scoring status. With regard to the Cultural services, the study sites significantly fall within the landscape category because of the rock art paintings that are found in both study areas. This category scores a 2 in terms of the ECPTA's biodiversity value scoring status (**Appendix 12 and 13**).

5.3.6 Eastern Cape Protected Area Expansion Strategy

Aligned to the National Protected Area Expansion Strategy, the Eastern Cape Protected Area Expansion Strategy (ECPAES) (Skowno, *et.al.*, 2012) identified 20 spatially explicit priority focus areas for protected area expansion in the province. The strategy highlights the value of Biodiversity

Stewardship as a sustainable and cost-effective mechanism to support protected area expansion. The privately-owned Glencoe and Reedsdell study sites form part of the North Eastern Grasslands Priority Area and contributes towards meeting set provincial conservation targets (**Figure 5.6 and 5.7**).

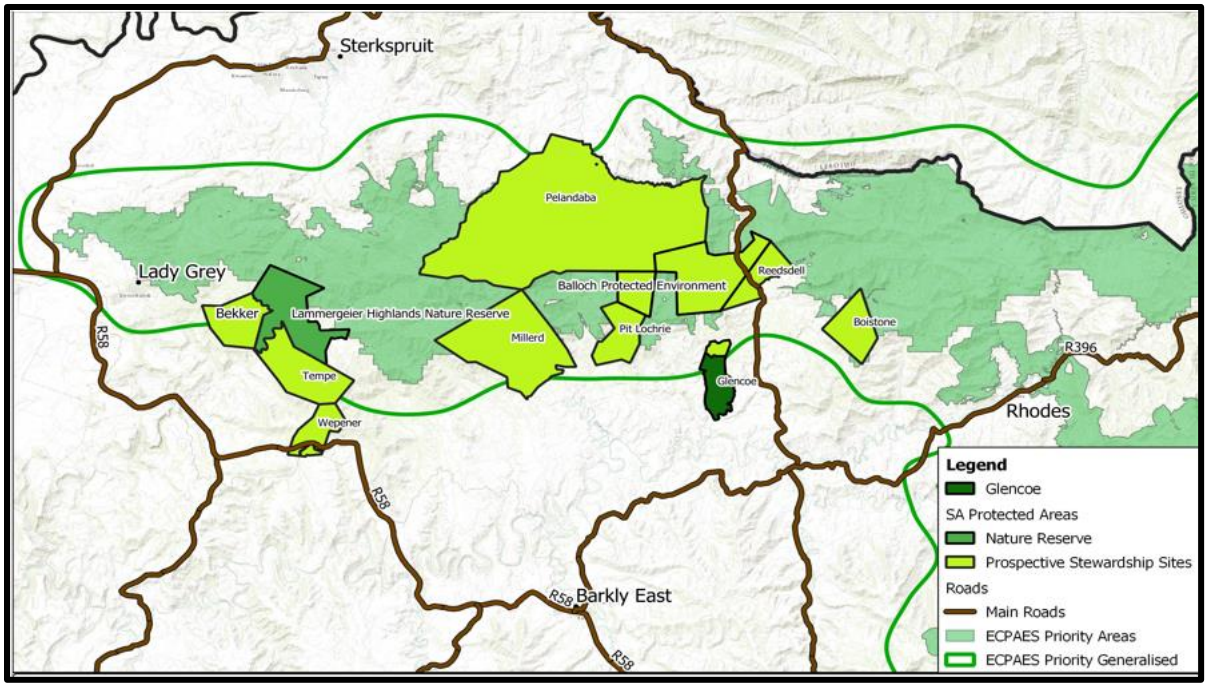


Figure 5.6: The Eastern Cape Protected Area Expansion Strategy for the Glencoe study site.

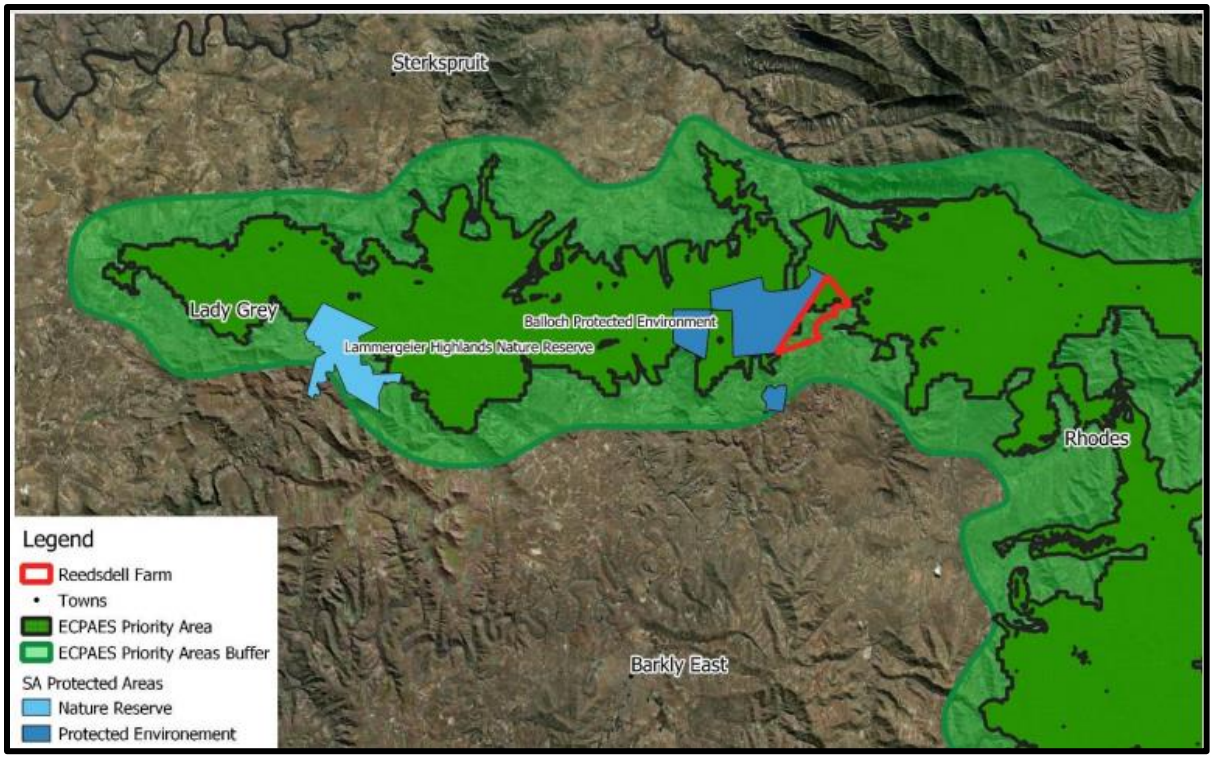


Figure 5.7: The Eastern Cape Protected Area Expansion Strategy for the Reedsdell study site.

In terms of the alignment with the ECPAES category, Glencoe and Reedsdell study sites fall within the North Eastern Cape Grasslands priority area. This category falls under the high ECPAES priority in terms of the ECPTA's biodiversity value scoring status (**Appendix 12 and 13**). This means that Glencoe and Reedsdell study sites are a very important part of the protected areas network in South Africa.

5.4 Protected Area category qualification

5.4.1 Qualification threshold

As per the SANBI (2018) guidelines for the implementation of BSP, Biodiversity Site Assessment should be conducted on each Biodiversity Stewardship Site in order to determine the biodiversity value of the property and the protected area category the property qualifies for. In accordance with

the Eastern Cape parks and Tourism Agency's scoring system, **Table 5.3** below represents the interpretation of the scoring of scores against the BSP categories.

Table 5.3: Eastern Cape Parks and Tourism Agency Biodiversity Protected Area Category qualification threshold scoring (Skowno *et al*, 2012).

Category	Maximum Score		Average Score		Total Score	
	Min	Max	Min	Max	Min	Max
Nature Reserve	4	0	3	0	30	0
Protected Environment	3	4	2,5	3	25	30
Biodiversity Agreement	2	3	2	2,5	20	25
Conservation Area	1	2	1	2	10	20

5.4.2 Glencoe and Reedsdell study areas Protected Area category qualification per metric

The Eastern Cape Park and Tourism Agency's scoring sheet was developed by a group of ecologists and endorsed by the ECPTA. Both study sites scored 2,0 in terms of the biodiversity plans for maximum score and average score, and both study sites scored a total score of 4,0 (**Table 5.4**). This means that the two sites are similar in terms of the Eastern Cape Province biodiversity plans (**Appendix 12 and 13**).

For Habitats, the Glencoe study site scored 2,0 for both maximum and average scores, and a total score of 2,0. Whereas, the Reedsdell study site scored 1,3 for both maximum and average scores, and a total score of 2,7 (**Table 5.4**). This is because the Reedsdell study site falls within two habitat types (Lesotho Highlands Basalt Grassland and the Southern Drakensburg Highlands Grassland), whereas the Glencoe study site is characterised by one habitat type (Southern Drakensburg Highlands Grassland) (**Appendix 12 and 13**).

For Species, the Glencoe study site scored 2,0 in terms of the maximum score, 1,4 in terms of the average score and a total score of 12,5. Whereas the Reedsdell study site scored 4 in terms of the maximum score, a score of 1,6 in terms of the average score and a total score of 14,0 (**Table 5.4**).

This is because as much as the study sites are home to similar species of concern, Reedsdell study site caters for more species population size than Glencoe (**Appendix 12 and 13**).

For Ecological Processes, the Glencoe study site scored 4,0 in terms of the maximum score, a score of 1,8 in terms of the average score and a total score of 7,0. Whereas, Reedsdell study site also scored 4,0 in terms of the maximum score, a score of 2,7 in terms of the average score and a total score of 8,0 (**Table 5.4**). This is because the Reedsdell study site sits on more (two) habitat types than the Glencoe (**Appendix 12 and 13**).

For Ecosystems Goods and Services, both study sites scored 3,0 in terms of the maximum score, a score of 2,3 in terms of the average score and a total score of 7,0 (**Table 5.4**). This means that both study sites are similar in terms of the ecosystem's goods and services (**Appendix 12 and 13**).

In terms of the overall total score and in accordance with the ECPTA's scoring system, the Glencoe study site scored an overall total score of 32,5, whereas the Reedsdell study site scored 35,7 (**Table 5.4**). This means that the Reedsdell study site's biodiversity value is slightly higher than the biodiversity value of the Glencoe. However, both study sites are eligible for a Nature Reserve category because they both scored above the minimum score of 30 as per the ECPTA's scoring threshold table (**Table 5.4**).

Table 5.4: The qualification per metric results scores for Glencoe and Reedsdell study site.

Summary per criterion	**Maximum Score**		**Average Score**		**Total**	
	Glencoe	**Reedsdell**	**Glencoe**	**Reedsdell**	**Glencoe**	**Reedsdell**
Biodiversity Plans	2,0	2,0	2,0	2,0	4,0	4,0
Habitats	2,0	1,3	2,0	1,3	2,0	2,7
Species	2,0	4,0	1,4	1,6	12,5	14,0
Ecological Processes	4,0	4,0	1,8	2,7	7,0	8,0

Ecosystem Goods and Services	3,0	3,0	2,3	2,3	7,0	7,0
				Total	**32,5**	**35,7**

5.5 Study sites' eligibility for protected area category

As per the outcomes of the biodiversity site assessment, both study sites are eligible to be declared as protected areas with a Nature Reserve status. Among the reasons for their qualification is that they both fall within the National Protected Area Expansion Strategy, within the Eastern Cape Protected Area Expansion Strategy; and within the planning domain of numerous important landscape-level biodiversity conservation initiatives which seek to expand and link key Protected Areas and ecological corridors across the region.

Given the high altitude, the region supports the largest extent of C3 grasslands in South Africa, almost none of which is found in current existing formally declared protected areas in the Eastern Cape Province, this means that the declaration of Glencoe and Reedsdell study sites will contribute greatly in terms of the protection of the C3 grasslands. The vegetation types occurring on these study sites are poorly protected in the province, therefore, declaration of these study sites will contribute significantly towards achieving the target for the less protected vegetation types in the region (Lesotho Highland Basalt and Southern Drakensburg Highland Vegetation Type).

5.6 Recommendations and Conclusion

Based on the findings of the assessment tool, it is evident that both study sites have significant biodiversity value, hence they are important for the conservation of the Grasslands Biome and to form part of the South Africa's protected areas network. Glencoe and Reedsdell qualify for the Nature Reserve category in terms of the National Environmental Management: Protected Areas Act (NEM: PAA) (57 of 2003). However, it is important to note that, although the study areas qualify for Nature Reserve status, the landowners may select the Protected Environment status instead. This is because the ownership and management responsibilities lie with the landowner

and the Nature Reserve category has stricter regulations in terms of permissible and non-permissible activities compared to the Protected Environment category, hence, the Stewardship Programme is completely based on the voluntary landowner willingness.

The following guidelines are applicable to the two categories:

1. Nature Reserve category (NR): Livestock grazing is usually not permitted on a NR as per the norms and standards for privately owned nature reserves. Therefore, livestock grazing is permitted only on the condition that it is controlled, monitored and compatible with the conservation management of a nature reserve. An ecological carrying capacity study must be undertaken to determine the appropriate stocking density for the vegetation type, as well as a fire management plan that needs to be developed. This shall be indicated in the management plan and implemented once the property is declared, with the support from a Conservation Agency such as ECPTA. The NR is declared for not less than 99 years, or into perpetuity; and in terms of Section 35 & 36 of the NEM: PAA and must-have a title deed endorsement that binds the successors in title (Wright, *et al.*, 2018; Cockburn, *et al*., 2019). In terms of the Income Tax Act (58 of 1962), the landowner of a NR may qualify to deduct 4% of the value of that declared land from their taxable income each year for 25 years. This is to compensate the landowner for setting aside the land for conservation management (SANBI 2014).
2. Protected Environment category (PE): Livestock grazing is permitted in a protected environment and must be controlled and monitored based on the management plan. The PE is declared for a minimum of 30 years (SANBI, 2018).

According to the results of the assessment tool, the key factors contributing to this decision are that both study sites fall within the Priority Area for the EC Protected Area Expansion Strategy, which is a breeding site for the Endangered bearded vulture and Vulnerable cape vulture, the presence of the Endangered mountain reedbuck, and the importance from a hydrological perspective, having numerous seeps and the source of rivers, while they fall within the Critical Biodiversity Area. It is therefore advisable or recommended for ECPTA to consider these two

study sites and enter into a biodiversity stewardship agreement with the management authorities (legal entities) of Glencoe and Reedsdell, depending on the landowners' willingness and the most preferred protected area category they choose.

The reasons for the recommendation are as follow:

i. The study sites as Protected Areas may ensure that a natural corridor of priority conservation estate remains unfragmented across a collection of prospective stewardship sites.
ii. Considering that the region produces the greatest water yield nationally, the properties contribute to the provision of ecosystem services that are of strategic significance to a broader community and which contribute to supporting economic activities beyond the property boundaries.
iii. Several threatened species are known to occur on the study area.
iv. The vegetation types are not adequately represented in the current protected area network.
v. The study sites are largely untransformed and categorised as CBA and FEPA.
vi. Both landowners have shown some level of willingness, hence they have granted consent for this study to be conducted within their properties.

Chapter 6: Conclusion

Grasslands in South Africa provide many critical ecosystem services, most prominently through providing the best agricultural land in the country and a significant amount of water as Strategic Water Source Areas and sequestering carbon in soils. Both Glencoe and Reedsdell study sites fall within the North Eastern Cape Grasslands priority site in the Eastern Cape Drakensberg Strategic Water Source. This is the primary reason for the importance of these study sites and their selection for this research as they are located within a critical biodiversity area. No similar studies have been undertaken within both study sites, and this study forms the basis of a first formal scientific study ever conducted there.

The vegetation of both study sites is relatively homogeneous and occurs within the Grassland Biome. The overall objectives of this study were successfully achieved as the vegetation analysis was undertaken through classification of the different plant communities that occur within the study areas, which were further assessed to determine their veld condition and their biodiversity merit for inclusion into the South African Protected Areas Network.

The Braun-Blanquet classification was effectively employed for the purpose of classifying the different plant communities. The results of the classification revealed nine different plant communities for both Glencoe and Reedsdell study sites that are made up of two major communities. The Glencoe study site had a plant community that is made up of only one relevé, which is uncommon but aligns with a similar study that identified a sub-community that had only two relevés (Goetze *et al.*, 2008). The Glencoe study site had a greater number of species recorded (156 species) than Reedsdell (125 species). In the same way, greater number of woody species was recorded at Glencoe than in Reedsdell. However, both study sites have a relatively small number of woody species as an overall total of 281 herbaceous species and 34 woody species were recorded. The relatively small number of woody species concurs with the fact that the study area falls within a Grassland Biome.

Since livestock grazing is the primary land-use activity on both study sites veld condition assessments and proper rangeland management initiatives are immensely important to ensure that the condition of the veld is well maintained. The results of the veld condition revealed that both study sites are in moderate condition and are dominated by the presence of Increaser II species, which are species that increase in a veld that is over utilised. It is therefore, recommended that improved management interventions be employed to improve the condition of the veld from moderate to good. This may be achieved through conducting veld condition assessments regularly (biannually, depending on the available resources), maintaining the number of livestock at an adequate carrying capacity, developing a grazing management plan, to monitor change in vegetation over time.

Livestock grazing needs to be controlled through the application of the correct stocking rate units so that overgrazing can be prevented on both study sites. Constant veld condition assessments need to be undertaken to inform management intervention, to understand the correct stocking rate and to track changes in the condition of the veld over time. A comprehensive rangeland management intervention should be prioritised for these study areas to ensure that the rich biodiversity that occurs in the study areas is conserved and kept in a natural state.

For the Glencoe study site, the lowest points are at the river that is surrounding the entire study site and the highest peak is on the mountainous area located on the eastern side of the study site. The lowest points are not easily accessible to cattle and may be dangerous to the livestock. According to the landowner's information, some cattle have fallen off the cliff into the riverine community and died. It is recommended that the lowest points should be fenced off to prevent cattle from falling off the cliffs.

A vegetation management and monitoring plan should be developed to effectively deal with the potential future degradation of near-natural habitats as a result of overgrazing and over browsing (overstocking), or selective and under-grazing. This should be done in conjunction with the veld management plan, which shall encompass constant veld condition assessments and subsequent monitoring, as a form of optimal management intervention.

Overgrazing should be minimised on these sites as it could lead to other environmental threats such as soil erosion through loss of the vegetation cover. It is, therefore, imperative for the management to implement rangeland management initiatives and control the livestock numbers and keep the numbers at an adequate stocking rate. Constant veld condition assessments need to be undertaken to monitor the veld over time to avoid further veld deterioration.

In terms of the Biodiversity Assessments, both study sites qualify for a Nature Reserve Category based on the biodiversity value that they maintain. However, the Reedsdell study site scored higher according to the overall total score (35,7%) than the Glencoe study site in terms of the biodiversity value (32,5). This means that both study sites should be maintained in good condition to ensure the conservation of the biodiversity value. A detailed Protected Area Management Plan should be developed to guide the overall management of the study area once declared as part of formal protected areas. The management plan should focus on strategic priorities rather than detailing all operational and potential reactive courses of action in the next five years by:

- Serving as the primary strategic tool for the management of the study sites informing the need for specific programmes and operational procedures.
- Providing for capacity building, future thinking, and continuity of management.
- Enabling landowners to develop and manage the study sites in such a way that their values and the purpose for which they were established are protected

Effective management of these study areas will aid in effectively conserving and protecting the key biodiversity features, ecological processes, natural resources, and landscape features. This will allow landowners to operate in economically viable and ecologically sustainable livestock farming and also allow for the management of the interrelationship between the natural environment and the commercial farming activities based on sound ecological principles. To also preserve the ecological integrity of the natural systems.

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Appendixes

Appendix 1: Description of the Southern Drakensberg Highlands Grasslands vegetation type

Description of Vegetation Type	
Southern Drakensberg Highland Grasslands	
Bioregion	Drakensberg Grasslands Bioregion
Endemism to Eastern Cape	88.8 %
Ecosystem Threat Status	Least Concern
Ecosystem Protection Level	Not Protected.
Description	**Vegetation & Landscape Features:** Steeply sloping mountainous areas on and below the summit of the Great Escarpment supporting dense tussock grassland on slopes sometimes with a dwarf-shrubby component and dwarf shrubland on exposed rocky areas (Mucina, Rutherford, & Powrie, 2006). The tussock grassland is dominated by various species of *Festuca* and other grasses such as *Themeda triandra*, *Heteropogon contortus*, *Eragrostis racemosa*, *Eragrostis chloromelas*, *E. curvula*, *Elionurus muticus*, *Trachypogon spicatus*, *Andropogon appendiculatus*, *Harpochloa falx* and *Tristachya leucothrix* (Mucina & Rutherford, 2006). **Important Taxa Graminoids:** *Alloteropsis semialata* subsp. *eckloniana (d), Aristida junciformis* subsp. *galpinii (d), Catalepis gracilis (d), Diheteropogon filifolius (d), Eragrostis caesia (d), E. chloromelas (d), E. planiculmis (d), E. racemosa (d), Festuca caprina (d), Microchloa caffra (d), Monocymbium ceresiiforme (d), Pennisetum sphacelatum (d), Rendlia altera (d), Themeda triandra (d), Trachypogon spicatus (d), Tristachya leucothrix (d), Agrostis lachnantha, Andropogon appendiculatus, Aristida diffusa, Cymbopogon pospischilii, Elionurus muticus, Eragrostis capensis, E. curvula, E. plana, Festuca scabra, Fingerhuthia sesleriiformis, Harpochloa falx, Helictotrichon turgidulum, Heteropogon contortus,*

	Juncus exsertus subsp. *exsertus, Koeleria capensis, Pentaschistis cirrhulosa, P. microphylla, Poa binata, Schoenoxiphium sparteum, Sporobolus centrifugus.* **Herbs:** *Ajuga ophrydis, Aster bakerianus, Euphorbia epicyparissias, Galium capense* subsp. *capense, Gazania krebsiana* subsp. *krebsiana, Haplocarpha scaposa, Hebenstretia dentata, Helichrysum chionosphaerum, H. nudifolium var. pilosellum, H. rugulosum, H. umbraculigerum, Kohautia amatymbica, Lactuca inermis, Lasiospermum bipinnatum, Lobelia erinus, L. flaccida, L. vanreenensis, Pentanisia prunelloides* subsp. *latifolia, Psammotropha mucronata var. foliosa, Rumex lanceolatus, Salvia stenophylla, Selago densiflora, S. galpinii, Senecio asperulus, S. erubescens var. crepidifolius, Tolpis capensis, Trifolium burchellianum* subsp. *burchellianum, Wahlenbergia cuspidata, W. stellarioides.* **Geophytic Herbs:** *Cheilanthes hirta, Corycium dracomontanum, Disa fragrans* subsp. *fragrans, Disperis oxyglossa, Drimia macrocentra, Eriospermum ornithogaloides, Geum capense, Hypoxis rigidula var. pilosissima.* **Herbaceous Climber:** *Rhynchosia totta.* **Low Shrubs:** *Chrysocoma ciliata, Erica caffrorum var. caffrorum, Euryops candollei, Felicia filifolia* subsp. *filifolia, F. muricata, Helichrysum asperum var. albidulum, H. splendidum, H. trilineatum, Passerina montivagus, Pentzia cooperi, Rubus ludwigii* subsp. *ludwigii, Selago albida, S. saxatilis, Senecio burchellii.*
Remarks	Unmapped patches of Drakensberg Wetlands are abundant in seepage areas (dominated by *Merxmuellera drakensbergensis*) and in drainage valleys, typically with the tall shrub *Leucosidea sericea* dominant.

Appendix 2: Description of the Lesotho Basalt Highland Grassland vegetation type.

Description of Vegetation Type	
Lesotho Basalt Highland Grasslands	
Bioregion	Drakensberg Grasslands Bioregion
Endemism to Eastern Cape	17.6 %
Ecosystem Threat Status	Least Concern
Ecosystem Protection Level	Not Protected.
Description	**Vegetation & Landscape Features:** Landscape consists of many plateaus and high ridges of mountains separated by often deep valleys. Vegetation is closed, short grassland with many areas, also with *Passerina montana*-dominated shrubland (Mucina, L., & Rutherford, 2006). The much smaller shrubs, such as *Chrysocoma ciliata* and *Pentzia cooperi*, are often very common in clearly disturbed areas (especially on the warmer slopes at higher altitudes) (Mucina & Rutherford, 2006; Cadman *et al*., 2013). *Chrysocoma ciliata* is the typical component of 'sehalahala scrub'. In terms of dominant species, *Themeda triandra* tends to be more important at the lower and middle elevations and *Festuca caprina* at higher altitudes, although there is considerable altitudinal overlap between these species (Mucina & Rutherford, 2006). Although *Kniphofia caulescens* has a wide altitudinal distribution, its large aggregate patches (often hundreds of square meters in extent) are mostly evident in the upper half of the altitudinal range corresponding to larger sponge areas (2 500 to 2 900 m with most mass flowering displays best observed around 2 700 (Mucina & Rutherford, 2006). The medium-tall distinctive grass *Merxmuellera macowanii* occurs along watercourses and drainage lines (Cadman *et al*., 2013). **Graminoids:** *Bulbostylis humilis (d), Cymbopogon dieterlenii (d), Elionurus muticus (d), Eragrostis curvula (d), Festuca caprina (d), Harpochloa falx (d), Koeleria capensis (d), Merxmuellera disticha*

	(d), Pentaschistis oreodoxa (d), Poa binata (d), Scirpus falsus (d), Aristida junciformis subsp. *galpinii, Carex glomerabilis, Cymbopogon marginatus, Eragrostis caesia, Helictotrichon turgidulum, Luzula africana, Merxmuellera drakensbergensis, Rendlia altera.* ***Herbs:*** *Helichrysum subglomeratum (d), Anthospermum herbaceum, Cerastium arabidis, Cotula hispida, Dimorphotheca jucunda, Haplocarpha scaposa, Helichrysum acutatum, H. cerastioides, H. setigerum, Senecio asperulus, Silene burchellii, Trifolium burchellianum* subsp. *burchellianum, Ursinia montana, Zaluzianskya microsiphon.* **Geophytic Herbs:** *Disa sankeyi, D. tysonii, Geum capense, Moraea modesta, Oxalis depressa, Rhodohypoxis baurii var. baurii, R. baurii var. confecta, R. baurii var. platypetala, Satyrium longicauda.* **Succulent Herb:** *Crassula peploides. Semiparasitic.* **Herb:** *Thesium nigrum.* **Low Shrubs:** *Euphorbia striata, Hebenstretia dura, Helichrysum infaustum, H. odoratissimum, H. sessile, H. sutherlandii, Pentzia cooperi.* **Succulent Shrub:** *Delosperma crassuloides.*
Remarks	This vegetation type constitutes the major portion of the Drakensberg Alpine Centre of Endemism. The area has a remarkably high bulbous component such as orchids, which require high soil moisture over prolonged periods of time.

Appendix 3: Data Sheet for the Braun-Blanquet method

Plot no:				**Date:**		
Geology:				**Slope:**		
Soil:				**Aspect:**		
GPS:	**S:**			**E:**		
				Altitude		
% Tree cover			**Dominant spp.**			
% Shrub cover						
% Herb cover			**Signs of wildlife**			
% Grass cover			**Accessibility / Fire**			
% Rockiness			**Erosion**			
Remarks:						
Trees & Shrubs	**BB**	**Density**	**Grasses**	**BB**	**Herbs/Forbs**	**BB**
Other:						

Appendix 4: Data Sheet for the Step-point method

	Plot no:			**Date:**		
	Geology:			**Slope:**		
	Soil:			**Aspect:**		
	GPS:	**S:**		**E:**		
	Grass species	Hit	Miss	**Grass species**	Hit	Miss
1						
2						
3						
4						
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6						
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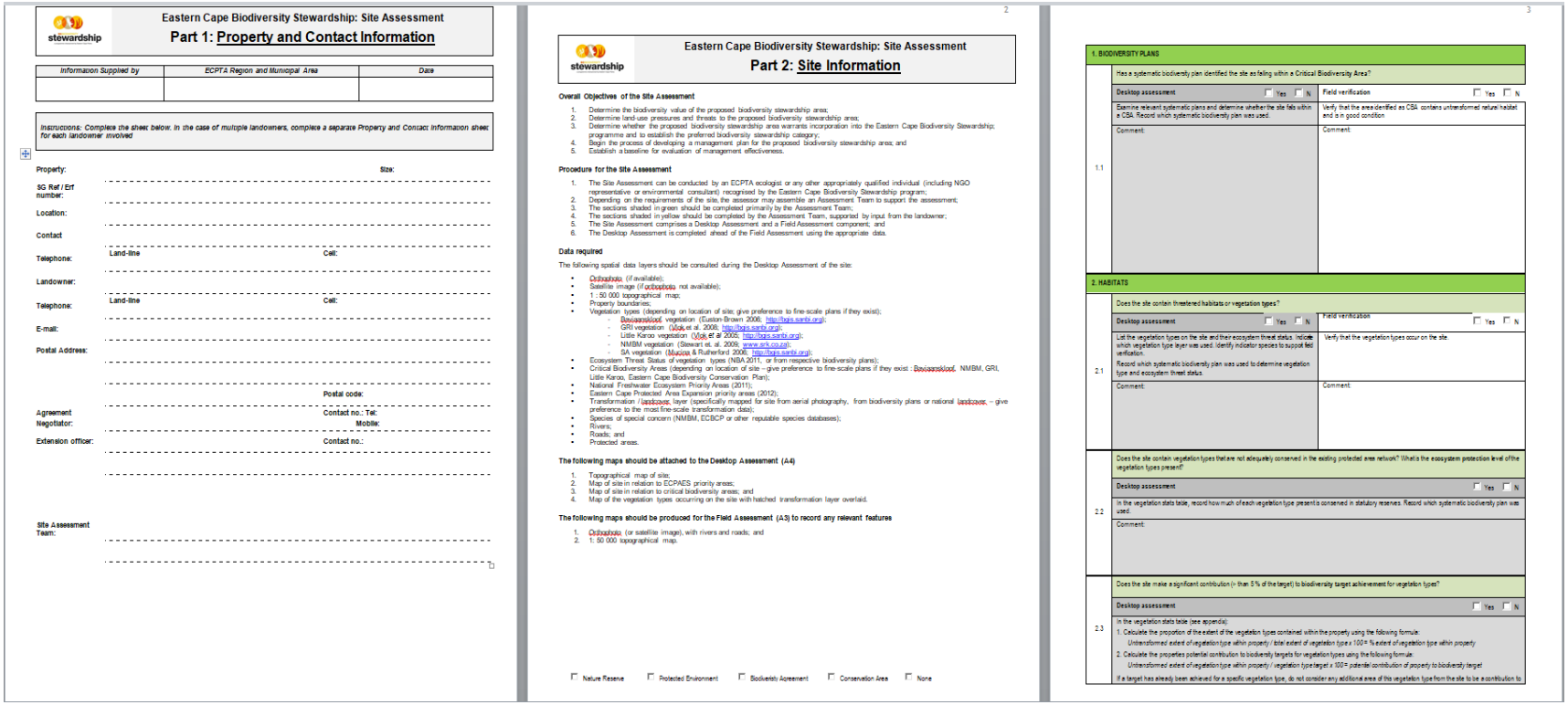
Appendix 5: Biodiversity Site Assessment Tool



Eastern Cape Biodiversity Stewardship: Site Assessment

Part 1: Property and Contact Information

Information Supplied by	ECPTA Region and Municipal Area	Date

Instructions: Complete the sheet below. In the case of multiple landowners, complete a separate Property and Contact Information sheet for each landowner involved

Property: **Size:**

SG Ref / Erf number:

Location:

Contact

Telephone: **Land-line** **Cell:**

Landowner:

Telephone: **Land-line** **Cell:**

E-mail:

Postal Address:

Postal code:

Agreement Negotiator: **Contact no.: Tel:** **Mobile:**

Extension officer: **Contact no.:**

Site Assessment Team:

2

Eastern Cape Biodiversity Stewardship: Site Assessment

Part 2: Site Information

Overall Objectives of the Site Assessment

1. Determine the biodiversity value of the proposed biodiversity stewardship area;
2. Determine land-use pressures and threats to the proposed biodiversity stewardship area;
3. Determine whether the proposed biodiversity stewardship area warrants incorporation into the Eastern Cape Biodiversity Stewardship programme and to establish the preferred biodiversity stewardship category;
4. Begin the process of developing a management plan for the proposed biodiversity stewardship area; and
5. Establish a baseline for evaluation of management effectiveness.

Procedure for the Site Assessment

1. The Site Assessment can be conducted by an ECPTA ecologist or any other appropriately qualified individual (including NGO representative or environmental consultant) recognised by the Eastern Cape Biodiversity Stewardship program;
2. Depending on the requirements of the site, the assessor may assemble an Assessment Team to support the assessment;
3. The sections shaded in green should be completed primarily by the Assessment Team;
4. The sections shaded in yellow should be completed by the Assessment Team, supported by input from the landowner;
5. The Site Assessment comprises a Desktop Assessment and a Field Assessment component; and
6. The Desktop Assessment is completed ahead of the Field Assessment using the appropriate data.

Data required

The following spatial data layers should be consulted during the Desktop Assessment of the site:

- Orthophoto (if available);
- Satellite image (if orthophoto not available);
- 1 : 50 000 topographical map;
- Property boundaries;
- Vegetation types (depending on location of site; give preference to fine-scale plans if they exist);
  - Bayanskloof vegetation (Euston-Brown 2006, http://bgis.sanbi.org);
  - GRI vegetation (Vlok et al. 2008, http://bgis.sanbi.org);
  - Little Karoo vegetation (Vlok et al. 2005, http://bgis.sanbi.org);
  - NMBM vegetation (Stewart et. al. 2009, www.srk.co.za);
  - SA vegetation (Mucina & Rutherford 2006, http://bgis.sanbi.org);
- Ecosystem Threat Status of vegetation types (NBA 2011, or from respective biodiversity plans);
- Critical Biodiversity Areas (depending on location of site – give preference to fine-scale plans if they exist : Bayanskloof, NMBM, GRI, Little Karoo, Eastern Cape Biodiversity Conservation Plan);
- National Freshwater Ecosystem Priority Areas (2011);
- Eastern Cape Protected Area Expansion priority areas (2012);
- Transformation / landcover, layer (specifically mapped for site from aerial photography, from biodiversity plans or national landcover, – give preference to the most fine-scale transformation data);
- Species of special concern (NMBM, ECBCP or other reputable species databases);
- Rivers;
- Roads; and
- Protected areas.

The following maps should be attached to the Desktop Assessment (A4)

1. Topographical map of site;
2. Map of site in relation to ECPAES priority areas;
3. Map of site in relation to critical biodiversity areas; and
4. Map of the vegetation types occurring on the site with hatched transformation layer overlaid.

The following maps should be produced for the Field Assessment (A3) to record any relevant features

1. Orthophoto (or satellite image), with rivers and roads; and
2. 1: 50 000 topographical map.

☐ Nature Reserve ☐ Protected Environment ☐ Biodiversity Agreement ☐ Conservation Area ☐ None

3

1. BIODIVERSITY PLANS

1.1 Has a systematic biodiversity plan identified the site as falling within a Critical Biodiversity Area?

Desktop assessment ☐ Yes ☐ N	Field verification ☐ Yes ☐ N
Examine relevant systematic plans and determine whether the site falls within a CBA. Record which systematic biodiversity plan was used.	Verify that the area identified as CBA contains untransformed natural habitat and is in good condition
Comment:	Comment:

2. HABITATS

2.1 Does the site contain threatened habitats or vegetation types?

Desktop assessment ☐ Yes ☐ N	Field verification ☐ Yes ☐ N
List the vegetation types on the site and their ecosystem threat status. Indicate which vegetation type layer was used. Identify indicator species to support field verification. Record which systematic biodiversity plan was used to determine vegetation type and ecosystem threat status.	Verify that the vegetation types occur on the site.
Comment:	Comment:

2.2 Does the site contain vegetation types that are not adequately conserved in the existing protected area network? What is the ecosystem protection level of the vegetation types present?

Desktop assessment ☐ Yes ☐ N

In the vegetation stats table, record how much of each vegetation type present is conserved in statutory reserves. Record which systematic biodiversity plan was used.

Comment:

2.3 Does the site make a significant contribution (> than 5 % of the target) to biodiversity target achievement for vegetation types?

Desktop assessment ☐ Yes ☐ N

In the vegetation stats table (see appendix):

1. Calculate the proportion of the extent of the vegetation types contained within the property using the following formula:
   Untransformed extent of vegetation type within property / total extent of vegetation type x 100 = % extent of vegetation type within property
2. Calculate the properties potential contribution to biodiversity targets for vegetation types using the following formula:
   Untransformed extent of vegetation type within property / vegetation type target x 100 = potential contribution of property to biodiversity target

If a target has already been achieved for a specific vegetation type, do not consider any additional area of this vegetation type from the site to be a contribution to

target achievement.

Comment:

2.4 Are the vegetation types / habitats in a relatively natural condition?

Desktop assessment ☐ Yes ☐ N	Field verification ☐ Yes ☐ N
Using a habitat transformation / landcover layer, indicate the level of habitat transformation for the site and the individual vegetation types.	Assess the condition of the vegetation types – consult an expert if necessary.
Comment:	Comment:

2.5 Are the vegetation types / habitats on the site relatively unfragmented?

Desktop assessment ☐ Yes ☐ N	Field verification ☐ Yes ☐ N
Using a habitat transformation / landcover layer and aerial photos, comment on fragmentation.	Verify the degree of fragmentation of natural areas on the site.
Comment:	Comment:

2.6 Do degraded areas on the site have a good potential for rehabilitation?

Desktop assessment ☑ ? ☐ Yes ☐ N	Field verification ☐ Yes ☐ N
Evaluate the potential to rehabilitate degraded areas of the site.	Evaluate the potential to rehabilitate degraded areas of the site.
Comment:	Comment:

3. SPECIES

3.1 Do any threatened or range restricted species occur on the site?

Desktop assessment ☐ Yes ☑ N	Field verification ☐ Yes ☐ N	
Using species databases, or other reputable sources, list species of special concern. Note the data source and whether species records are based on actual occurrences or modelled or historic data.	If possible, confirm that the species of special concern listed in the desktop assessment occur on the site. Consult an expert, if necessary. Note any additional species of special concern that have been observed during the field assessment or that have been confirmed to occur on site.	
Species: A	Species:	Source:

3.2 Can the site contribute to the recovery of threatened species (e.g. through reintroduction of threatened species)?

Desktop assessment ☐ ? ☐ Yes ☐ N	Field verification ☐ Yes ☐ N
According to available information does the property appear to be suitable for the recovery of threatened species (e.g. does the site fall within the known distribution range of threatened species, does it have suitable habitats for threatened species, do populations of threatened species on occur in similar situations nearby)?	Confirm suitability for species recovery.

Comment:

Comment:

4. ECOLOGICAL PROCESSES

4.1 Does the site have an exceptionally high level of habitat heterogeneity?

Desktop assessment ☐ Yes ☐ N	Field verification ☐ Yes ☐ N
Examine a map of vegetation types and comment on the habitat heterogeneity on the site.	Confirm habitat heterogeneity on the site. Include any additional habitats not listed in the desktop assessment.
Comment:	Comment:

4.2 Does the site contribute to the conservation of ecological processes at the scales listed below?

Desktop assessment		
Compare the size of the property in relation to the suite of ecological processes that occur at various scales for the particular habitat types concerned.		
Comments:		☐ Yes ☐ N
		☐ Yes ☐ N
		☐ Yes ☐ N

4.3 Will the property be able to contribute to biological adaptations to climate change (does it contain significant altitudinal gradients)?

Desktop assessment ☐ Yes ☐ N
Consult map of climate change resilience areas (Hoffman & Bradshaw 2012) and indicate importance for climate change resilience.
Also calculate altitudinal gradients using the following formula: *Highest point on property - lowest point on property = altitudinal gradient*
Comments:

4.4 Is the site a critical ecological process area or vital corridor or 'stepping stone' for the movement of species?

Desktop assessment ☐ Yes ☐ N	Field verification ☐ Yes ☐ N
Has the site been identified in a systematic biodiversity plan as a corridor area or a critical ecological process area? Examine the map of vegetation types and a transformation / landcover layer in the context of the landscape within which the site falls. Does the property serve as a corridor or stepping stone for the movement of species? Indicate land use on surrounding properties.	Confirm that any identified corridors or stepping stones exist (i.e. that they have not been transformed subsequent to date of production of the data).
Comments:	Comments:

4.5 Is the property of strategic value as a buffer to protected areas or as a protected area consolidation or expansion area?

Desktop assessment ☐ Yes ☐ N
Consult the Protected Areas layer. Is the property adjacent to a protected area? Does it support consolidation of protected areas? Examine the Eastern Cape Protected Areas Expansion Strategy layer. Is the property identified as a priority area for protected area expansion? Comment on the opportunity for expansion of the biodiversity stewardship site.
Comment:

5. ECOSYSTEM GOODS AND SERVICES

5.1 Do important provisioning services occur as a result of the natural systems on the site (i.e. are products obtained from the natural systems)?

Field assessment

Evaluate the (province) significance of provisioning services provided by the site by checking the boxes. If not applicable, leave the boxes unchecked.

Provisioning services	Nature of product	Significance
Clean water production (natural vegetation function)		☐ High ☐ Mod ☐ Lo
Water purification (wetland function)		☐ High ☐ Mod ☐ Lo
Food		☐ High ☐ Mod ☐ Lo
Medicinal plants or products		☐ High ☐ Mod ☐ Lo
Harvesting of plant material (thatch, poles, firewood etc)		☐ High ☐ Mod ☐ Lo
Grazing		☐ High ☐ Mod ☐ Lo
Pollination		☐ High ☐ Mod ☐ Lo
Animal harvesting		☐ High ☐ Mod ☐ Lo
Other		☐ High ☐ Mod ☐ Lo

Comments:

5.2 Do important regulating services occur?

Field Assessment

Evaluate the (province) significance of regulating services provided by the site by checking the boxes. If not applicable, leave the boxes unchecked.

Regulating services	Nature of regulating service	Significance
Regulation / attenuation of floods and water supply		☐ High ☐ Mod ☐ Lo
Carbon sequestration		☐ High ☐ Mod ☐ Lo
Other		☐ High ☐ Mod ☐ Lo

Comments:

5.3 Rate any important cultural services (non-material benefits) occur?

Field assessment

Evaluate the (provincial) significance of cultural services provided by the site by checking the boxes. If not applicable, leave the boxes unchecked.

Cultural services	Nature of cultural service	Significance
Education		☐ High ☐ Mod ☐ Lo
Recreation		☐ High ☐ Mod ☐ Lo
Aesthetics		☐ High ☐ Mod ☐ Lo
Spiritual or cultural		☐ High ☐ Mod ☐ Lo
Other		☐ High ☐ Mod ☐ Lo

Comment:

6. THREATS

	Field assessment		
	Rate the significance of the following threats to biodiversity on the site (also add any threat not captured below)		
6.1	Threat	Nature of threat (e.g. species of invasive alien plants)	Significance
	a. Invasive alien plants		☐ High ☐ Mod ☐ Lo
	b. Poaching / illegal harvesting		☐ High ☐ Mod ☐ Lo
	c. Fire		☐ High ☐ Mod ☐ Lo
	d. Grazing		☐ High ☐ Mod ☐ Lo
	e. Accelerated soil erosion		☐ High ☐ Mod ☐ Lo
	f. Extra-limital / alien animals		☐ High ☐ Mod ☐ Lo
	g. Land-invasion		☐ High ☐ Mod ☐ Lo
	h. Mining		☐ High ☐ Mod ☐ Lo
	j. Water abstraction / dams		☐ High ☐ Mod ☐ Lo
	j. Pollution		☐ High ☐ Mod ☐ Lo
	k. Uncontrolled Access		☐ High ☐ Mod ☐ Lo
	l. Other		☐ High ☐ Mod ☐ Lo
	Comment:		

7. MANAGEMENT ISSUES

7.1	Field assessment	☐ Yes ☐ N
	Has the landowner invested any resources in alien plant eradication? Indicate hectares cleared and funds invested. If possible, map cleared areas.	
	Comment:	
7.2	Field assessment	☐ Yes ☐ N
	Has the Working for Water Programme been active within the property? What forms of assistance have been provided?	
	Comment:	
7.3	Field assessment	☐ Yes ☐ N
	Determine if there is a written management plan for the property and, if so, what is its status (e.g. in development, draft plan or completed plan).	
	Comment:	
7.4	Field assessment	
	What is the current burning regime on the site?	
	Comment:	
7.5	Field assessment	
	Provide details around the grazing system used (rotational system, stocking rate, time of year, domestic livestock and indigenous game)	
	Comment:	
7.6	Field assessment	
	Describe the notable management or restoration actions required (e.g. erosion control, de-stocking, fencing).	
	Comment:	
7.7	Field assessment	☐ Yes ☐ N
	Does the landowner have any specific management needs or has the landowner requested any specific support from ECPTA or other agencies?	
	Comment:	
7.8	Field assessment	☐ Yes ☐ N
	Are there any veterinary restrictions imposed on the proposed biodiversity stewardship area?	
	Comment:	

8. PARTNERSHIP OPPORTUNITIES AND DEVELOPMENT

8.1	Field assessment	☐ Yes ☐ N
	Are there other current partnerships, memberships or existing statuses to note (e.g. Conservancy, Fire Protection Association, Water users Association, Natural Heritage Site, Registered Commercial Game Farm or Registered Important Bird Area)?	
	Comment:	
8.2	Field assessment	☐ Yes ☐ N
	Do any conditions or agreements applying to property (e.g. Trusts, MoA's, MoU's, permissions, permits, EIA applications, development conditions, liabilities and directives in terms of any legislation, and claims or servitudes).	
	Comment:	
8.3	Field assessment	☐ Yes ☐ N
	Does the landowner have any development intentions for the area proposed for conservation?	
	Comment:	
8.4	Field assessment	☐ Yes ☐ N
	Does the landowner have any intentions of selling the property in the near future	
	Comment:	

9. LAND CLAIMS

	Desktop assessment ☐ Yes ☐ N	Field verification ☐ Yes ☐ N
9.1	Is there a land claim on the property? If yes, determine at what stage the land claim is	Verify if there is a land claim on the property is and determine the stage in the process
	Comment:	Comment:

SUMMARY

CONTRIBUTION TO CONSERVATION			
Rate the significance (at a provincial scale) of the site's contributionto the biodiversity conservation			
Contributes to conservation of vegetation types	☐ Essential	☐ Important	☐ Not Essential or Important
Contributes to conservation of species	☐ Essenti	☐ Importan	☐ Not Essential or Important
Contributes to conservation of ecological process	☐ Essenti	☐ Importan	☐ Not Essential or Important
Contributes to conservation of systems that provide ecosystem services	☐ Essenti	☐ Importan	☐ Not Essential or Important

NEMA PAA CHECKLIST	
Tick the appropriate box	
2 b (i) has significant features or biodiversity	☐
2 b (ii) is of scientific, cultural, historical or archaeological interest	☐

2 b (iii) is in need of long-term protection for the maintenance of its biodiversity or for the provision of environmental goods and services	☐
2 c provides for a sustainable flow of natural products and services to meet the needs of a local community	☐
2 d enables the continuation of such traditional consumptive uses as are sustainable	☐
2 e provides for nature-based recreation and tourism opportunities	☐

Give a summary of 4 or 5 major reasons for suggested biodiversity stewardship status.
Describe the most important conservation Management Objectives for the property.
Comments and Additional Information:
RECOMMENDED CATEGORY
Recommend an appropriate category
☐ Nature Reserve ☐ Protected Environment ☐ Biodiversity Agreement ☐ Conservation Area ☐ None
Comment: NR for south-eastern portion of site and PE for remainder. Or NR for entire site if existing land-use can be accommodated.
Indicate the landowner's preferred category
☐ Nature Reserve ☐ Protected Environment ☐ Biodiversity Agreement ☐ Conservation Area ☐ Undecided
Comment: NR for south-eastern portion of site and PE for remainder. Or NR for entire site if existing land-use can be accommodated.
MAPS

Appendices

Appendix 6: Species list for the Glencoe study site

No	Species	Common name	Conservation Status
1	*Abrus laevigatus*	Lucky bean creeper	Least concern
2	*Amaranthus blitum*	Purple amaranth	Weed
3	*Andropogon appendiculatus*	Blue grass	Least concern
4	*Artemisia pontica*	Roman wormwood	Least concern
5	*Artemisia stelleriana*	Hoary mugwort	Least concern
6	*Arundinella nepalensis*	Beesgras	Least concern
7	*Asparagus officinalis*	Sparrow grass	Least concern
8	*Athrixia angustissina*	Bush tea	Least concern
9	*Atriplex prostrata boucher*	Spear leaved orache	Exotic
10	*Barkheya purpurea*	Purple berkheya	Least concern
11	*Bolboschoenus maritimus*	Sea Club rush	Least concern
12	*Bromus catharticus*	Broom grass	Weed
13	*Buddleja salviifolia*	Sagewood	Least concern
14	*Carex cognata*	Carex drakensbergensis	Least concern
15	*Cephalaria galpiniana*	Tsoene	Least concern
16	*Cheilanthes feei*	Slender lip fern	Least concern
17	*Chenopodium album*	Common pigweed	Exotic
18	*Chrysocoma oblongifolia*	Bitter Karoo bush	Least concern
19	*Cliffortia paucistaminea*	Rock rice bush	Least concern
20	*Corycium nigrescens*	Black-faced orchid	Least concern
21	*Cotula socialis*	Button wood	Least concern
22	*Crassula alba*	Feko	Least concern
23	*Crassula vaginata*	White stone crop	Least concern
24	*Cucumis zeyheri*	Wild cucumber	Least concern
25	*Cymbopogon caesius*	Common turpentine grass	Not yet identified
26	*Cymbopogon pospischilii*	Bitter turpentine grass	Not Evaluated
27	*Cyperus congestus*	Dense flat sedge	Least concern
28	*Cyperus marginatus*	Matjiesgoed	Least concern
29	*Cyperus obstusiflorus*	Yellow flowered plant	Least concern
30	*Cyperus rupestris*	Russet rock sedge	Least concern
31	*Cyperus semitrifidus*	Sedge	Least concern
32	*Cyperus sphaerocephalus*	Yellow sedge	Least concern
33	*Cyperus subsquarrosus*	Paper Plant	Least concern
34	*Dactylis glomerata*	Cocksfoot grass	Exotic
35	*Delosperma caespitosum*	Not found	Not found
36	*Delosperma cooperi*	Ice plant	Least concern
37	*Dianthus crenatus*	Wild Pink	Least concern

38	*Dianthus mooiensis*	Frilly carnation	Least concern
39	*Diclis reptans*	Dwarf snapdragon	Least concern
40	*Dierama floriferum*	Lilac hairbell	Least concern
41	*Diospyros lycioides*	Bush veld blue bush	Least concern
42	*Dipcadi serotinum*	Brown blue bell	Least concern
43	*Dryopteris pentheri*	Penther's wood fern	Least concern
44	*Eleocharis dregeana*	Finger sedge	Least concern
45	*Elionurus muticus*	Lemon scented grass	Least concern
46	*Enneapogon scoparius*	Bottle brush grass	Least concern
47	*Epilobium ciliatum*	Fringed willowherb	Not Evaluated
48	*Eragrostis capensis*	Small heart seed grass	Least concern
49	*Eragrostis chloromelas*	Blue love grass	Least concern
50	*Eragrostis curvula*	Weeping love grass	Least concern
51	*Eragrostis plana*	Tough love grass	Least concern
52	*Eragrostis racemosa*	Narrow heart love grass	Least concern
53	*Erica arborea*	Tree heather	Least concern
54	*Erica reunionensis*	Not found	Not found
55	*Euryops tysonii*	Sehlakoana-se-nyenyana	Least concern
56	*Felicia muricata*	Wild Aster	Least concern
57	*Fingerhuthia africana*	Thimble grass	Least concern
58	*Fuirena hirsuta*	Unknown	Least concern
59	*Garuleum sonchifolium*	Unknown	Least concern
60	*Gazania krebsiana*	Butter flower	Least concern
61	*Gerbera aurantiaca*	Hilton daisy	Endangered
62	*Gerbera pilloselloides*	Tsebe-ea- pela	Least concern
63	*Gunnera perpense*	Wild rhurbarb	Least concern
64	*Harpocloa falx*	Caterpillar grass	Least concern
65	*Haplocarpha scaposa*	False gerbera	Least concern
66	*Helichrysum aureum*	Leabana	Not Evaluated
67	*Helichrysum aurioniten*	Golden everlasting	Least concern
68	*Helichrysum cephaloideum*	Mosuoane-oathaba	Least concern
69	*Helichrysum chionosphaerum*	Tiny snowball everlasting	Least concern
70	*Helichrysum glumaceum*	Not found	Not found
71	*Helichrysum halicum*	Curry bush	Least concern
72	*Helichrysum inornatum*	Not found	Least concern
73	*Helichrysum italicum*	Curry plant	Least concern
74	*Helichrysum krookii*	Leme-la-khomo	Least concern
75	*Helichrysum nanum*	Not found	Not found
76	*Helichrysum nudifolium*	Wild tea	Least concern
77	*Helichrysum odoratissimum*	Hottentotskuie/Tooane	Least concern
78	*Helichrysum pallidum*	Bolebatsi	Least concern

79	*Helichrysum pilosellum*	Boleba/ Umadotsheni	Least concern
80	*Helichrysum splendidum*	Cape Gold	Least concern
81	*Helichrysum stoechas*	Shrubby everlasting	least concern
82	*Heteropogon contortus*	Common spear grass	Least concern
83	*Hyparrhenia hirta*	Common thatch grass	Least concern
84	*Hypericum lalandii*	Spindly hypericum	Least concern
85	*Hypochaeris glabra*	Smooth cat's ear	Not Evaluated
86	*Hypochaeris radicata*	Harry wild lettuce	Not Evaluated
87	*Hypoxis acuminata*	African potato	Least concern
88	*Indigofera dimidiata*	Trifoliate indigofera	Least concern
89	*Juncus effusus*	Soft rush	Least concern
90	*Kniphofia porphyrantha*	Dwarf red hot poker	Least concern
91	*Kniphofia rooperi*	Winter poker	Least concern
92	*Koeleria capensis*	June grass	Least concern
93	*Leersia hexandra*	Southern cut grass	Least concern
94	*Leucosidea sericea*	Old wood	Least concern
95	*Lobelia erinus*	Edging lobelia	Least concern
96	*Lotononis galpini*	Hairy lotononis	Least concern
97	*Loudetia simplex*	Russet grass	Least concern
98	*Malva neglecta*	Common mallow	Not Evaluated
99	*Melica decumbens*	Staggers grass	Least concern
100	*Mesembryanthemum nodiflorum*	Slenderleaf iceplant	Least concern
101	*Merximuellera dura*	Not found	Not found
102	*Merxmuellera macowanii*	Molalashlolo	Unknown
103	*Microchloa caffra*	Pin Cushion grass	Least concern
104	*Miscanthus junceus*	Broom grass	Weed
105	*Moraea huttonii*	Peacock lily	Least concern
106	*Myriopteris gracilis*	Slender lip fern	Least concern
107	*Nidorella anomala*	Mokoteli	Least concern
108	*Oenothera roea*	Rose evening primrose	Not Evaluated
109	*Olea europaea*	African olive	Least concern
110	*Oxalis latifolia*	Garden pink sorrel	Least concern
111	*Oxalis obliquifolia*	Oblique leaved sorrel	Least concern
112	*Panicum ecklonii*	Guinea grass	Least concern
113	*Panicum natalense*	Natal buffalo grass	Least concern
114	*Panicum schinzii*	Buffalo grass	Least concern
115	*Pennisetum sphacelatum*	Bulgrass	Least concern
116	*Pennisetum thunbergii*	Napier millet	Least concern
117	*Pinus taeda*	Loblolly pine	Exotic
118	*Polygala virgata*	Water speedwell	Least concern
119	*Populus canescens*	Grey poplar	Not Evaluated

120	*Purtulaca oleracea*	Common purslane	Exotic
121	*Pycreus macranthus*	Unknown	Least concern
122	*Pycreus mauritius*	NAA	NAA
123	*Pycreus nitidus*	Waterbessie	Least concern
124	*Ranunculus acris*	Meadow buttercup	Exotic
125	*Robinia pseudoacacia*	Locust tree	Least concern
126	*Rosa rubiginosa*	Sweet brier	Exotic
127	*Rubus laciniatus*	Cutleaf blackberry	Least concern
128	*Rumex salicifolius*	Willow dock	Not found
129	*Salvia repens*	Creeping sage	Data Insufficient
130	*Scabiosa columbaria*	Wild scabiosa	Least concern
131	*Schkuhria pinnata*	Yellow tumble weed	Not Evaluated
132	*Schoenoplectus corymbosus*	Matjiesgoed	Least concern
133	*Scirpus ficinioides*	Club rush	Least concern
134	*Scleria angusta*	Not found	Least concern
135	*Searsia divaricata*	Mountain kuni bush	Least concern
136	*Sebaea filiformis*	Not found	Least concern
137	*Sebaea sedoides*	Isvumelwano esikhulu	Least concern
138	*Senecio glaberrimus*	Lehlomane	Least concern
139	*Senecio lividus*	Oldman in the spring	Not Evaluated
140	*Senecio paucicalyculatus*	Unknown	Least concern
141	*Senecio squalidus*	No Data	No Data
142	*Senecio ulopterus*	Canary creeper	Least concern
143	*Setaria incrassata*	Vlei brittle grass	Least concern
144	*Setaria sphacelata var. sphacelata*	African brittle grass	Least concern
145	*Sonchus arvensis*	Perennial sowthistle	Unknown
146	*Stiburus alopecuroides*	Pongwa Grass	Least concern
147	*Tagetes minuta*	Southern cone marigold	Least concern
148	*Tenrhynea phylicifolia*	Unknown	Least concern
149	*Themeda triandra*	Red grass	Least concern
150	*Trachypogon spicatus*	Giant spear grass	Least concern
151	*Trifolium burchellianum*	Wild clover	Least concern
152	*Trifolium dubium*	Lesser trefoil	Exotic
153	*Tristachya leucothrix*	Hairy trident grass	Least concern
154	*Vernonia fastigiata*	Narrow leaved vernonia	Least concern
155	*Veronica peregrina*	Purslane	Least concern
156	*Wahlenbergia krebsii*	Fairy bell flower	Least concern

Appendix 7: Species list for the Reedsdell study site

No	Species	Common name	Conservation Status
1	*Agrostis lachnantha*	South African bent grass	Least Concern
2	*Andropogon appendiculatus*	Blue grass	Least Concern
3	*Argyrolobium tuberosum*	Little russet pea	Least Concern
4	*Aristea woodii*	Wood's aristea	Unknown
5	*Artemisia annua*	Sweet wormwood	Threatened
6	*Artemisia pontica*	Roman wormwood	Least Concern
7	*Artemisia stelleriana*	Hoary mugwort	Least Concern
8	*Asparagus officinalis*	Sparrow grass	Least Concern
9	*Berkheya onopordifolia*	Purple berkheya	Least Concern
10	*Berkheya purpurea*	Purple stream thistle	Least Concern
11	*Bidens pilosa*	Blackjack	Weed
12	*Bromus catharticus*	Broom grass	Weed
13	*Bryonia alba*	White bryony	Least Concern
14	*Buddleja salviifolia*	Mountain sedge	Least Concern
15	*Carex cognata*	Carex drakensbergensis	Least Concern
16	*Cheilanthes feei*	Slender lip fern	Least Concern
17	*Cotula hispida*	Silver cotula	Least Concern
18	*Cotula socialis*	Not found	Least Concern
19	*Crassula vaginata*	White stonecrop	Least Concern
20	*Cymbopogon caesius*	Common turpentine grass	Not yet identified
21	*Cyperus filiformis*	Wiry flat sedge	Least Concern
22	*Cyperus obstusiflorus*	Yellow flowered plant	Least Concern
23	*Cyperus semitrifidus*	Sedge	Least Concern
24	*Delosperma carterae*	Not found	Least Concern
25	*Dianthus crenatus*	Wild pink	Least Concern
26	*Dianthus mooiensis*	Frilly carnation	Least Concern
27	*Eleocharis dregeana*	Finger sedge	Least Concern
28	*Elionurus muticus*	Lemon scented grass	Least Concern
29	*Eragrostis capensis*	Small heart seed grass	Least Concern
30	*Eragrostis chloromelas*	Blue love grass	Least Concern
31	*Eragrostis curvula*	Weeping love grass	Least Concern
32	*Eragrostis plana*	Tough love grass	Least Concern
33	*Eragrostis racemosa*	Narrow heart love grass	Least Concern
34	*Erica arborea*	Tree heather	Least concern
35	*Erica hillburttii*	Not found	Critically endangered
36	*Erica reunionensis*	Erica revoluta	Least Concern
37	*Felicia muricata*	Wild aster	Least Concern

38	*Ficinia nodosa*	Knotted club rush	Least Concern
39	*Fingerhuthia africana*	Thimble grass	Least Concern
40	*Fuirena hirsuta*	Umbrella sedge	Least Concern
41	*Geranium sylvaticum*	Wood cranesbill	Least Concern
42	*Gerbera piloselloides*	Swartteebossie	Least Concern
43	*Gunnera perpense*	Wild rhubarb	Least Concern
44	*Harpocloa falx*	Caterpillar grass	Least Concern
45	*Haplocarpha scaposa*	False gerbera	Least Concern
46	*Harveya speciosa*	Tall white ink flower	Least Concern
47	*Helichrysum aureum*	Leabane	Not evaluated
48	*Helichrysum aurionitens*	Golden everlasting	Least Concern
49	*Helichrysum chionosphaerum*	Tinysnowball everlasting	Least Concern
50	*Helichrysum glumaceum*	Not found	Not found
51	*Helichrysum halicum*	No Data	No Data
52	*Helichrysum inornatum*	Not found	Least Concern
53	*Helichrysum italicum*	Italian strawflower	Exotic
54	*Helichrysum pallidum*	Bolebatsi	Least Concern
55	*Helichrysum splendidum*	Cape gold	Least Concern
56	*Helichrysum stoechas*	Curry plant	Least Concern
57	*Heteropogon contortus*	Common Spear grass	Least Concern
58	*Hypochaeris glabra*	Smooth Cat's ear	Not evaluated
59	*Hypochaeris radicata*	Cat's Ear	Not evaluated
60	*Hypoxis acuminata*	Yellow star/African potato	Least Concern
61	*Hypoxis argentea*	Small silver star flower	Least Concern
62	*Hypoxis hirsuta*	Yellow star grass	Least Concern
63	*Hypoxis rigidula*	Small silver star flower	Least Concern
64	*Juncus effusus*	Soft rush	Least Concern
65	*Koeleria capensis*	June grass	Least Concern
66	*Leersia hexandra*	Cut grass	Least Concern
67	*Leucosidea sericea*	Old wood	Least Concern
68	*Lobelia erinus*	Wild lobelia	Least Concern
69	*Lobelia Flaccida*	Motlapa-tsoinjane	Least Concern
70	*Loudetia simplex*	Russet grass	Least Concern
71	*Malva neglecta*	Dwarf mallow plant	Not evaluated
72	*Melica decumbus*	Staggers grass	Least Concern
73	*Merximuellera dura*	Not found	Specie not found
74	*Merxmuellera macowanii*	Molalashlolo	Unknown
75	*Microchloa caffra*	Pin cushion grass	Least Concern
76	*Miscanthus capensis*	Eastcoast boom grass	Invasive
77	*Miscanthus junceus*	Wire leaf daba grass	Least Concern
78	*Myosotis semiaplexicaulis*	Forget-me-not	Data insufficient

79	*Myosotis sylvatica*	Forget-me-not	Not evaluated
80	*Nassella tussock*	Mexican feather grass	Invasive
81	*Nemesia denticulata*	The toothed aloha	Least Concern
82	*Nidorella undulata*	Mokoteli o-moholo	Least Concern
83	*Lampranthus deltoides*	Wedgewood	Not evaluated
84	*Oenothera rosea*	Rose evening primrose	Not evaluated
85	*Oxalis obliquifolia*	Oblique leaved sorrel	Least Concern
86	*Oxalis smithiana*	Star leaved sorrel	Least Concern
87	*Panicum ecklonii*	Guinea grass	Least Concern
88	*Panicum natalense*	Natal buffalo grass	Least Concern
89	*Panicum schinzii*	Buffalo grass	Least Concern
90	*Paspalum dilatatum*	Dallas grass	Not evaluated
91	*Passerina montana*	Mountain gonna	Least Concern
92	*Pelargonium lichenoides*	Lady's mantle leaved	Least Concern
93	*Pennisetum sphacelatum*	Bulgras	Least Concern
94	*Pennisetum thunbergii*	Napier millet	Least Concern
95	*Pycreus macranthus*	Sedge	Least Concern
96	*Pycreus nitidus*	Waterbiesie	Least Concern
97	*Ranunculus multifidus*	Common buttercup	Least Concern
98	*Rhynchospora corymbosa*	West indian beak sedge	Least Concern
99	*Rosa rubiginosa*	Sweet-Brier	Exotic
100	*Rubus laciniatus*	Cutleaf blackberry	Exotic
101	*Salix fragilis*	Crack willow	Not evaluated
102	*Schoenoplectus corymbosus*	Common sedge	Least Concern
103	*Scirpus ficinioides*	Club rush	Least Concern
104	*Scleria angusta*	Not found	Least concern
105	*Searsia divaricata*	Rusty leaved currant	Least Concern
106	*Sebaea sedoides*	Isvumelwano esikhulu	Least concern
107	*Selago densiflorus*	Not found	Least concern
108	*Selago galpinii*	Tsitoanyane	Least concern
109	*Senecio harveianus*	Narrow leaved ragwot	Least Concern
110	*Senecio heliopsis*	Sunbush	Least Concern
111	*Senecio inaequidens*	South African ragwort	Least Concern
112	*Senecio squalidus*	No data	No Data
113	*Senecio ulopterus*	Canary creeper	Least Concern
114	*Setaria incrassata*	Vlei brittle grass	Least Concern
115	*Setaria sphacelata var. sphacelata*	African brittlegrass	Least Concern
116	*Solanum nigrum*	Black night shade	Exotic
117	*Stiburus alopecuroides*	Pongwa grass	Least Concern
118	*Tagetes minuta*	Southern cone marigold	Least Concern
119	*Taraxacum officinale*	Common dandelion	Not evaluated

120	*Tephrosia grandiflora*	Bush pea	Least Concern
121	*Themeda triandra*	Red grass	Least Concern
122	*Trachypogon spicatus*	Giant spear grass	Least Concern
123	*Tristachya leucothrix*	Hairy trident grass	Least Concern
124	*Wahlenbergia krebsii*	Fairy bell flower	Least Concern
125	*Wahlenbergia planiflora*	Flat bluebell	Exotic

Appendix 8: Woody species list and height classes for the study area.

		Lower		Medium		Upper	
		Glencoe	**Reedsdell**	**Glencoe**	**Reedsdell**	**Glencoe**	**Reedsdell**
1	*Abrus laevigatus*	1	0	0	0	0	0
2	*Artemisia annua*	0	1	0	0	0	0
3	*Artemisia pontica*	8	1	0	0	0	0
4	*Asparagus officinallis*	6	0	0	1	0	0
5	*Buddleja salviifolia*	3	1	0	0	1	0
6	*Chrysocoma oblongifolia*	1	0	0	0	0	0
7	*Cliffortia paucistaminea*	1	0	0	0	0	0
8	*Diospyros lycioides*	2	0	0	0	0	0
9	*Erica arborea*	7	5	0	0	0	0
10	*Erica hillburttii*	0	2	0	0	0	0
11	*Erica reunionensis*	3	2	0	1	0	0
12	*Leucosidea sericea*	7	2	3	5	4	6
13	*Lotononis galpini*	1	0	0	0	0	0
14	*Olea europaea*	1	0	0	0	1	0
15	*Passerina montana*	0	1	0	0	0	0
16	*Pinus taeda*	0	0	0	0	1	0
17	*Populus canescens*	1	0	0	0	0	0
18	*Robinia pseudoacacia*	1	0	0	0	0	0
19	*Rosa rubiginosa*	3	3	1	1	1	2
20	*Rubus laciniatus*	1	2	0	0	0	0
21	*Salix fragilis*	0	0	0	0	0	1
22	*Searsia divaricata*	12	4	3	3	0	1
23	*Selago densiflorus*	0	9	0	0	0	0
24	*Solanum nigrum*	0	1	0	0	0	0
25	*Tagetes minuta*	2	0	0	0	0	0
		61	**34**	**7**	**11**	**8**	**10**

Appendix 9: Veld condition assessment for the Glencoe study site.

Species Name	Ecological group	Factor	Community 1		Community 2		Sub-community 2.1		Sub-community 2.2		Variant 2.2.1		Variant 2.2.2		Variant 2.2.3		Variant 2.2.4		Sub-community 2.3	
			%	Score	%	Score	%	Score	%	Score	%	Score	%	Score	%	Score	%	Score	%	Score
Panicum schinzii			14	**140**	0,6	**6**		**0**	0,8	**8**		**0**	3,7	**37**	1,4	**14**	0,8	**8**		**0**
Seteria sphacelata var sphac			14	**140**	1,1	**11**		**0**	1,4	**14**	0,5	**5**	5	**50**	2	**20**	1,2	**12**	0,6	**6**
Setaria incrassata				**0**	1,3	**13**	9,5	**95**	0,04	**0,4**		**0**		**0**	0,1	**1**	0,1	**1**	1	**10**
Fingerhuthia africana				**0**	0,1	**1**	0,8	**8**	0	**0**		**0**		**0**		**0**		**0**		**0**
Themeda traindra	**Decreaser**			**0**	7,5	**75**	1,3	**13**	9,8	**98**	2,2	**22**	4	**40**	14,6	**146**	17,5	**175**	3	**30**
Festuca scabra				**0**	0,8	**8**	0	**0**	0,1	**1**		**0**		**0**	0,1	**1**	0,2	**2**		**0**
Ehrharta calycina				**0**	0,3	**3**	0	**0**	0,4	**4**		**0**		**0**	0,6	**6**	0,8	**8**		**0**
Penicum natalense				**0**	0,1	**1**	0	**0**		**0**		**0**		**0**		**0**		**0**	0,8	**8**
Andropogon appendiculatus				**0**	0,1	**1**	0	**0**	0,2	**2**		**0**		**0**	0,2	**2**	0,3	**3**		**0**
Panicum ecklonii				**0**	0,8	**8**	0,8	**8**	0,9	**9**	0,5	**5**		**0**	1,2	**12**	1,5	**15**	0,2	**2**
TOTAL			**28**	**280**	**12,7**	**127**	**12,4**	**124**	**13,64**	**136,4**	**3,2**	**32**	**12,7**	**127**	**20,2**	**202**	**22,4**	**224**	**5,6**	**56**
Harpochloa falx			7	**49**	6,7	**46,9**	6,3	**44,1**	7,7	**53,9**	10	**71,4**	3,3	**23,1**	6,2	**43,4**	7	**49**	2,4	**16,8**
Trachypogon spicatus			6	**42**	1,5	**10,5**	1,5	**10,5**	1,6	**11,2**	1,3	**9,1**	2,7	**18,9**	1,7	**11,9**	1,5	**10,5**	1	**7**
Tristachya leucothrix				**0**	5,2	**36,4**	1,8	**12,6**	6,5	**45,5**	9,8	**68,6**	2	**14**	4,4	**30,8**	5,1	**35,7**	2	**14**
Pennisetum thunbergii				**0**	0,4	**2,8**		**0**	0,4	**2,8**	0,5	**3,5**		**0**	0,4	**2,8**	0,5	**3,5**	0,4	**2,8**
Cymbopogon caesius	**Increaser I**	**7**		**0**	2,7	**18,9**	0	**0**	3,7	**25,9**	0,2	**1,4**	2	**14**	6,6	**46,2**	7,8	**54,6**		**0**
Melinis nerviglumis				**0**	0,03	**0,21**		**0**		**0**		**0**		**0**		**0**		**0**	0,2	**1,4**
Hyparrhenia hirta				**0**	0,1	**0,7**		**0**	0,3	**2,1**		**0**	0,7	**4,9**	0,5	**3,5**	0,5	**3,5**		**0**
Miscanthus capensis				**0**	0,1	**0,7**	0	**0**	0,1	**0,7**		**0**	1	**7**	1,4	**9,8**	1,5	**10,5**	0,4	**2,8**
Pennisetum sphacelatum				**0**	0,1	**0,7**		**0**	0,1	**0,7**		**0**		**0**	0,1	**0,7**	0,2	**1,4**		**0**
Miscanthus junceus				**0**	0,3	**2,1**		**0**	0,4	**2,8**		**0**		**0**	0,6	**4,2**	0,8	**5,6**		**0**
TOTAL			**13**	**91**	**17,13**	**119,91**	**9,6**	**67,2**	**20,8**	**145,6**	**22**	**154**	**11,7**	**81,9**	**21,9**	**153,3**	**24,9**	**174,3**	**6,4**	**44,8**
Microchloa caffra			5	**20**	11,9	**47,6**	22	**88**	11,5	**46**	22,5	**90**	15,3	**61,2**	4,5	**18**	1,5	**6**	6	**24**
Eragrostis racemosa			9	**36**	2,1	**8,4**	4,3	**17,2**	2	**8**	3,6	**14,4**	3,3	**13,2**	1,1	**4,4**	0,5	**2**	1	**4**
Loudetia simplex			7	**28**	7,7	**30,8**	0,5	**2**	9,4	**37,6**	4,5	**18**	11	**44**	10,9	**43,6**	10,8	**43,2**	6,8	**27,2**
Eragrostis chloromelas			12	**48**	10,1	**40,4**	14,3	**57,2**	5,8	**23,2**	2,7	**10,8**	14,3	**57,2**	8,3	**33,2**	6,6	**26,4**	21,4	**85,6**
Eragrostis plana			11	**44**	1	**4**		**0**	1	**4**		**0**	5,7	**22,8**	1,8	**7,2**	0,7	**2,8**	2,2	**8,8**
Eragrostis capensis			4	**16**	9,5	**38**	19	**76**	7,4	**29,6**	11,2	**44,8**	3	**12**	5,1	**20,4**	5,7	**22,8**	12,8	**51,2**
Eragrostis curvula	**Increaser II**	**4**		**0**	3,9	**15,6**	1,5	**6**	3,9	**15,6**	4,5	**18**	0,3	**1,2**	3,7	**14,8**	4,6	**18,4**	6,8	**27,2**
Koeleria capensis				**0**	3	**12**	2,5	**10**	3	**12**	3,6	**14,4**	2	**8**	2,8	**11,2**	3	**12**	3	**12**
Cynodon dactylon				**0**	0,2	**0,8**		**0**		**0**		**0**		**0**		**0**		**0**	4,8	**19,2**
Heteropogon contortus				**0**	1,3	**5,2**	0,3	**1,2**	1,3	**5,2**	1,5	**6**		**0**	1,2	**4,8**	1,5	**6**	2,2	**8,8**
Digitaria monodactyla				**0**	0,1	**0,4**		**0**	0,1	**0,4**		**0**		**0**		**0**		**0**		**0**
Eragrostis cilianensis				**0**	0,5	**2**		**0**	0,7	**2,8**	1,5	**6**		**0**	0,1	**0,4**	0,2	**0,8**		**0**
Melica decumbens				**0**	0,1	**0,4**		**0**		**0**		**0**		**0**		**0**		**0**	0,4	**1,6**
Digitaria sanguinalis				**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**	4,8	**19,2**
TOTAL			**48**	**192**	**51,4**	**205,6**	**64,4**	**257,6**	**46,1**	**184,4**	**55,6**	**222,4**	**54,9**	**219,6**	**39,5**	**158**	**35,1**	**140,4**	**72,2**	**288,8**
Elionurus muticus			**9**	**9**	**10,5**	**10,5**	**7,8**	**7,8**	**11,4**	**11,4**	**13,7**	**13,7**	**10,7**	**10,7**	**9,6**	**9,6**	**9,3**	**9,3**	**8,6**	**8,6**
Bare			**2**	**2**	**4,5**	**4,5**	**1**	**1**	**5**	**5**	**1,9**	**1,9**	**9,3**	**9,3**	**7,1**	**7,1**	**6,5**	**6,5**	**5,8**	**5,8**
Enneapogon scoparius				**0**	**0,4**	**0,4**		**0**	**0,5**	**0,5**	**0,7**	**0,7**		**0**	**0,4**	**0,4**	**0,5**	**0,5**		**0**
Lophachme digitata				**0**	**0,1**	**0,1**		**0**	**0,1**	**0,1**	**0,1**	**0,1**		**0**		**0**		**0**		**0**
Cymbopogon pospischilli	**Increaser III,**			**0**	**0,5**	**0,5**		**0**	**0,6**	**0,6**		**0**		**0**		**0**		**0**		**0**
Forb	**Invaders, Bare &**	**1**		**0**	**0,4**	**0,4**	**1,8**	**1,8**	**0,2**	**0,2**	**0,4**	**0,4**	**0,7**	**0,7**	**0,1**	**0,1**		**0**	**0,2**	**0,2**
Bromus catharticus	**Forbes**			**0**	**0,5**	**0,5**	**0,8**	**0,8**	**0,2**	**0,2**		**0**		**0**	**0,4**	**0,4**	**0,5**	**0,5**	**0,2**	**0,2**
Merximuellera dura				**0**	**0,3**	**0,3**	**0,8**	**0,8**	**0,1**	**0,1**	**0,1**	**0,1**		**0**	**0,1**	**0,1**	**0,1**	**0,1**	**0,8**	**0,8**
Leersia hexandra				**0**	**1,2**	**1,2**	**2**	**2**	**1,2**	**1,2**	**2,3**	**2,3**		**0**	**0,4**	**0,4**	**0,5**	**0,5**	**0,2**	**0,2**
Dactylis glomerata				**0**	**0,6**	**0,6**		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Pspalum distichum				**0**	**0,2**	**0,2**		**0**	**0,1**	**0,1**		**0**		**0**	**0,1**	**0,1**	**0,2**	**0,2**		**0**
			11	**11**	**19,2**	**19,2**	**14,2**	**14,2**	**19,4**	**19,4**	**19,2**	**19,2**	**20,7**	**20,7**	**18,2**	**18,2**	**17,6**	**17,6**	**15,8**	**15,8**
TOTAL INDEX SCORE			100	**574**	**100**	**471,71**	**101**	**463**	**100**	**485,8**	**100**	**427,6**	**100**	**449,2**	**99,8**	**531,5**	**100**	**556,3**	**100**	**405,4**
PERCENTAGE SCORE (%)				57%		47%		46%		49%		43%		45%		53%		56%		41%

Appendix 10: Veld condition assessment for the Reedsdell study site.

Species Name	Ecological group	Factor	Community 1		Sub-community 1,2		Variant 1.1.1		Community 2		Sub-community 2,1		Sub-community 2,2		Variant 2.2.1		Variant 2.2.2		Variant 2.2.3	
			%	Score	%	Score	%	Score	%	Score	%	Score	%	Score	%	Score	%	Score	%	Score
Seteria sphacelata var sphacelata			0,3	**3**	0,3	**3**		**0**	0,7	**7**	0,4	**4**	1,3	**13**	0,4	**4**		**0**	1,8	**18**
Setaria incrassata			0,3	**3**	0,3	**3**		**0**	0,3	**3**	0,5	**5**		**0**	0,6	**6**		**0**		**0**
Fingerhuthia africana			0,4	**4**	0,4	**4**		**0**	0,04	**0,4**		**0**	0,1	**1**		**0**		**0**	0,1	**1**
Themeda traindra	**Decreaser**		11,4	**114**	10,7	**107**	10,6	**106**	13,8	**138**	13,3	**133**	16,2	**162**	8,8	**88**	24,7	**247**	17,4	**174**
Helictotrichon turgidulum				**0**		**0**		**0**	0,2	**2**	0,4	**4**		**0**	0,5	**5**		**0**		**0**
Ehrharta calycina				**0**		**0**		**0**		**0**	0,6	**6**		**0**		**0**		**0**		**0**
Andropogon appendiculatus			0,6	**6**	0,7	**7**	0,2	**2**	0,2	**2**	0,4	**4**		**0**	0,5	**5**		**0**		**0**
Panicum ecklonii			3,2	**32**	3,6	**36**	6,4	**64**	1,2	**12**		**0**	1,9	**19**	0,7	**7**		**0**	2,5	**25**
TOTAL			**16,2**	**162**	**16**	**160**	**17,2**	**172**	**16,44**	**164,4**	**15,6**	**156**	**19,5**	**195**	**11,5**	**115**	**24,7**	**247**	**21,8**	**218**
Harpochloa falx			2,1	**14,7**	1,9	**13,3**	2,8	**19,6**	2,4	**16,8**	2,1	**14,7**	3	**21**	1,4	**9,8**	4,7	**32,9**	3,1	**21,7**
Trachypogon spicatus			1,3	**9,1**	1,3	**9,1**	0,6	**4,2**	0,8	**5,6**	1,1	**7,7**	0,4	**2,8**	1,3	**9,1**		**0**	0,5	**3,5**
Tristachya leucothrix			2,8	**19,6**	2,2	**15,4**	1,4	**9,8**	5,6	**39,2**	4,3	**30,1**	7,5	**52,5**	2,8	**19,6**	10,7	**74,9**	9	**63**
Cymbopogon caesius	**Increaser I**	**7**	2,7	**18,9**	2	**14**	2,8	**19,6**	0,7	**4,9**	0,1	**0,7**	1,5	**10,5**	0,1	**0,7**		**0**	2,1	**14,7**
Miscanthus capensis			5,4	**37,8**	6	**42**	4,2	**29,4**	0,5	**3,5**	0,8	**5,6**	0,1	**0,7**	0,9	**6,3**		**0**	0,1	**0,7**
Pennisetum sphacelatum			0,2	**1,4**	0,2	**1,4**		**0**	0,6	**4,2**	1	**7**		**0**	1,2	**8,4**		**0**		**0**
Miscanthus junceus				**0**		**0**		**0**	1,2	**8,4**	1,2	**8,4**	1,4	**9,8**	1,2	**8,4**		**0**	1,9	**13,3**
TOTAL			**14,5**	**101,5**	**13,6**	**95,2**	**11,8**	**82,6**	**11,8**	**82,6**	**10,6**	**74,2**	**13,9**	**97,3**	**8,9**	**62,3**	**15,4**	**107,8**	**16,7**	**116,9**
Microchloa caffra			3	**12**	2,7	**10,8**	4,8	**19,2**	4,8	**19,2**	4,4	**17,6**	5	**20**	5,2	**20,8**	7	**28**	3,9	**15,6**
Eragrostis racemosa			7,7	**30,8**		**0**		**0**	2	**8**	2	**8**	2,2	**8,8**	2,2	**8,8**	1	**4**	1,9	**7,6**
Loudetia simplex			9	**36**	9,4	**37,6**	5,8	**23,2**	8,9	**35,6**	10,3	**41,2**	6,7	**26,8**	11,8	**47,2**	4	**16**	6,9	**27,6**
Eragrostis chloromelas			12,5	**50**	12,3	**49,2**	18,2	**72,8**	9,2	**36,8**	12,1	**48,4**	4,3	**17,2**	14,6	**58,4**	4	**16**	4,4	**17,6**
Eragrostis plana				**0**		**0**		**0**	1,2	**4,8**	2,1	**8,4**	0,4	**1,6**	2,2	**8,8**		**0**	0,5	**2**
Eragrostis capensis	**Increaser II**	**4**		**0**	8,2	**32,8**	4,2	**16,8**	8,2	**32,8**	8,9	**35,6**	6,5	**26**	9,5	**38**	6,7	**26,8**	7	**28**
Eragrostis curvula			8,4	**33,6**	9,2	**36,8**	11,2	**44,8**	6	**24**	6,6	**26,4**	4,8	**19,2**	7,7	**30,8**	3,3	**13,2**	2,9	**11,6**
Koeleria capensis			0,5	**2**	0,6	**2,4**	1	**4**	0,5	**2**	0,6	**2,4**	0,5	**2**	0,5	**2**	0,7	**2,8**	0,6	**2,4**
Heteropogon contortus			3,3	**13,2**	3,2	**12,8**	1,2	**4,8**	5,5	**22**	6,7	**26,8**	3,8	**15,2**	6	**24**	10,7	**42,8**	3,5	**14**
Panicum schinzii			0,6	**2,4**	0,7	**2,8**	1,2	**4,8**	0,5	**2**	0,4	**1,6**	0,5	**2**	0,5	**2**		**0**	0,8	
Digitaria sanguinalis			0,1	**0,4**	0,1	**0,4**	0,2	**0,8**		**0**		**0**		**0**		**0**		**0**		**0**
TOTAL			**45,1**	**180,4**	**46,4**	**185,6**	**47,8**	**191,2**	**46,8**	**187,2**	**54,1**	**216,4**	**34,7**	**138,8**	**60,2**	**240,8**	**37,4**	**149,6**	**32,4**	**126,4**
Elionurus muticus			**10,2**	**10,2**	**10,2**	**10,2**	**8,2**	**8,2**	**10,8**	**10,8**	**9,2**	**9,2**	**12,5**	**12,5**	**9,3**	**9,3**	**13**	**13**	**10,9**	**10,9**
Bare			**6,5**	**6,5**	**6,2**	**6,2**	**10,2**	**10,2**	**7,5**	**7,5**	**4,4**	**4,4**	**11,5**	**11,5**	**5**	**5**	**5,3**	**5,3**	**9**	**9**
Melica decumbens			**0,4**	**0,4**	**0,4**	**0,4**	**0,8**	**0,8**	**0,4**	**0,4**	**0,7**	**0,7**		**0**	**0,8**	**0,8**		**0**		**0**
Merxmuellera macowanii			**1,2**	**1,2**	**1,2**	**1,2**		**0**	**0,6**	**0,6**		**0**	**1,5**	**1,5**		**0**		**0**	**2**	**2**
Bromus catharticus	**Increaser III, Invaders, Bare & Forbes**	**1**	**1,3**	**1,3**	**1,4**	**1,4**	**2,6**	**2,6**	**0,9**	**0,9**	**1,4**	**1,4**		**0**	**1,8**	**1,8**		**0**		**0**
Merximuellera dura				**0**		**0**		**0**	**0,1**	**0,1**	**0,1**	**0,1**		**0**	**0,2**	**0,2**		**0**		**0**
Leersia hexandra			**0,6**	**0,6**	**0,7**	**0,7**	**1**	**1**	**0,5**	**0,5**	**0,4**	**0,4**	**0,5**	**0,5**	**0,5**	**0,5**		**0**	**0,8**	**0,8**
Stiburus alopecuroides			**1,7**	**1,7**	**1,9**	**1,9**		**0**	**2,4**	**2,4**	**2,6**	**2,6**	**3,7**	**3,7**	**1,6**	**1,6**		**0**	**5**	**5**
Poa annua									**0,2**	**0,2**	**0,3**	**0,3**		**0**	**0,3**	**0,3**				
Nassella tussock			**2,3**	**2,3**	**1,8**	**1,8**	**0,4**	**0,4**	**1,5**	**1,5**	**0,9**	**0,9**	**2,3**	**2,3**	**0,1**	**0,1**	**4,3**	**4,3**	**1,6**	**1,6**
			24,2	**24,2**	**23,8**	**23,8**	**23,2**	**23,2**	**24,9**	**24,9**	**20**	**20**	**32**	**32**	**19,6**	**19,6**	**22,6**	**22,6**	**29,3**	**29,3**
TOTAL INDEX SCORE			100	**468,1**	**100**	**464,6**	**100**	**469**	**100**	**459,1**	**100**	**466,6**	**100,1**	**463,1**	**100**	**437,7**	**100,1**	**527**	**100,2**	**490,6**
PERCENTAGE SCORE (%)				47%		46%		47%		46%		47%		46%		44%		53%		49%

Appendix 11: Ecological grouping, Grazing value, Plant succession and Palatability of the study area.

No.	Grass Species	Ecological Index	Grazing Value		Plant Succession		Palatability	
			Glencoe	Reedsdell	Glencoe	Reedsdell	Glencoe	Reedsdell
1	*Seteria sphacelata var. sphacelata*	Decreaser	High	High	Climax	Climax	High	High
2	*Setaria incrassata*		High	High	Climax	Climax	Moderate	Moderate
3	*Fingerhuthia africana*		Average	Average	Subclimax & Climax	Subclimax & Climax	Moderate	Moderate
4	*Themeda triandra*		High	High	Climax	Climax	High	High
5	*Helictotrichon turgidulum*			Average		Subclimax & Climax		High
6	*Ehrharta calycina*		High	High	Subclimax & Climax	Subclimax & Climax	High	High
7	*Panicum natalense*		Low	Low	Climax	Climax	Poor	Poor
8	*Andropogon appendiculatus*		High	High	Climax	Climax	High	High
9	*Panicum ecklonii*		Average	Average	Climax	Climax	Moderate	Moderate
10	*Festuca scabra*		Average		Climax		Poor	
1	*Harpochloa falx*	Increaser I	Low	Low	Climax	Climax	Moderate	Moderate
2	*Trachypogon spicatus*		Low	Low	Climax	Climax	Poor	Poor
3	*Tristachya leucothrix*		Average	Average	Climax	Climax	Poor	Poor
4	*Cymbopogon caesius*		Low	Low	Climax	Climax	Poor	Poor
5	*Miscanthus capensis*		Low	Low	Climax	Climax	Poor	Poor
6	*Pennisetum sphacelatum*		Average	Average	Climax	Climax	Moderate	Moderate
7	*Miscanthus junceus*		Low	Low	Climax	Climax	Poor	Poor
8	*Pennisetum thumbergii*		Average		Climax		Moderate	
9	*Melinis nerviglumis*		Average		Climax		Moderate	
10	*Hyparrhenia hirta*		Average		Subclimax & Climax		Moderate	
1	*Microchloa caffra*	Increaser II	Low	Low	Pioneer	Pioneer	Moderate	Moderate
2	*Eragrostis racemosa*		Average	Average	Subclimax	Subclimax	Moderate	Moderate

3	*Loudetia simplex*		Average	Average	Climax	Climax	Poor	Poor
4	*Eragrostis chloromelas*		Average	Average	Subclimax & Climax	Subclimax & Climax	Moderate	Moderate
5	*Eragrostis plana*		Low	Low	Subclimax	Subclimax	Poor	Poor
6	*Eragrostis capensis*		Average	Average	Subclimax & Climax	Subclimax & Climax	Moderate	Moderate
7	*Eragrostis curvula*		Average	Average	Subclimax	Subclimax	Poor	Poor
8	*Koeleria capensis*		Low	Low	Climax	Climax	Poor	Poor
9	*Panicum schinzii*		High	High	Pioneer	Pioneer	High	High
10	*Heteropogon contortus*		Average	Average	Subclimax	Subclimax	High	High
11	*Cynodon dactylon*		High		Pioneer		High	
12	*Digitaria monodactyla*		Average		Subclimax		High	
13	*Eragrostis cilianensis*		Average		Pioneer		Poor	
15	*Digitaria sanguinalis*		Average		Pioneer		High	
1	*Elionurus muticus*		Low	Low	Climax	Climax	Poor	Poor
2	*Melica decumbens*		Low	Low	Climax	Climax	Moderate	Moderate
3	*Merxmuellera macowanii*			Unknown		Unknown		Unknown
4	*Cymbopogon pospischilii*		Low		Climax		Poor	
5	*Enneapogon scoparious*		Low		Climax		Poor	
6	*Lophachme digitata*		Unknown		Unknown		Unknown	
1	*Bromus catharticus*	**Invader**	High	High	Pioneer	Pioneer	High	High
2	*Merxmuellera dura*		Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
3	*Leersia hexandra*		High	High	Unknown	Unknown	High	High
4	*Poa annua*			Low		Pioneer		Poor
5	*Stiburus alopecuroides*			Low		Climax		Poor
6	*Nassella tussock*			Unknown		Unknown		Unknown
7	*Dactylis glomerata*		Unknown		Unknown		Unknown	
8	*Paspalum distichum*		High		Pioneer		High	

Appendix 12: Biodiversity Site Assessment scoring result for the Glencoe study site.

Site name: Glencoe		
Site should qualify as:	**Nature Reserve**	**high ECPAES priority**

Biodiversity Plans

Max score	2,0	Count	2
Average score	2,0		
Subtotal	4,0		

ECBCP CBA				**NFEPA**			
Score			2	Score			-	Score			2
Category	Yes / No	Scoring	Score	Category	Yes / No	Scoring	Score	Category	Yes / No	Scoring	Score
CBA 1		2,5		CBA		2,75		Priority wetland		2,75	
CBA 2	Yes	2	2	ESA		2		Priority catchment / river FEPA	Yes	2	2
CBA 3		0		ONA		0		Not identified		0	

Habitats

Max score	2,0	Count	1
Average score	2,0		
Subtotal	2,0		

Southern Drakensberg Highland Grassland											
Score			2,0	Score			-	Score			-
Ecosystem Threat Status	Yes / No	Scoring	Score	Ecosystem Threat Status	Yes / No	Scoring	Score	Ecosystem Threat Status	Yes / No	Scoring	Score
CE / EN		4		CE / EN		4		CE / EN		4	
VU		2		VU		2		VU		2	
LT	Yes	0	0	LT		0		LT		0	

Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected	Yes	4	4
Hardly - mod protected		2	
Well protected		0	
% Of target on site	Yes / No	Scoring	Score
>= 5%		4	
1-5%	Yes	2	2
<1%		0	
-			
Score			-
Ecosystem Threat Status	Yes / No	Scoring	Score
CE / EN		4	
VU		2	
LT		0	
Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected		4	
Hardly - mod protected		2	
Well protected		0	
% Of target on site	Yes / No	Scoring	Score
>= 5%		4	
1-5%		2	
<1%		0	
-			
Score			-
Ecosystem Threat Status	Yes / No	Scoring	Score
CE / EN		4	
VU		2	

Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected		4	
Hardly - mod protected		2	
Well protected		0	
% Of target on site	Yes / No	Scoring	Score
>= 5%		4	
1-5%		2	
<1%		0	
-			
Score			-
Ecosystem Threat Status	Yes / No	Scoring	Score
CE / EN		4	
VU		2	
LT		0	
Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected		4	
Hardly - mod protected		2	
Well protected		0	
% Of target on site	Yes / No	Scoring	Score
>= 5%		4	
1-5%		2	
<1%		0	
-			
Score			-
Ecosystem Threat Status	Yes / No	Scoring	Score
CE / EN		4	
VU		2	

Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected		4	
Hardly - mod protected		2	
Well protected		0	
% Of target on site	Yes / No	Scoring	Score
>= 5%		4	
1-5%		2	
<1%		0	
-			
Score			-
Ecosystem Threat Status	Yes / No	Scoring	Score
CE / EN		4	
VU		2	
LT		0	
Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected		4	
Hardly - mod protected		2	
Well protected		0	
% Of target on site	Yes / No	Scoring	Score
>= 5%		4	
1-5%		2	
<1%		0	
-			
Score			-
Ecosystem Threat Status	Yes / No	Scoring	Score
CE / EN		4	
VU		2	

LT		0		LT		0		LT		0	
Ecosystem Protection Level	Yes / No	Scoring	Score	Ecosystem Protection Level	Yes / No	Scoring	Score	Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected		4		Not protected		4		Not protected		4	
Hardly - mod protected		2		Hardly - mod protected		2		Hardly - mod protected		2	
Well protected		0		Well protected		0		Well protected		0	
% Of target on site	Yes / No	Scoring	Score	% Of target on site	Yes / No	Scoring	Score	% Of target on site	Yes / No	Scoring	Score
>= 5%		4		>= 5%		4		>= 5%		4	
1-5%		2		1-5%		2		1-5%		2	
<1%		0		<1%		0		<1%		0	
-				-				-			
Score			-	Score			-	Score			-
Ecosystem Threat Status	Yes / No	Scoring	Score	Ecosystem Threat Status	Yes / No	Scoring	Score	Ecosystem Threat Status	Yes / No	Scoring	Score
CE / EN		4		CE / EN		4		CE / EN		4	
VU		2		VU		2		VU		2	
LT		0		LT		0		LT		0	
Ecosystem Protection Level	Yes / No	Scoring	Score	Ecosystem Protection Level	Yes / No	Scoring	Score	Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected		4		Not protected		4		Not protected		4	
Hardly - mod protected		2		Hardly - mod protected		2		Hardly - mod protected		2	
Well protected		0		Well protected		0		Well protected		0	
% Of target on site	Yes / No	Scoring	Score	% Of target on site	Yes / No	Scoring	Score	% Of target on site	Yes / No	Scoring	Score
>= 5%		4		>= 5%		4		>= 5%		4	
1-5%		2		1-5%		2		1-5%		2	
<1%		0		<1%		0		<1%		0	
Species											
Max score	2,0			Count	9						
Average score	1,4										
Subtotal	12,5										

Blue Crane		Weight	Score
Score	2	0,25	0,5
Red List Status	Yes / No	Scoring	Score
CE / EN		4	
VU	Yes	2	2
LT		0	
Population size	Yes / No	Scoring	Weight
Significant populations		1	
Minor populations		0,5	
Unconfirmed presence	Yes	0,25	0,25

Bearded Vulture	RLS	Weight	Score
Score	4	0,5	2,0
Red List Status	Yes / No	Scoring	Score
CE / EN	Yes	4	4
VU		2	
LT		0	
Population size	Yes / No	Scoring	Weight
Significant populations		1	
Minor populations	Yes	0,5	0,5
Unconfirmed presence		0,25	

Mountain Reedbuck	RLS	Weight	Score
Score	4	0,5	2,0
Red List Status	Yes / No	Scoring	Score
CE / EN	Yes	4	4
VU		2	
LT		0	
Population size	Yes / No	Scoring	Weight
Significant populations		1	
Minor populations	Yes	0,5	0,5
Unconfirmed presence		0,25	

Verreaux's eagle	RLS	Weight	Score
Score	2	0,5	1,0
Red List Status	Yes / No	Scoring	Score
CE / EN		4	
VU	Yes	2	2
LT		0	
Population size	Yes / No	Scoring	Weight
Significant populations		1	
Minor populations	Yes	0,5	0,5
Unconfirmed presence		0,25	

Cape Vulture	RLS	Weight	Score
Score	2	1	2,0
Red List Status	Yes / No	Scoring	Score
CE / EN		4	
VU	Yes	2	2
LT		0	
Population size	Yes / No	Scoring	Weight
Significant populations	Yes	1	1
Minor populations		0,5	
Unconfirmed presence		0,25	

Denhams Bustard	RLS	Weight	Score
Score	2	0,5	1,0
Red List Status	Yes / No	Scoring	Score
CE / EN		4	
VU	Yes	2	2
LT		0	
Population size	Yes / No	Scoring	Weight
Significant populations		1	
Minor populations	Yes	0,5	0,5
Unconfirmed presence		0,25	

Secretary Bird	RLS	Weight	Score
Score	2	0,5	1,0
Red List Status	Yes / No	Scoring	Score
CE / EN		4	
VU	Yes	2	2

Grey Crowned Crane	RLS	Weight	Score
Score	2	1	2,0
Red List Status	Yes / No	Scoring	Score
CE / EN		4	
VU	Yes	2	2

Erica hillburttii	RLS	Weight	Score
Score	4	0,25	1,0
Red List Status	Yes / No	Scoring	Score
CE / EN	Yes	4	4
VU		2	

LT		0		LT		0		LT		0	
Population size	Yes / No	Scoring	Weight	Population size	Yes / No	Scoring	Weight	Population size	Yes / No	Scoring	Weight
Significant populations		1		Significant populations	Yes	1	1	Significant populations		1	
Minor populations	Yes	0,5	0,5	Minor populations		0,5		Minor populations		0,5	
Unconfirmed presence		0,25		Unconfirmed presence		0,25		Unconfirmed presence	Yes	0,25	0,25

Ecological processes

Max score	4,0	Count	4
Average score	1,8		
Subtotal	7,0		

Property size

Score 2,0

Size of property	Yes / No	Scoring	Score
> 50 000 ha		4	
10 000- 50 000 ha		3	
1 000 - 10 000 ha	Yes	2	2
< 1 000 ha		0	

Connectivity

Score 4,0

Connectivity	Yes / No	Scoring	Score
Critical PA link / bound. consol.	Yes	4	4
Landscape / notional corridor	Yes	2,5	2,5
PA buffer		1	
None of the above		0	

Habitat heterogeneity (According to SA Map

Score 0,0

Ecosystem Threat Status	Yes / No	Scoring	Score
6 or more habitat types		2,5	
3-5 habitat types		2	
2-3 habitat types		1	
1 habitat type	Yes	0	0

Resilience to climate change

Score 1,0

CC resilience score (*Holness et al.*, 2012)	Yes / No	Scoring	Score
8-10		3	
5-7		2	
3-4	Yes	1	1
0-2		0	

Ecosystem Goods and Services

Max score	3,0	Count	3
Average score	2,3		

Subtotal	7,0											
Provisioning services				**Regulating services**				**Cultural services**				
Score			3	Score			2,0	Score			2,0	
Significance	Yes / No	Scoring	Score	Significance	Yes / No	Scoring	Score	Significance	Yes / No	Scoring	Score	
Country-wide / provincial	Yes	3	3	Country-wide / provincial		3		Country-wide / provincial		3		
Landscape		2		Landscape	Yes	2	2	Landscape	Yes	2	2	
Local		1		Local		1		Local		1		
None		0		None		0		None		0		

ECPAES		
Category	Yes / No	ECPAES
Priority area	Yes	high ECPAES priority
High value area		mod ECPAES priority
Not in ECPAES		low ECPAES priority

Appendix 13: Biodiversity Site Assessment scoring result for the Reedsdell study site.

Site name: Reedsdell		
Site should qualify as:	**Nature Reserve**	**high ECPAES priority**

Biodiversity Plans											
Max score	2,0			Count	2						
Average score	2,0										
Subtotal	4,0										
ECBCP CBA								**NFEPA**			
Score			2	Score			-	Score			2
Category	Yes / No	Scoring	Score	Category	Yes / No	Scoring	Score	Category	Yes / No	Scoring	Score
CBA 1	No	2,5		CBA		2,75		Priority wetland		2,75	
CBA 2	Yes	2	2	ESA		2		Priority catchment / river FEPA	Yes	2	2
CBA 3		0		ONA		0		Not identified		0	
Habitats											
Max score	1,3			Count	2						
Average score	1,3										
Subtotal	2,7										
Lesotho Highland Basalt Grassland				**Southern Drakensberg Highland Grassland**							
Score			1,3	Score			1,3	Score			-
Ecosystem Threat Status	Yes / No	Scoring	Score	Ecosystem Threat Status	Yes / No	Scoring	Score	Ecosystem Threat Status	Yes / No	Scoring	Score
CE / EN		4		CE / EN		4		CE / EN		4	
VU		2		VU		2		VU		2	
LT	Yes	0	0	LT	Yes	0	0	LT		0	

Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected	Yes	4	4
Hardly - mod protected		2	
Well protected		0	
% Of target on site	Yes / No	Scoring	Score
>= 5%		4	
1-5%		2	
<1%	Yes	0	0
-			
Score			-

Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected	Yes	4	4
Hardly - mod protected		2	
Well protected		0	
% Of target on site	Yes / No	Scoring	Score
>= 5%		4	
1-5%		2	
<1%	Yes	0	0
-			
Score			-

Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected		4	
Hardly - mod protected		2	
Well protected		0	
% Of target on site	Yes / No	Scoring	Score
>= 5%		4	
1-5%		2	
<1%		0	
-			
Score			-

Ecosystem Threat Status	Yes / No	Scoring	Score
CE / EN		4	
VU		2	
LT		0	
Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected		4	
Hardly - mod protected		2	
Well protected		0	
% Of target on site	Yes / No	Scoring	Score
>= 5%		4	
1-5%		2	
<1%		0	
-			
Score			-

Ecosystem Threat Status	Yes / No	Scoring	Score
CE / EN		4	
VU		2	
LT		0	
Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected		4	
Hardly - mod protected		2	
Well protected		0	
% Of target on site	Yes / No	Scoring	Score
>= 5%		4	
1-5%		2	
<1%		0	
-			
Score			-

Ecosystem Threat Status	Yes / No	Scoring	Score
CE / EN		4	
VU		2	
LT		0	
Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected		4	
Hardly - mod protected		2	
Well protected		0	
% Of target on site	Yes / No	Scoring	Score
>= 5%		4	
1-5%		2	
<1%		0	
-			
Score			-

Ecosystem Threat Status	Yes / No	Scoring	Score	Ecosystem Threat Status	Yes / No	Scoring	Score	Ecosystem Threat Status	Yes / No	Scoring	Score
CE / EN		4		CE / EN		4		CE / EN		4	
VU		2		VU		2		VU		2	
LT		0		LT		0		LT		0	
Ecosystem Protection Level	Yes / No	Scoring	Score	Ecosystem Protection Level	Yes / No	Scoring	Score	Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected		4		Not protected		4		Not protected		4	
Hardly - mod protected		2		Hardly - mod protected		2		Hardly - mod protected		2	
Well protected		0		Well protected		0		Well protected		0	
% Of target on site	Yes / No	Scoring	Score	% Of target on site	Yes / No	Scoring	Score	% Of target on site	Yes / No	Scoring	Score
>= 5%		4		>= 5%		4		>= 5%		4	
1-5%		2		1-5%		2		1-5%		2	
<1%		0		<1%		0		<1%		0	
-				-				-			
Score			-	Score			-	Score			-
Ecosystem Threat Status	Yes / No	Scoring	Score	Ecosystem Threat Status	Yes / No	Scoring	Score	Ecosystem Threat Status	Yes / No	Scoring	Score
CE / EN		4		CE / EN		4		CE / EN		4	
VU		2		VU		2		VU		2	
LT		0		LT		0		LT		0	
Ecosystem Protection Level	Yes / No	Scoring	Score	Ecosystem Protection Level	Yes / No	Scoring	Score	Ecosystem Protection Level	Yes / No	Scoring	Score
Not protected		4		Not protected		4		Not protected		4	
Hardly - mod protected		2		Hardly - mod protected		2		Hardly - mod protected		2	
Well protected		0		Well protected		0		Well protected		0	
% Of target on site	Yes / No	Scoring	Score	% Of target on site	Yes / No	Scoring	Score	% Of target on site	Yes / No	Scoring	Score
>= 5%		4		>= 5%		4		>= 5%		4	

1-5%		2		1-5%		2		1-5%		2	
<1%		0		<1%		0		<1%		0	
Species											
Max score	4,0			Count	9						
Average score	1,6										
Subtotal	14,0										
Blue Crane		Weight	Score	**Bearded Vulture**	RLS	Weight	Score	**Mountain Reedbuck**	RLS	Weight	Score
Score	2	0,25	0,5	Score	4	1	4,0	Score	4	0,5	2,0
Red List Status	Yes / No	Scoring	Score	Red List Status	Yes / No	Scoring	Score	Red List Status	Yes / No	Scoring	Score
CE / EN		4		CE / EN	Yes	4	4	CE / EN	Yes	4	4
VU	Yes	2	2	VU		2		VU		2	
LT		0		LT		0		LT		0	
Population size	Yes / No	Scoring	Weight	Population size	Yes / No	Scoring	Weight	Population size	Yes / No	Scoring	Weight
Significant populations		1		Significant populations	Yes	1	1	Significant populations		1	
Minor populations		0,5		Minor populations		0,5		Minor populations	Yes	0,5	0,5
Unconfirmed presence	Yes	0,25	0,25	Unconfirmed presence		0,25		Unconfirmed presence		0,25	
Verreaux's eagle	RLS	Weight	Score	**Cape Vulture**	RLS	Weight	Score	**Denhams Bustard**	RLS	Weight	Score
Score	2	0,5	1,0	Score	2	1	2,0	Score	2	0,25	0,5
Red List Status	Yes / No	Scoring	Score	Red List Status	Yes / No	Scoring	Score	Red List Status	Yes / No	Scoring	Score
CE / EN		4		CE / EN		4		CE / EN		4	
VU	Yes	2	2	VU	Yes	2	2	VU	Yes	2	2
LT		0		LT		0		LT		0	
Population size	Yes / No	Scoring	Weight	Population size	Yes / No	Scoring	Weight	Population size	Yes / No	Scoring	Weight
Significant populations		1		Significant populations	Yes	1	1	Significant populations		1	

Minor populations	Yes	0,5	0,5	Minor populations		0,5		Minor populations		0,5	
Unconfirmed presence		0,25		Unconfirmed presence		0,25		Unconfirmed presence	Yes	0,25	0,25
Secretary Bird	RLS	Weight	Score	**Grey Crowned Crane**	RLS	Weight	Score	***Erica hillburttii***	RLS	Weight	Score
Score	2	0,5	1,0	Score	2	1	2,0	Score	4	0,25	1,0
Red List Status	Yes / No	Scoring	Score	Red List Status	Yes / No	Scoring	Score	Red List Status	Yes / No	Scoring	Score
CE / EN		4		CE / EN		4		CE / EN	Yes	4	4
VU	Yes	2	2	VU	Yes	2	2	VU		2	
LT		0		LT		0		LT		0	
Population size	Yes / No	Scoring	Weight	Population size	Yes / No	Scoring	Weight	Population size	Yes / No	Scoring	Weight
Significant populations		1		Significant populations	Yes	1	1	Significant populations		1	
Minor populations	Yes	0,5	0,5	Minor populations		0,5		Minor populations		0,5	
Unconfirmed presence		0,25		Unconfirmed presence		0,25		Unconfirmed presence	Yes	0,25	0,25
Ecological processes											
Max score	4,0			Count	3						
Average score	2,7										
Subtotal	8,0										
Property size				**Connectivity**				**Habitat heterogeneity (According to SA Map)**			
Score			2,0	Score			4,0	Score			-
Size of property	Yes / No	Scoring	Score	Connectivity	Yes / No	Scoring	Score	Ecosystem Threat Status	Yes / No	Scoring	Score
> 50 000 ha		4		Critical PA link / bound. consol.	Yes	4	4	6 or more habitat types		2,5	
10 000- 50 000 ha		3		Landscape / notional corridor	Yes	2,5	2,5	3-5 habitat types		2	
1 000 - 10 000 ha	Yes	2	2	PA buffer		1		2-3 habitat types	Yes	1	
< 1 000 ha		0		None of the above		0		1 habitat type		0	

Resilience to climate change			
Score			2,0
CC resilience score (Holness *et al.*, 2012)	Yes / No	Scoring	Score
8-10	Yes	3	2
5-7		2	
3-4		1	
0-2		0	

Ecosystem Goods and Services			
Max score	3,0	Count	3
Average score	2,3		
Subtotal	7,0		

Provisioning services				**Regulating services**				**Cultural services**			
Score			3	Score			2,0	Score			2,0
Significance	Yes / No	Scoring	Score	Significance	Yes / No	Scoring	Score	Significance	Yes / No	Scoring	Score
Country-wide / provincial	Yes	3	3	Country-wide / provincial	Yes	3	2	Country-wide / provincial	Yes	3	2
Landscape		2		Landscape		2		Landscape		2	
Local		1		Local		1		Local		1	
None		0		None		0		None		0	

ECPAES

Category	Yes / No	ECPAES
Priority area	Yes	high ECPAES priority
High value area		mod ECPAES priority
Not in ECPAES		low ECPAES priority

Appendix 14: Research ethical clearance

UNISA

UNISA-CAES HEALTH RESEARCH ETHICS COMMITTEE

Date: 27/01/2020

Dear Mr Nsibande

Decision: Ethics Approval from 23/01/2020 to completion

NHREC Registration # : REC-170616-051
REC Reference # : 2019/CAES_HREC/200
Name : Mr TS Nsibande
Student #: 44982631

Researcher(s): Mr TS Nsibande
44982631@mylife.unisa.ac.za

Supervisor (s): Ms SE Nkosi
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Dr L Nemadodzi
nemadle@unisa.ac.za; 071-549-4542

Working title of research:

Description of vegetation types secured through biodiversity stewardship programme within the North Eastern Cape grasslands priority site, South Africa

Qualification: MSc Environmental Management

Thank you for the application for research ethics clearance by the Unisa-CAES Health Research Ethics Committee for the above mentioned research. Ethics approval is granted until the completion of the project, **subject to submission of yearly progress reports and further clarification. Failure to submit the progress report will lead to withdrawal of the ethics clearance until the report has been submitted.**

Due date for progress report: 31 January 2021

Please note the points below for further action:

1. The researcher indicates that random stratified sampling will be done. However, the correct term is stratified random sampling – the researcher should correct this.

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Appendix 15: Proof of manuscript submission to a journal

Applied Vegetation Science

Plant communities and veld condition of Glencoe farm in the North-Eastern Cape Grasslands Priority areas, South Africa

Journal:	*Applied Vegetation Science*
Manuscript ID	AVS-RES-03115
Wiley - Manuscript type:	Research Article
Date Submitted by the Author:	19-Jun-2022
Complete List of Authors:	Nsibande, T.S.; University of South Africa - Science Campus Nkosi, S.E.; University of South Africa - Science Campus
Keywords:	Braun-Blanquet method, vegetation classification, Grassland Biome, Strategic Water Source Area, Biodiversity Stewardship, Ecological Index Method

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