An archaeological perspective on the nineteenth century development of land, landscape and sheep farming in the Karoo

Troy Nathaniel Smuts
(SMTTRO002)

Thesis submitted for the Degree of Master of Science in the Department of Archaeology, Science Faculty, University of Cape Town.

Declaration

I, Troy Nathaniel Smuts declare that this thesis being submitted in fulfilment of the Degree of Master of Science in the Faculty of Science at the University of Cape Town is my own work. It has not been submitted either as a whole or in part for another degree at this or any other university.

Signature of candidate

Signed at …….. on this ……. day of August 2012

Acknowledgments

My most sincere thanks to my supervisor, Dr. Simon Hall for his help and guidance on this project. His comments and encouragement aided me in developing and expanding the ideas only touched upon herein. I would also like to thank Pat Kramer for her field observations and raw data, which contributed to the development of this thesis. A special thanks to Antonia Malan whose advice assisted in the progression of some of the chapters.

Many thanks to the supportive role played by my fellow post-grad students in the Department of Archaeology. The guidance provided by Steven Walker and Nicholas Lindenberg in the GIS aspects of my thesis was immensely useful.

A great debt is owed to the invaluable help and support of my family and friends, in particular my girlfriend and mother, for their unending encouragement and assistance throughout this project.

Contents

Abbreviations

AGIS – Agricultural Geo-Referenced Information System

AD – Anno Domini

AU – Animal Unit

BP – years Before the Present

cm – centimeter

°C – degrees Celsius

etc. – etcetera

GIS – Geographical Information System

GPS – Global Positioning Satellite

ha – hectare

ha/AU – hectares per Animal Unit

HLC – Historic Landscape Characterisation

hr – hour

i.e. – *id est* (in other words)

kg – kilogram

km - kilometres

m – meters

m^2 – square meters

ml - milliliter

mm – millimetres

MS – Microsoft

NC – Northern Cape

NP – No Projections

p – page

pp – pages

PR – Pitched Roof

RB – Round Base

RR – Round Roof

SB – Square Base

WC – Western Cape

VOC – Dutch East India Company

List of figures

List of tables

Abstract

The nineteenth century was one of considerable change within the Cape Colony. There was the change from Dutch VOC control to a British government early in the nineteenth century which exposed small scale Trekboer sheep farmers of the Karoo to a wider mercantile capitalism, especially with the adoption of Merino sheep for the global export market. This thesis charts the early nineteenth century history of colonial Trekboer society into the Karoo with a specific focus on the region to the north of the Roggeveld Mountains and west of the Nieuweveld Mountains. Of particular importance in this history is the change in land rights whereby title deeds and ownership were introduced by the British early in the nineteenth century. The distribution and chronology of title deeds are explored in this area of the Karoo using GIS to map and determine the chronological spread of deeded farms and possible links with environmental and ecological variability. While some correlations can be made under the assumption that better areas were claimed earlier in the nineteenth century other factors were also important. In particular the spread of Merino sheep, for wool production, from the Eastern Cape accounts for some of the geographic emphasis in title deed chronology, while technological innovations may underpin others. Furthermore, the thesis also examines the relationship between the title deeds and the distribution of corbelled buildings, a unique nineteenth century vernacular architecture associated with the Trekboer farmer. This is done to test whether these structures can be given a more secure chronology based on the date of the title deed of the farm upon which they were built. The outcome of this analysis concludes that there is no necessary correlation between title deed date and the date of the corbelled structures. An explanation for this could be that the vernacular architecture was a response by those who could not afford to purchase land and who consequently became itinerant squatters and relatively impoverished small scale stock farmers on land owned by others.

Chapter 1: A general introduction

The nineteenth century history of the Karoo is about a landscape undergoing both a physical, cultural and conceptual transformation. The reason for this was the growing presence of European settlers in the Karoo and the fundamentally negative impact this had on the indigenous Khoekhoe and San communities who lived there. Their social and material dwelling on this land, in terms of the seasonal availability of resources and their access to them was increasingly altered with the growing presence and dominance of European settlers. Although the settler exploitation of the land was based on continuities in sheep management, learnt from indigenous Khoekhoe pastoralists, it did eventually signal a shift in the approach to land usage as well as in the concept of landscape. This was essential in making a living in the Karoo, and focused on a change in the management and approach to small stock sheep farming through the course of the nineteenth century, the primary economic focus of the Karoo. The introduction of new technologies also contributed to the transformation of the nineteenth century Karoo landscape. The discovery of valuable minerals, namely diamonds and gold, further changed the Karoo from a place on the edge of the frontier of the Cape Colony.

It is within this historical context that this thesis will contribute by introducing and addressing some aspects of the colonial archaeology of the nineteenth century Karoo landscape. This shall be accomplished by investigating material and archaeologically measureable change on the landscape of the Karoo around the towns of Faserburg, Carnarvon and Williston. Specifically, this enquiry focuses on understanding the relationships between the biophysical attributes of the Karoo landscape and the colonial structure and management of nineteenth century small stock farming. To do this I focus on two attributes, which are the mapping of the legal status of land and the distribution of one type of nineteenth century colonial vernacular architecture, the corbelled building.

One of the prime issues of the nineteenth century Karoo landscape was the pressure to alter the relationship between farmers and their land, from animal management for meat production and subsistence towards commercial farming practices based upon wool production. As outlined by Beinart (2008) this had a significant impact on the ecology of the Karoo, which as an arid and marginal zone, was subject to demands that exceeded its natural carrying capacity. The first pressure was exerted with the shift from indigenous to European occupation of this land. With the arrival of Europeans in 1652 at the Cape of Good Hope and their inevitable drift into the interior, conflict occurred between them and indigenous pastoralists and San hunter-gatherers. European expansion and Khoekhoen resistance and an obvious desire to keep the land and their way of life, resulted in a change in the way the land was used and viewed by both the indigenous and European peoples. The Khoekhoe/San presence in the Karoo was no longer open and uncontested, but rather, it increasingly became a place of retreat, refuge and escape, and as European settlers pushed the frontier northwards and north-eastwards across the Karoo it became a place of open and bitter conflict and forceful appropriation (Wilmont, 1869; Penn, 1986; van der Merwe & Beck, 1995; Penn, 2005)

Over the course of the eighteenth and nineteenth centuries, European occupation of the Karoo resulted in a major change as they prevailed over Khoekhoe and San groups and forced, with the introduction by the British of Merino sheep, a shift in the economy from migrant subsistence meat farming to large scale wool production, that was geared to towards a global export economy. Thus new farming practices that emphasised commercial farming for profit and a more intensive use of the land changed the Karoo landscape. By the mid to late eighteenth century Trekboers[1] of Dutch and German descent had moved into the Karoo and this was followed by another demographic shift when the Great Trek took place in the 1830's. This

[1] - Trekboers were migrant livestock farmers of Dutch, German or French descent.

movement was in part forced by political pressures and a threat to cultural independence (van der Merwe & Beck, 1995).

While this history has been addressed (van der Merwe & Beck, 1995; Penn, 2005; Ross, 2008; Legassick, 2010) these eighteenth and nineteenth centuries developments have received little archaeological attention. There has, however, recently been a renewed interest in the historical archaeology of the Fraserburg, Carnarvon and Loxton areas by archaeologists (Moffett, 2011; Zachariou, 2011; Kramer, 2012). These have focused on preliminary examinations of vernacular architecture and entangled indigenous and European identities, baseline studies on the import and use of European ceramics and an examination of identity and change on the edge of the Cape Colony, as seen through the experiences of immigrant Nguni-speaking farmers from the Eastern Cape in the early nineteenth century. This thesis runs parallel with this work and contributes to a general description of this part of the Karoo in an effort to provide a baseline for understanding the material development and change to the land and the landscape through the nineteenth century. As noted, I seek to do this by comparing the chronology and geography of Karoo farm title deeds in relation to the biological and physical texture of the region as well as the chronology and development of one form of basic Trekboer dwelling; the menial and simply constructed corbelled buildings (Kramer, 2012). I examine their location and suggested chronological sequence in relation to the chronology of farm title deeds, concentrating on what these buildings reveal about changing notions of transhumance, appropriate dwelling and the increasing legal compartmentalisation of the Karoo.

Due to the large size of the Karoo only a small sample area of the central Karoo will be examined in detail. This is an area approximately 360km x 240km in size, bounded by the towns of Brandvlei in the north-west, Carnarvon in the east and Sutherland in the south (Figure 1.1). This area includes the high lying escarpment areas of the Roggeveld and Nieuweveld Mountains and interior plateau to the north and west. This specific part of the Karoo will henceforth be referred to as the "Karoo region" or "region of the Karoo". The reason for this geographic focus has been driven by the location of the corbelled buildings within it (Kramer, 2012) and furthermore, very little historical archaeology has been done in this northern border region of the Cape Colony and this investigation will add to the fledgling body of work.

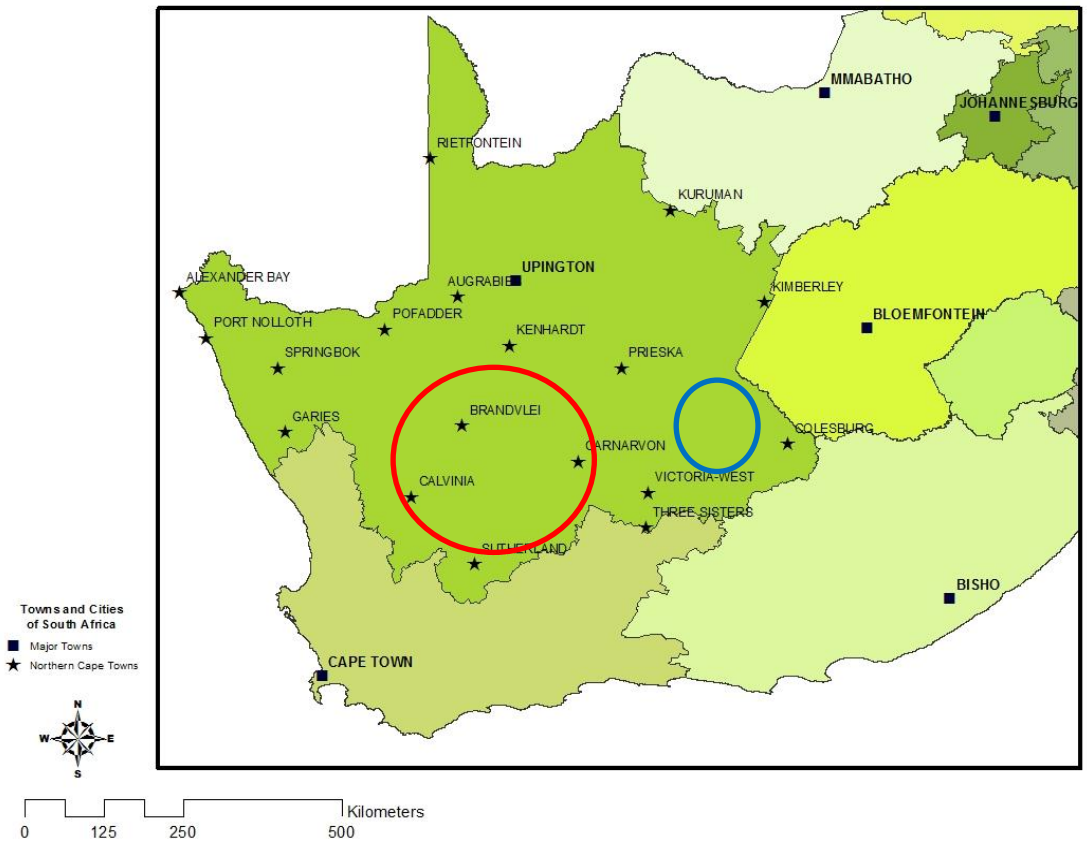

Figure 1.1 South African towns of the Northern Cape. The area circled in red is the area under investigation. The Seacow River Valley is circled in blue.

The archaeology of the Karoo that has been researched and published is primarily concerned with the Stone Age (Sampson, 2010), particularly the Later Stone Age of the Seacow River Valley (Figure 1.1), and the occupation of this region by indigenous groups such as Khoekhoen pastoralists. This work is varied in scope and a brief summary on the recent Stone Age archaeology is obviously important in view of the European presence that is layered upon this indigenous history. Numerous publications deal with the dating and description of pottery of these indigenous groups (Ridings & Sampson, 1990; Bollong *et al*., 1993; Bollong *et al*., 1997; Sadr & Sampson, 1999; Sampson, 2010). These reports outline the chronological development of pastoralists and hunter-gatherers and describe the differences between Khoekhoen and San pottery (Bollong *et al*., 1997). Ceramics with stamped impressions and Smithfield lithic assemblages provide important indicators as to the distribution of specific groups of Bushman as opposed to Khoekhoen sites. The coarse undecorated ceramic with the prominent use of fibre was indicative of early Bushman pottery which changed in AD 1200 when decoration of these ceramics began to appear (Bollong *et al*., 1997). This contrasts with the Khoekhoen pottery which is thinner and lacks the prominent use of fibre. Over time the Khoekhoen pottery became more prominent with the finer decorated ceramics being found in sites previously dominated by Bushman ceramics (Bollong *et al*., 1997). These ceramic stylistic groups identify where Khoekhoen chose to live in this area and the critical relationship between water and their camps (Sampson, 1984; Ridings & Sampson, 1990; Sampson, 1996). The development of Khoekhoen pottery from AD 400 shows four distinct phases, identified by different styles (Sadr & Sampson, 1999). These styles identify different areas of Khoekhoen occupation and the ebb and flow through time of frontiers between pastoralists and hunter-gatherers. Dating the ceramics has been achieved through luminescence and radiocarbon dating using the presence of different tempers (such as bone or grass). However, these tempers and their ability to absorb other components such as blood pose a problem in the dating of the pottery due to the varied composition of ^{14}C, which is used to date these artefacts (Bollong *et al*., 1993; Sampson & Vogel, 1996). An understanding of the composition of these Later Stone Age ceramics indicates that Khoekhoen herders were firmly established in the Seacow River Valley at AD 1780

when the pressure of Trekboers began to be felt (Bollong *et al*., 1997; Sampson, 2010).

Other cultural expressions such as rock art engravings have also been investigated (Beaumont & Vogel, 1989) and some of the geometric engravings have been associated with a Khoekhoen authorship (Smith *et al.*, 2004). Using radiocarbon dating associated with scraped engraving rock art, an age of 2500 BP is assigned to the establishment of this form of material culture in the Karoo (Morris, 1988; Beaumont & Vogel, 1989; Smith *et al.*, 2004). This archaeology, particularly of recent hunter/gatherer San and the herding Khoekhoen people provides insight into basic economic and ecological issues that underpin the antagonism that arose when Trekboers penetrated the region. Water, grazing and wild game were key attributes and the ability to move in a relatively unimpeded way in response to their fluctuation was critically important. Competition for and power over these resources underpinned the growing antagonism from the later eighteenth century.

Notwithstanding this focus on the Stone Age archaeology, there is research dealing with the eighteenth and nineteenth century and the changes that occurred with the migration of Europeans to the Karoo. This movement and the resulting antagonism and its intensification has been addressed by historians, such as Nigel Penn (1986) and more recently, Adhikari (2011) who reviewed the genocide to which San people were brutally subjected as their available resources and ranges contracted in the face of an increasingly competitive and aggressive Trekboer pastoralism. The eighteenth and nineteenth centuries in the Seacow River Valley, north of Graaff Reinet has also received some attention by archaeologists (Sampson *et al*., 1994; Sampson, 2010). This work addresses the archaeology of interactions between Trekboers and indigenous peoples, including the acquisition of fire arms by the San for hunting and to defend themselves (Westbury & Sampson, 1993). This development had a negative impact on the fauna of the Karoo and there was a resultant significant reduction in the amount of wild game (Plug & Sampson, 1996). Other studies address the arrival of the Trekboers and how they altered the land with the establishment of wagon trails (Neville *et al*., 1994) and farms and their

boundaries (Sampson *et al*., 1994). The manner in which the first Dutch settlers of the Seacow River Valley organised themselves and their farms is of particular interest. Sampson *et al.* (1994) showed that the first Trekboers to the Seacow River Valley in 1808 adapted their settlements to the loan farm system introduced by the British. This system of land allocation placed limits on where farmers could settle in relation to one another, but Sampson *et al.* (1994) discovered that the expected pattern of equally placed farmsteads did not emerge. Rather there was a clustering of farms in close proximity to one another. This grouping was probably driven by the Seacow River Valley Trekboers need for protection from Bushman raids as well as access to arable land which was only found along the river banks. Thus frontier farmers adapted the way they organised their farms to suit social and environmental factors and the hostilities of the Khoekhoe and San.

From an archaeological perspective very little research has been undertaken in the area west of the Seacow River Valley and Sneeuberg Mountains. The historian, Nigel Penn and his aptly titled book *The Forgotten Frontier: colonist and Khoisan on the Cape's northern frontier in the eighteenth century,* illustrates the lack of historical study of this western part of the Karoo and the Northern Cape (Penn, 1986; Penn, 2005). The focus of *The Forgotten Frontier* was built upon the important Ph.D work of Martin Legassick (1969), subsequently published as a book in 2010 (Legassick, 2010) on the late eighteenth and early nineteenth century northern Cape frontier as a shifting boundary line of fluid interaction in which social and racial identities were blurred and where new identities developed. Penn elaborates the discussion of the relationships and interactions between the indigenous Khoekhoen and San with the Europeans. The thesis by van der Merwe (1990) on the San rock art and rock engraving of the wider area addresses the incorporation of colonial material culture into their art as they sought to gain power over, manipulate and control the artefacts of dispossession.

Other material that is directly relevant to this thesis addresses the unique corbelled buildings of the Karoo, (Walton, 1951; Walton, 1960; Kramer, 2007; Maguire, 2008, Kramer, 2012). The earlier work is largely descriptive, but the subsequent thesis by Kramer (2012) has also addressed the origins of these corbelled buildings.

Importantly, this discussion of nineteenth century origins addresses the deep interaction between Khoekhoe, Xhosa and Trekboer in which indigenous architectural forms and dwellings were adopted and progressively adapted by Trekboers through the nineteenth century. It is this Trekboer use of an indigenous vernacular dwelling form that, as noted above, is a theme in this current work with a focus on the continuities and changes of land use by Trekboers through the nineteenth century.

The relative historical and archaeological neglect of the Karoo can perhaps be attributed in part to the marginal and arid nature of this environment where, because of these conditions, nothing much seemed to happen, compared for example, with the eighteenth and nineteenth century history of the Eastern Cape frontier. The early Europeans who travelled through this vast and dry region described the Karoo's harsh aridity and elaborated on its unforgiving nature (Burchell, 1824; Lichtenstein, 1928, Sparrman, 1977). The prevailing view was of a region unfit for permanent settlement that should be traversed quickly to reach the more favourable environments to the north and east. From the historical viewpoint, the Karoo was considered a homogenous and unfavourable environment. However, there is variability across the Karoo and despite these travellers' perceptions and the biophysical nature of the Karoo biome, many Khoekhoen and Trekboers lived and farmed there. The Karoo clearly had been occupied by indigenous San/Bushmen who were adapted to this difficult environment, and furthermore the archaeological evidence shows that the first pastoralists were present there from AD 400 (Sadr & Sampson, 1999). Khoekhoen were well adapted to the Karoo environment and followed the rains in order to find grazing for their sheep. The Trekboers, who began to arrive in this region in the late eighteenth century, also adjusted to this marginal region and adopted aspects of the Khoekhoen way of life that included seasonal strategies around the management of small livestock.

Despite the harshness of the environment, the Karoo became a productive region for livestock farming. The environment is unsuitable for extensive agriculture due to the low rainfall and the poor quality of the sandy soil. These two factors affect the

vegetation, with shrubs and drought resistant grasses predominating (Mucina & Rutherford, 2006). Thus only animals adapted to these conditions, such as sheep, could be successfully farmed. Success in this environment required having access to water, and knowing where to be seasonally in order to optimise rainfall and grazing. The nineteenth century was a pivotal period in the history of the Karoo and the livestock changed from indigenous sheep breeds to introduced breeds and wool production was added to the farming focus. These changes went hand-in-hand with technological and legislative developments that significantly altered the Karoo and the frontier of the Cape Colony. The change of government from the Dutch East India Company to British colonial rule first in 1795 and again from 1806 heralded many of these developments. The changes in land legislation, introduced by the British government, from the loan farm system to the quitrent system of payment as well as other policies pertaining to the frontier, influenced the way Trekboers farmed in the Karoo. As mentioned, the introduction of a new breed of sheep, the Merino, also impacted on those living in the arid interior.

Against this background the aim of this thesis is to add to the history of the Karoo by investigating material aspects that reflect the nature of change during the pivotal period of the nineteenth century. In particular, did the change in the designation and establishment of fixed farm boundaries and additionally the introduction of Merino sheep in 1789 result in an immediate and extensive change to the deeply engrained transhumant approach to Karoo livestock management? How were Merino sheep managed on the land, and how did this change as the nineteenth century progressed? Additionally, what were the factors influencing the establishment of farms in the Karoo, given the environmental and indigenous resistance to Trekboer expansion and how were the borders of farms defined? To address these questions I will look at the chronology and distribution of farms in the central Karoo based on title deed date. In addition, I also examine the legal segmentation of the land against the distribution and chronology of unique vernacular dwellings that, it has been suggested (Kramer, 2012), express an architectural form deeply rooted in transhumant pastoralism.

In Chapter 2 I elaborate on the history of the movement of European Trekboers into the Karoo that includes interaction with and the dispossession of indigenous groups living in the interior. I address the reasons for European settlement in which issues of land use, possession and Trekboer legal rights to land were critical and which intensified through increased competition with indigenous pastoralists. This focuses on how the Dutch East India Company regulated land access and ownership. The chapter goes on to discuss how land legislation began to change when the British took control of the Cape Colony in 1795. This is important background for the discussion of the development of deeded farms in the Karoo. I conclude the chapter with a brief outline of my methodology.

The overall focus in Chapter 3 is on the shift to the system of farm ownership through title deeds and a comparison of the legal segmentation of land with older historical processes of extensive transhumant livestock management. I describe the chronology and distribution of farm title deeds in my research area and compare discerned patterns and trends with the biophysical variability of the area and the requirements of livestock farming and the tolerances of sheep. I do this in order to investigate why certain areas may have been chosen before others. As a prominent industry in parts of the Karoo, I briefly discuss the history of wool production and additionally, the chronology and impact of new technologies, such as fencing and wind pumps. I also introduce the possible influence on the structure and chronology of land ownership by considering other factors such as the discovery of diamonds and gold to the north of the Karoo.

Chapter 4 continues the investigation into the nature of the nineteenth century landscape by introducing the distribution and the proposed chronology of corbelled buildings. This is done as a means to further explore relationships, and possible contradictions, between vernacular structures, that culturally embed those deeper time Trekboer environmental and historical interactions that gave rise to an extensive and transhumant approach to the land, against the changing legal status of land at the start of the nineteenth century. I also consider the distribution of these corbelled structures against some of the biophysical attributes introduced in

Chapter 3. How do these structures express cultural values about landscape through the nineteenth century as land becomes legally segmented?

Chapter 5 discusses the results of the previous two chapters and puts them into the historical context described in Chapter 2. Chapter 6, evaluates the results of this work, summarises the conclusions reached, and raises some prospects for future investigations of this region.

Chapter 2: Historical background to the Karoo

The focus of this thesis is about how European Trekboers[2] in the Karoo dealt with and instituted changes that came about in the nineteenth century. This chapter reviews the history of the Cape Colony and the factors that led to the expansion of these Trekboers into this difficult region. Additionally, I address interactions with and the response of indigenous people who were already on this landscape. Although the prime focus in the rest of this thesis is on the nineteenth century and the significant changes made at the beginning of British rule, the earlier history is important for highlighting how different and far reaching the changes instituted by the British were for European Trekboers.

2.1. Early farming in the Cape Colony and expansion into the Karoo

The station at the Cape was established in 1652 by the Dutch East India Company (VOC) in order to supply their ships with critical provisions for their outward bound voyages to the east and the homeward voyages back to The Netherlands. It was initially founded to grow affordable grain and other perishables and provide fresh water. However, the potential of the immediate Cape hinterland to manage this was limited and expansion consequently ensued. The expansion of the re-provisioning station occurred through the expanding but steadily declining trade for meat with

[2] In this chapter the appropriate names are given to the groups mentioned. In cases of ambiguity a collective name such as Khoesan, for the indigenous groups, or colonists, for the European settlers, are used.

indigenous Khoekhoen pastoralists and the movement inland of Europeans who were permitted to farm by the VOC.

Initially the first European farmers in the Colony were those employed by the VOC. They provided agricultural products, most importantly wheat and vegetables for the Company's ships (Ross, 2010). To meet increasing demands the VOC soon established a new class of people, the "free burgher" or free citizen. These citizens were granted rights to farm land and were able to make a living without being employed by the VOC. No longer constrained by the VOC, the free burghers could move and farm wherever free land was available. A small number of free burghers who occupied the more fertile lands around the Cape became wealthy and prosperous and quickly obtained adjacent fertile land. This resulted in poorer free burghers of the late seventeenth and early eighteenth centuries, who without the financial means to secure the high-valued fertile farms around the Cape, to venture further afield in search of land. These farmers later became known as Trekboers (migrant farmers) due to the fact that they traversed the Colony searching for suitable farming and grazing land.

The Cape Colony was unique in the rise of colonialism, because it was the only European colony in the southern hemisphere that had a segment of the indigenous population, the Khoekhoen, who were completely reliant on livestock. The first Europeans at the Cape, however, did not distinguish between the livestock farming Khoekhoe and the San hunter/gatherers when they were first encountered them (Penn, 2005). Over time a distinction between these two groups developed and this changed the way colonists interacted with them. The dealings with the Khoekhoe pastoralists became one of livestock trade, which included their fat-tailed sheep. The immediate benefit to the early colonists was that these sheep were well adapted to the local environment and diseases. Trade in and acquisition of indigenous livestock, through increasingly aggressive means, meant that free burghers could settle, expand and farm beyond the immediate environs of the Cape peninsula (Ross, 2010).

When the Cape Colony was founded, the VOC was the only purchaser of farming produce and deliberately keep the price of grain low, which meant low profits for the free burgher farmers. This, coupled with the difficulty of transporting grain from farms further inland beyond the Hottentos-Holland Mountain range, dampened the free burghers' willingness to take up agriculture and made stock farming much more appealing. There were other advantages to stock farming that helped entice more colonists to take it up. Firstly, meat could always be sold; if not to the Company then to other colonists or directly to passing ships. Secondly, the cost of stock farming was much lower and required far less capital than other forms of farming. Finally, the ability to farm animals and have another occupation also made it attractive to many administrators and colonists. This growing emphasis on stock farming began in the 1670's and consequently, in the environs of the Cape there was less communal land available for grazing. While wealthy burghers could obtain and control land, poorer burghers with no free hold property or any land were forced to move into the interior in search of grazing lands. While forced inland this movement was also motivated by a desire to escape the VOC's control. This gradual movement to the interior was supplemented and facilitated by hunting game and through trade with indigenous Khoekhoe (van der Merwe & Beck, 1995).

The continual interaction and extensive trading between the VOC and the Khoekhoe during the eighteenth century in the regions around Cape Town, rapidly undermined their way of life. By the eighteenth century the Khoekhoe and other indigenous groups near to Cape Town were "more dependent on the culture and commodities of the colony" (Penn, 2005: 22). This was due to these groups trading away their animals for European products such as brandy and tobacco. This left them without their core social and subsistence resource and they were increasingly forced to sell themselves as labourers and herders in the European economic system and forsake their own. The Khoekhoe were further forced into labour as the Europeans controlled all the available grazing lands, water sources and other natural resources south of the Koue Bokkeveld Mountains. The colonists only allowed the Khoekhoe access to these resources if they agreed to manage the farmer's stock (Penn, 2005).

Access to indigenous livestock and the poor profits from agriculture encouraged settlers to keep moving inland. As noted above available land in the immediate vicinity of the Cape rapidly diminished and was held in the hands of the wealthy elite. This meant that farmers had to travel further in order to find grazing and farming land and with the help of the Khoekhoe labourers, livestock farming became attractive.

There were other factors that drove free burghers away from the Cape and into the interior during the course of the eighteenth century. In his book, *Die noordwaartse beweging van die Boere voor die Groot Trek (1770-1842),* P. J. van der Merwe (1937), highlights that with land in short supply it was over-farmed and this was exacerbated by natural disasters, such as drought. Expansion into the arid areas up the western Cape coast and north eastwards into the interior were less attractive and these constraints resulted in the main direction of settler movement to the east along the southern Cape coast towards the Eastern Cape where the environment was more favourable (Beinart, 2008), although some farmers did move northwards. Additionally, the VOC's main concern was to assign land specifically for grain farming, while grazing land was considered communal. Thus according to the Company, grazing land was defined as the "entire country" (van der Merwe & Beck, 1995: 51), which they decreed the colonist could make use of (van der Merwe & Beck, 1995). Access to land, especially for grazing, was further aided by the introduction of grazing licenses in 1703. This legislation along with continuing trade and interaction with Khoekhoe pastoralists encouraged European stock farming and facilitated the migration of people further north to the base of the Karoo escarpment around the Roggeveld and Nieuweveld mountains (van der Merwe & Beck, 1995) (Figure 2.1). Grazing licenses gave farmers rights to a portion of land for a period of two to three years.

Simon van de Stel (the governor of the Cape between 1679 and 1699) was strongly opposed to this. He believed that as colonists spread they would become vulnerable to aggression from indigenous people. He also believed that this would detract from the development of the Cape Colony and neglect the Colony's main concern,

producing grain. Despite his concerns, agriculturalists continued to ask for more land as grazing areas quickly became exhausted due to a lack of manure fertiliser, and this contributed to further expansion inland against the governor's wish to keep the Colony compact and secure.

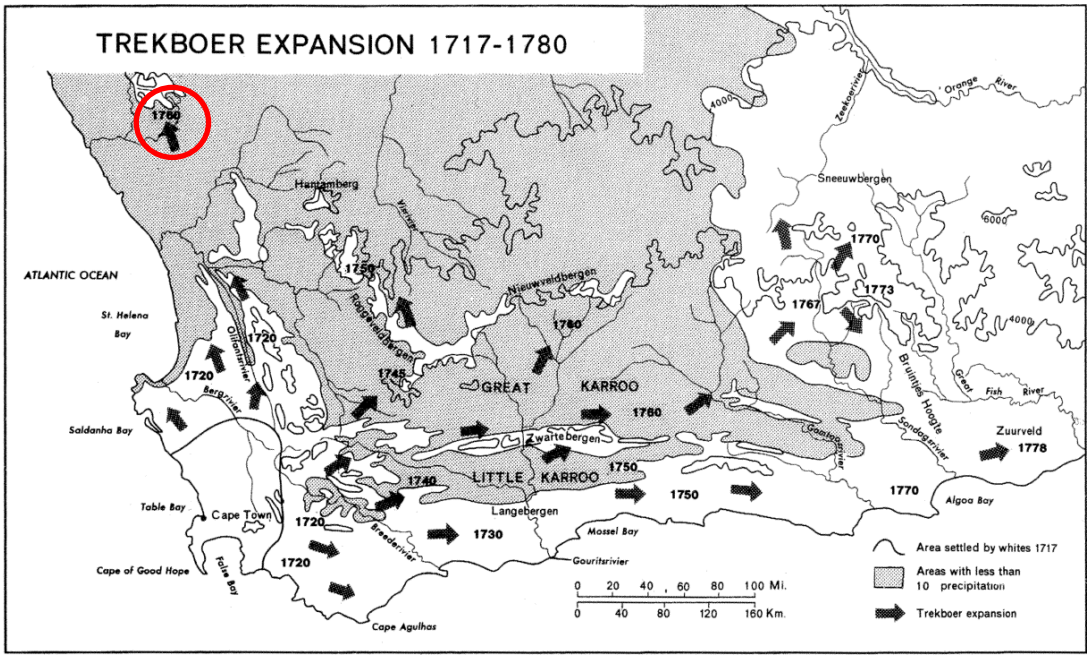

Figure 2.1 Map of the early Cape Colony showing time points during the eighteenth century when settlers reached different regions of the interior. (Guelke and Shell, 1992)

The migration of farmers to the east, however, was hampered by VOC ownership of the eastern pastures around Swellendam. The new governor, William Adriaan van de Stel, who succeeded his father Simon van de Stel in November 1699, allowed colonists possession of his own livestock posts, however, which helped open up the eastern frontier. He accepted that expansion was inevitable and rather than hinder colonial development it would instead be more beneficial. He communicated this belief to the Lords XVII (the heads of the Dutch East India Company), who also wished this expansion to be curtailed. Additional to land for livestock and crop farming other reasons for expansion were the lack of water in and around the Cape and the Khoekhoe's waning power due to the small pox epidemic of 1713, which meant that security was no longer a major VOC concern. The VOC, consequently, allowed farmers to move to new areas in search of suitable land. The search for

better grazing lands beyond the frontier resulted in new regions being occupied. By 1717 livestock posts were established in Verlore Valley, along the Kruis River and Breede River. The vegetation of this area is south west coast renosterveld and limestone fynbos which are well suited for grazing (Mucina & Rutherford, 2006). By 1725 settlements were found along the Olifants River on the border of the little succulent Karoo to the north and the renosterveld to the south (Figure 2.1) (Walt, 1928).

This rapid spread north included expansion to the Roggeveld by 1746 (Figure 2.1) where the climate and environment was conducive for stock farming. Accounts by the Roggevelders mentioned that rivers overflowed and that there was "an over flow of water" (Godée-Molsbergen, 1916: 181). This ameliorated the environmental pressure placed on this region by pastoralist groups. However, reduced rainfall at the beginning of the 1800's reminded pastoralists how tenuous their lives were when there were also increased conflicts over resources (Penn, 2005). In 1760 the Kamiesberg region in the north-western Cape was reached (Figure 2.1), however, further colonisation in this direction faltered until the beginning of the nineteenth century. Expansion into the increasingly marginal areas of the Roggeveld and Kamiesberg was made more difficult due to the continual harassment of raiding Bushmen, who stole livestock and burned homes.

To the east, by the mid-1700's there were two streams of colonists, one moving in a more northerly direction along the borders of the great Karoo and the other below the Cape Fold Mountains nearer the coast (Figure 2.1) (Walt, 1928). These migrations resulted in the establishment Swellendam in 1745 and Graaff-Reinet in 1786 and also led to the development of the Cape Colony as an important economic region (Hockly, 1957). However, continued assaults by San slowed further movement north until their power began to wane at the beginning of 1800's.

The VOC's more relaxed land policy meant that anyone could be their own master. This became the cultural norm and working for others gained social stigma, fostered by the early colonists and the development of a slave society. No colonist was

willing to be seen as a ‘slave’ by working for another man, even if he was paid. Other work such as carpentry or stone masonry was also performed by slaves, thus making farming the only socially acceptable vocation for a European colonist (Grosskopf & Carnegie Commission, 1932).

The rapid population increase in the Colony, from 1625 people in 1705 to 2710 in 1731, coupled with the social stigma of not being one’s own master, and a desire for independence lured many people inland in order to earn a living (Guelke, 1988). However, the unwillingness of the Trekboers to work for others made access to labour a significant concern for the early colonists. In 1784 a petition by a number of prominent Cape colonists collated all the economic knowledge of the time in order to understand the labour problem facing the Colony. They determined that the principal issue was that population growth far exceeded the Colony’s economic ability to sustain it. The conclusion reached by this petition was that every colonist’s son should become a farmer in his own right in order to increase the economy and disperse the population (van der Merwe & Beck, 1995).

However, the petition did not consider the possibility of colonists making a living by working for another. This would solve the labour shortage and decrease the expansion of the Colony. The petition also believed that the available Khoekhoen labour was unsuited to help on crop farms as this was largely a foreign concept to them. Further, the number of local indigenous groups like the Khoekhoen and San was too low to meet all farm labour demands and in order to address this issue slaves were imported, but they were expensive and did not fill all the labour requirements. Crop and stock farmers wanted or only trusted Europeans for specific jobs, such as foremen or overseers. Yet this did not occur despite the dire need for more farm hands. Sons still left their fathers to start their own farms. This aggravated the problem as more labour was then needed as described by W.J. Mackrill in 1827 (Theal, 1897; Hancock, 1958).

Europeans settlers wanted to be farmers and to become a stock farmer and acquire animals was fairly simple. Strategies included working temporarily for an established

farmer and getting paid in livestock and once a sustainable number of animals was reached the colonist could start his own farm or loan or gift animals to their son. The Company had no set principles about where or how people lived or the way the Colony should expand. As long as they received enough meat and grain they were not concerned with the livelihoods of the colonists. This meant that agricultural land was free to those who wished to grow crops and stock farmers had only to pay quitrent which was cheap and the collection of which was often lax (Pringle, 1834; Moodie, 1835).

Another reason for the search for new land, water and grazing north of the Bokkeveld Mountains during the 1740's, was that a man's wealth was measured by his breeding stock. All pastoralists, including the Trekboers and the British settlers after the 1830s, for example, placed a high priority on the accumulation of animals (Ross, 1975). The northern frontier around the Roggeveld Mountains, however, was only 'open' for a short while (1740-1760) allowing pioneer pastoralists to occupy new areas and access resources easily. The freely accessible resources meant the movement of groups into new areas did not result in conflict over grazing and water which diminished the possibility of hostilities between groups. The frontier closed when Trekboers took control of the landscape, marginalising and blocking other pastoralists, namely the Khoekhoen, from critical resources (Penn, 1986).

2.2. The Karoo environment

As the Colony expanded into the interior well beyond the Cape's poor infrastructure, tenuous communication and the general harshness of the environment resulted in difficult and strained relationships between VOC authority, the Trekboers and Khoesan.

In order to sell livestock and obtain money to purchase essentials such as gun powder Trekboers needed to travel to Cape Town. One fundamental difficulty facing farmers was the ability to travel and journeying 'down' to the Cape was challenging because of deep sand and steep mountains that made wagon trips mechanically difficult, time consuming and expensive. The roads were often treacherous owing to attacks from Bushmen or wild animals. Fodder for trek oxen was, however, provided along the roads and farmers en route were hospitable, often granting travellers a place to stay. Many outspan areas were available for those making the journey; however, these were often overgrazed. The time taken to travel to the Cape was an issue as a day travelling by wagon could be covered by one person on horseback in only four hours. Droughts and floods often delayed those travelling by up to a week, particularly if there was no water or a river was in flood (Lichtenstein, 1928; Sparrman, 1977). These problems made a trip to the Cape a rare occurrence and farmers further from Cape Town only made the journey once, in order to get married. Once in Cape Town many only stayed for a day to conduct their business. When their matters were settled and provisions obtained, such as brandy, farming implements, tobacco and gunpowder and shot, the return trip could take up to five months (Theal, 1897; Grosskopf & Carnegie Commission, 1932).

These problems were somewhat offset by butchers' servants who transported animals to the Cape Town market on their behalf and farmers could therefore remain on their farms. Butchers' servants bought animals ready for market. Farmers were paid in butcher's notes which could be recouped for currency in the Cape when they personally made the trip. The practice did, however, have its problems because of poor communication and so butchers' servants arrived when the livestock was lean or they failed to arrive and consequently remote Trekboers had to make the journey themselves (Burchell, 1824; Lichtenstein, 1928).

The labour issue and poor communication meant that frontier farmers were self-sufficient, hardy and therefore environmentally and culturally well adapted. The seclusion and minimal contact with the "civilised" townspeople meant that most interaction was with Khoesan people. This interaction taught Trekboers how to

manage livestock in the difficult environments of the Karoo, and adopt indigenous methods of livestock farming. The distribution of water, grazing and equable climate was not equal or constant throughout the year and thus a key management strategy was the seasonal migration of animals and people. This was a deeply embedded practice used by Khoekhoe and the San for many centuries (Figure 2.2). Either voluntarily or unbeknownst to them, these groups helped guide the Trekboers to areas of water and good grazing (Mentzel *et al*., 1944). The transhumance across the summer/winter rainfall boundary took place in October and November with movement to the summer rainfall regions and the return to the winter areas in April and May. This cycle also mirrored a movement down from the cold high lying areas in winter and a return in summer to these cooler pastures (Figure 2.2). This movement, besides ensuring the flocks of the Trekboers had sufficient water, also allowed time for the grazing veld to recover (van der Merwe, 1945). The harshness of the environment, however, resulted in conflict over diminishing communal resources of water and grazing (Penn, 2005). To ensure their flocks were provided for, the Trekboers made sure that they owned the watering points surrounding their grazing lands. This was important as without access to water the land around these features was useless (Penn, 2005).

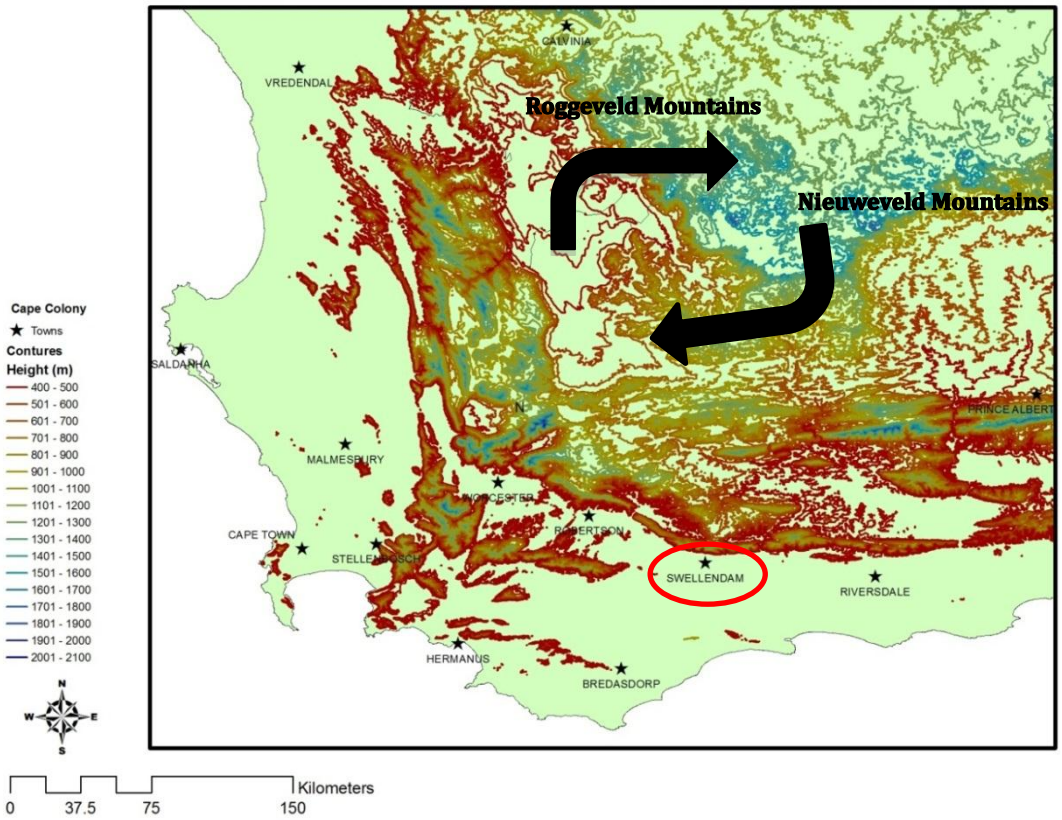

Figure 2.2 Map showing the location of the Roggeveld and Nieuweveld Mountains. The arrows show seasonal movement of the early Trekboers from the winter rainfall areas in the west to the summer rainfall areas in the east. Locations of the various towns in the Cape are also shown with the town of Swellendam circled in red.

This environmental knowledge facilitated Trekboer expansion during the eighteenth century. In the north-east the colonists spread beyond the Bokkeveld in 1740, and travelled through the upper Karoo to settle along the escarpment slopes of the Roggeveld and Nieuweveld Mountains (Figure 2.2). There was settlement further north, but these were temporary pasture areas along a narrow strip of the surrounding mountains, such as the northern Roggeveld. The Nieuweveld escarpment was not successfully occupied during the 1700s due to the intense resistance of the Khoesan and its very low rainfall (12-25mm per annum) (Wellington, 1955).

Trekboers were reluctant to move to the winter rainfall region, west of the Roggeveld Mountains, due to the low rainfall, preventing the Nieuweveld vegetation from fully recovering (Lichtenstein, 1928). This caused significant damage to the veld

and an increase in tension and animosity toward the Khoesan. The aridity of the area north of the Roggeveld resulted in it becoming a natural boundary for the frontier (Penn, 2005). The northern settlements extended as far as the Rhenoster River and both the Small and Great Riet Rivers (Figure 2.3). The government induced colonists by offering loan farms or legplaats in these areas and these farms were rent free due to their proximity to the northern frontier (Penn, 2005).

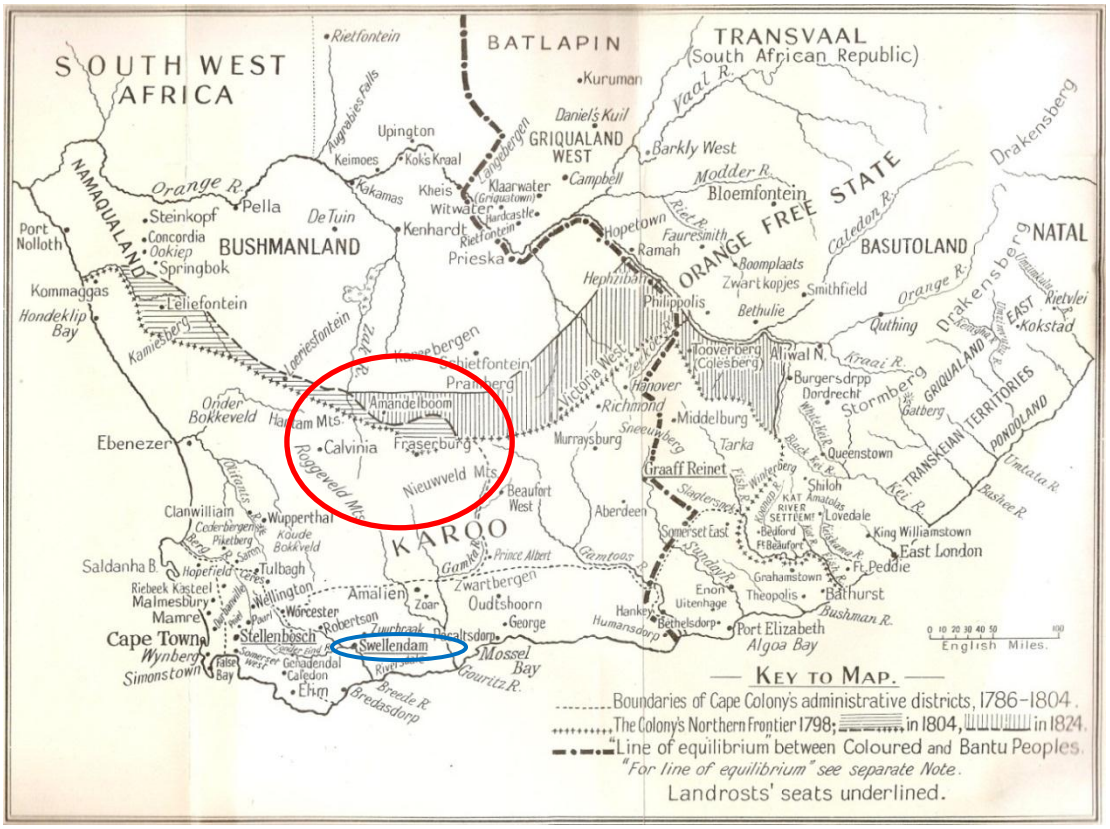

Figure 2.3 Map showing the borders of the Cape Colony from 1786 to 1824. Red circle indicates northern region of settlement in the late 1700's. The town of Swellendam is circled in blue (Marais, 1939).

As more Trekboers moved to the interior, lured there by rent free farms and independence, the frontier began to close and pressure was placed on resources. Skirmishes between Trekboers and indigenous groups around the Roggeveld and Nieuweveld Mountains increased. A significant conflict in 1739 resulted in the confiscation of many of the Khoekhoen livestock (Penn, 2005). Elsewhere in the colony the VOC used its influence and power to extract more livestock from the Khoekhoen resulting in further economic and social collapse and the loss of their

independence. Khoekhoen resistance was met with force and this provided justification for unscrupulous colonists to take the last of the Khoekhoen herds. For a period between 1740-1770 the Nieuweveld environment provided indigenous Khoekhoen groups a place of refuge (Penn, 2005), but exploitation and mistreatment continued and increased in the Roggeveld. The Roggeveld frontier was too far from Cape Town for authorities to manage and control and seldom was any legal action instituted against hostile Trekboers (Penn, 2005). In response to lawlessness, and in order to exercise greater control over colonists and tax collection, the Cape Government in 1745 established a drostdy at Swellendam (Figure 2.3) and the boundaries of this district, known as Swell-en-dame, were fixed in the east at the Brak River. The drostdy was a means "to keep a watchful eye on activities of the residents and to look after judicial concerns" (van der Merwe & Beck, 1995: 109).

Despite the establishment of the drostdy the eastward spread of the Colony, into the "wilderness" was viewed negatively by Jan Willem Cloppenburg, a deputy governor in 1766. Dispersion, he believed, was the cause of many of the Colony's ills such as godlessness and crudeness and to bring back order he suggested that granting more farms should cease and he encouraged the poor to work on already established farms. Furthermore, he hoped that this would reduce the importation of slaves and the use of Khoekhoe labour instead. This did not occur. Cloppenburg did not wield much power and the culture of owning slaves was already firmly established (van der Merwe & Beck, 1995).

At the beginning of the 1770s the spread of the Colony into the interior stalled. This was in part due to increasing resistance by the Khoesan as the once plentiful water and grazing resources became scarce coupled with the difficulty of farming in a new and different environment, around of the Roggeveld Mountains. Penn states that "The most dogged resistance to colonial expansion took place along an important environmental frontier – imprecise and shifting though it was – between the winter and summer rainfall regions of the Cape" (Penn, 2005: 82).

Desperate resistance on this frontier by Khoesan forced Trekboers to prioritise security and away from the acquisition of new land and water. The frequency of commando patrols also increased. The commando was an integral part of Trekboer society as both a military institution and an economic one. As a military force the commandos protected the Trekboers from hostilities whenever they arose. The economic side of this institution was that it did facilitate the expansion of the frontier and the acquisition of important water sources, grazing land and livestock (Penn, 1986). Commandos required horses to have a tactical advantage and consequently areas with exceptional grazing lands, such as Akerendam (present-day Calvinia) grew in prominence (Botha, 1927; van der Merwe, 1937; Penn, 2005).

The resistance by the Khoesan across the northern frontier was harming the interests of the Company in the Cape and the combined boards of the landdrost, Heemraad and military councils met to discuss the situation (Moodie, 1960). It was decided that a frontier wide commando, if large enough, could sweep aside all hostile groups and put an end to all rebellions and resistance. Consequently, the General Commando was established in 1774. This was approved by government rather than a unilateral farmer response to hostilities (Penn, 2005) and thus enjoyed the full power and resources of the government. Any resistance to the Colony was met with the full force of the Company and local settlers, but no thought was given to addressing the causes of the Khoesan resistance; only that it had to end (Penn, 2005).

The success of the commando meant that by the end of the eighteenth century most of the Khoesan were displaced and dispossessed and had very few places of refuge from which to resist. Those who were not overwhelmed by colonist numbers and the loss of livestock moved further north into Bushmanland (Figure 2.3). By the beginning of the nineteenth century the Karoo was no longer a flash point for conflict with Khoekhoe, although settler genocide of San continued deep into the nineteenth century (Adhikari, 2011).

While the General Commando brought the frontier under control though military means it also had some unintended consequences. The foremost of these was that the Company had to relinquish much of its operational control to the commando leaders to allow them to act and be effective in securing the frontier. In so doing much of the Company's influence along the frontier was lost. The authority of Company *veldwachtmeesters* (Field Commandants), who had to maintain the Company's control of these areas, was usurped by commandos. In order to regain some control the Company attempted to use their ownership of ammunition as a means of leverage. However, the VOC's need for cheap meat from the interior far outweighed the farmers need for ammunition, and furthermore, frontier profit and production could only be maintained if the commandos continued to enforce control of the frontier. The result was that as commandos grew independently successful in controlling and governing the frontier, they were less inclined to support or acknowledge the government and its interference on the frontier (Penn, 2005).

2.3. The VOC and land tenure

Over the course of the eighteenth century the control of land changed as the commandos and Trekboers grew in power and independence. The Company's policy on land ownership, however, hardly changed during this century. This policy influenced how the Colony spread and also caused conflict.

As indicated above the initial concern of the VOC focused on adequate land to produce wheat and other grains and land deemed suitable for crop production was allocated solely for this use. Grazing areas were not specified as the Company's policy was that all other land not used for agriculture could be used for grazing (van der Merwe & Beck, 1995). This caused concern because farmers wanted reassurance in knowing which land was theirs and some security and rights over it. A temporary concession was granted in 1691 that gave some farmers private grazing

rights. Land specifically for grazing was granted to Cape farmers when the borders were expanded to the north of the Paarl Mountain and Babylon Tower (van der Merwe & Beck, 1995). While these rights gave farmers access to crown land they did not own or have any legal rights to this land. In addition, these licenses could be revoked at any time. This uncertainty contributed to many farmers migrating further into the interior.

At the beginning of the eighteenth century few grazing licences were issued, but those that were granted were vague about the specific location of use (van der Merwe & Beck, 1995). This was, in part, due to the fact that these early forms of grazing licences were not intended for individuals, but rather for large groups of colonists. However, few groups actually used these grazing licences and this is not surprising given that the few grazing licences that were issued were only valid for up to six months (van der Merwe & Beck, 1995). The licence did not provide a farmer with a specific piece of land, nor did it confine him to a certain farm size. Therefore, this allowed the farmer in possession of a licence to expand the size of his herd unchecked. Those without free hold land gradually made use of grazing licenses (later referred to as loan farm leases) and by the end of the eighteenth century there were more loan farm tenants (farmers who obtained grazing licenses) than owners of free hold land. This policy of allowing farmers to settle wherever they chose continued unchecked, as the Company's only concern was that of increasing its profits (van der Merwe & Beck, 1995).

Furthermore, the issuing of new grazing licences required no investigation into the precise area of occupation chosen by the farmer, and the government was often unsure of the exact location of the area requested (van der Merwe & Beck, 1995). The result was that many farmers complained that new colonists settled on land too close to their own and overexploited the resources. To help prevent overcrowding, a minimum distance between the centres of the farms was instated. This was determined to be half an hour's walk or 3000 paces, ideally forming a circular farm. However this, was never strongly enforced as the shape of the farm was defined more by the landscape, distribution of water resources, location of other farms and

other factors (Theal, 1897; van der Merwe & Beck, 1995). The goal was to give each new loan farm owner enough pasture for grazing, but not so much that it negatively impacted on others in the vicinity, yet often the farm was not what the purchaser of the loan farm wished or wanted. To accommodate the minimum distance between farms and the restrictions placed on farmers the Colony soon began to expand as areas were quickly claimed and more land was needed.

In 1714 the VOC government instituted yearly quitrent (payment for the loan farm) which led to increased concern for many farmers because regardless of differences in land size, quality and location, the payment was the same. This issue intensified when denser settlement meant that there was less “open” space available to graze. In an effort to correct the imbalance between land and quitrent costs, the VOC exempted farms on the frontier of the Colony from paying rent due to the difficulties they faced (Theal, 1897; van der Merwe & Beck, 1995). This encouraged colonists to move out beyond the border in search of better grazing land and this inevitably led to greater conflicts with the indigenous peoples.

To help control where Trekboers settled, grazing licenses were further altered whereby a farmer was given a defined spot on the landscape. This spot was chosen by the farmer and often strategically selected so that he could continue to move inland beyond the frontier. Even though this movement was against the government’s intentions, the VOC was unconcerned so long as they were still able to collect taxes and quitrent from the Trekboers.

Over the course of the eighteenth century stock farming became more profitable and slowly replaced agriculture in economic importance to the Colony (van der Merwe & Beck, 1995). To ensure that stock farming continued to expand, the government stated that the Karoo was communal grazing land. Many farmers, however, moved back and forth between the same areas as part of the seasonal moments, as described above. An informal agreement between local farmers was soon established. It was agreed that certain areas “belonged” to particular farmers by virtue of the repeated occupation by the same farmers. Over time these Karoo

stock posts (that were meant to be unoccupied) were improved with buildings, houses, cages and pens. This structural improvement meant that many farmers frequently returned there even though the structures were not of much value. As a result these buildings could be abandoned for months without worry of loss due to raids or natural disaster. This repetitive and informal use of the same land was eventually recognised by the government and some farmers gained rights to it (van der Merwe & Beck, 1995).

The issue of land and the location of farms changed when the British took control of the Cape Colony in 1795. The transition of governments resulted in some unrest, yet the general system of land tenure remained the same for a short time. In 1806 the British approach to land ownership altered and the way land was divided and allocated changed. How this change in land tenure affected the Karoo as the introduction of new ideas on farming entered the region will be explored in the next section.

2.4. The British and land tenure

When the British gained control of the Cape Colony in 1795 they inherited a Colony beset with conflict along the eastern frontier and before they could profit from their 'asset' they first had to resolve these tensions. One of the chief concerns was the threat of Xhosa chiefdoms on the eastern frontier who were increasingly wary of the settler advance into their own land. Frontier conflicts absorbed much of the British government's attention and resources. There were, however, individuals who felt that the government should not forget the San and the danger they posed. One such individual was John Barrow who worked as the private secretary of the Governor, Earl Macartney, and played a major role in shaping policy concerning the San (Lloyd, 1970).

Shortly after the British takeover a burgher rebellion broke out, led chiefly by the burghers of Swellendam and Graaff-Reinet (Boucher & Penn, 1992). They were dissatisfied with how the previous VOC government dealt with both the San and Xhosa bordering their lands and wanted the new British administration to take appropriate action. The burghers wanted the government to assert complete European control over indigenous people, but the government's inability to deal with the 'native problem', however, resulted in independent settler action and rebellion. The rebellions were brought to an end once the British Commander, General Craig, cut off the rebel burghers' access to ammunition, but even with order restored settler negativity towards the government still persisted (Giliomee, 1975; Giliomee, 1989).

In 1797, John Barrow, went to the Eastern Cape to ascertain the main causes of the unrest on the frontier. Communication with the San over their issues was largely unsuccessful because they had no leadership hierarchy where one man or an elite group could speak for the entire San 'nation'. Barrow's joint meeting with San and Boers over land deteriorated into open conflict. As a result of this conflict San were killed, and by Barrow's own admission, it was the Boer's commando system and antagonistic mentality that had initiated it and Barrow viewed the San as "mild and manageable in the highest degree" (Barrow, 1968: 268). To prevent further hostilities and to placate the San, Barrow suggested that no further commandos should be made against them. Boers held, however, that commandos were essential in keeping the San under control and Barrow recognised that trespassing by grazing on land exclusively used by the San would only continue to antagonise them (Barrow, 1968; Lloyd C, 1970).

The chief concern for the government and the colonists was the security of the border towns, especially Graaff-Reinet, because it was the main meat supplier to the Colony. Consequently, more effort was placed on securing the frontier zone. From the end of the burgher rebellion until the British temporarily relinquished control of the Colony in 1803, they had to suppress a Khoekhoen uprising, contend

with another burgher rebellion and develop new measures to curb the growing power of the Xhosa in the east (Giliomee, 1975; Giliomee, 1989).

Turning to the northern frontier around the Roggeveld Mountains, Governor Macartney viewed it as “amorphous, fluid and undefined” (Penn, 1993). To help fix the extent of the northern frontier and gauge tensions in the area, the Governor again dispatched John Barrow in 1798 (Penn, 1993). This was because there had been severe fighting in the early part of the 1790’s and the districts of the Nieuweveld and Koup had few colonists and the San occupied some of the most valuable land. Furthermore, the frontier settlement ebbed and flowed as drought forced many of the remaining Boers to retreat. As a result, the few colonists present in the region could not ward off Khoesan assaults and commandos were sent out in 1792, but these were unsuccessful in ending the troubles.

In 1798 the *veldwachtmeester* of the Roggeveld, Floris Visser, believed stability and peace with the San could be achieved despite the numerous attacks by them (Penn, 2005). In one such attack 6000 sheep and 253 cattle were taken from Butcher servants moving through the area on their way to Cape Town. In response a commando was dispatched and recovered most of the livestock, but in the process approximately 300 Khoesan were killed. This created further tensions between the indigenous groups and the colonists, making the prospect of peace even more unlikely (van der Merwe, 1937).

During the initial British rule at the Cape they clearly did not have complete control (Botha, 1919). To help foster better relations with the colonists and in particular the Trekboers, the British government wrote off the 200 000 rixdollars in taxes and rent that was owed to the previous government. It was only after regaining control of the Cape from the Batavian Republic in 1806 that the British government sought more direct control.

When the British took over from the VOC in 1795 they continued with the same system of land administration. The British maintained the Dutch governments’ administrative structure and staff despite the differences in language and

management. The result was the retention of the land tenure system which the VOC had employed. This, however, was retained only for a short time while the new administration was set up and Caledon, the first British governor of the Cape (1807-1811), sought to change how the land tenure system worked. His first declaration was to negate all non-documented rights to land, such as verbal agreements. Governor Caledon promoted the use of a fifteen year quitrent loan over farms and other land (Botha, 1919). By the end of his service he had limited the options for land tenure and in order not to force any land policy on his successor, he did away with the loan freehold (one year lease that was automatically renewed each year and which had been the most secure form of land ownership), and fifteen year quitrent tenure (a fifteen year lease that was renewed every 15 years, but the owner had to pay an annual rent depending on the farm size) (Duly, 1968).

The poor VOC control over land extended to survey and when the British took over from the Dutch, only 29 612 morgen (25 369 hectares) of land had been surveyed since the cataloguing of land had began in 1685 (Cape of Good Hope (South Africa), 1859). What surveys had been done were poor in quality because there was not a standard unit to measure land, nor were the surveyors adequately trained. The result was that boundary disputes between land owners often hinged on surveyors searching for ill-defined beacons or markings and oral testimony to ascertain boundaries. Although Caledon was ignorant of how poorly the surveys were done he required that each quitrent farm be surveyed. This policy proved to be expensive because almost all the government surveyors were stationed in Cape Town which raised travel costs These costs, however, were passed on to the applicant farmers and consequently, many Trekboer farmers were reluctant to apply for their farms to be surveyed.

Governor Cradock (1811-1814), Caledon's successor, wished to use the land tenure system as a means to bring the Trekboers and the British government closer together. As with his predecessor, Cradock favoured quitrent as the form of land tenure as this allowed the government to obtain more money and retain control of the land. To enforce this, Cradock required all loan and other forms of land tenure to

change to quitrent. This change accommodated European farmers and land owners, but obviously not indigenous Khoesan. The Governor's opinion was that the indigenous peoples should be under the supervision of the missionaries rather than the government (Duly, 1968).

Cradock's land reform was done without any consultation from either the district landdrosts or the colonists themselves as to their needs and opinions over land distribution. As a result the system implemented was ineffectual in meeting the requirements of the growing Colony. For example, there was a backlog of over 3000 land tenure requests that resulted from the implementation of the system in 1813 (Duly, 1968). The Trekboers did not like this new system as it failed to secure their ownership of the land. The major concern for the British administration was the collection of rents. This meant that little attention was paid to the sale and acquisition of land between farmers, resulting in the loss of revenue to the government from these sales.

After Cradock's term as governor ended in 1814, the administration continued to struggle with a poor land tenure policy. This was in part due to interference from London and the Cape's own lack of understanding about what was really going on along the frontier. The interventions from London sought to solve issues relating to the government rather than that of the Colony. These interventions included the promotion of peace along the frontier by restricting where future land would be given to Trekboers. This resulted in no lands being granted in the north or east of the Colony from 1825 to 1836 by order of the Earl of Bathurst, the British Secretary of State for War and the Colonies (1812 to 1827) (Duly, 1968). As a result acting Governor Bourke suspended the issuing of title deeds for the districts of Albany, Somerset, Graaff-Reinet, Beaufort and Worcester. By the end of 1828 there was no defined plan for how land tenure in the Cape should proceed and as a result farmers were forced to occupy land outside of the government's control.

Between 1828 and 1834 there continued to be a lack of concern over the way the government instated land policy and there was poor communication between

government and the districts that continued to hinder the development of the land. In 1828 land tenure was issued yet it retained the same rent payment system, which was based on the value of the land and the worth of the farmer's livestock. In 1831 the Ripon regulations sought to control where land was sold in the Colonies and for what price. This however, was not instituted in the Cape as the mechanisms of the government to institute such a regulation were not in place. The first land department was established in the Cape in 1835 which helped alleviate some of the issues of land tenure. However, it was only after 1844 that the main problems of the administration and issuing of land were solved (Duly, 1968).

2.5. Conclusion

As the Colony expanded further to the north and east, Trekboers entered the semi-arid and low rainfall environment of the Karoo. They adopted the same livestock management patterns of the Khoekhoe that focused on seasonal transhumance. Although this migrant way of life was essential for surviving during the latter parts of the eighteenth century and the beginning of the nineteenth century the British government did not fully understand it. The government, however, still required title deeds for farms to be for a specific location and of a designated size. Yet, due to the ineffectual nature of the British government and the distance from major towns, those living in the Karoo could maintain their trekking way of life, free from governmental control.

The migrant farmer faced many difficulties including conflicts with indigenous people, change in governments and change to the structure of land tenure and land ownership. The possession of title deeds to land showed ownership, but did not necessarily mean occupation. The changes in land tenure as well as other developments in farming over the course of the nineteenth century were significant and had an effect on the lifestyle of farmers in the Karoo.

The fundamental issue is the contrast between the cultural attitudes to land and the change in land tenure in the nineteenth century. The cultural attitude to land that was integral to Trekboer life focused on transhumance, an absence of administrative accountability and a fluid relationship with the land that placed limited emphasis on marking residential permanence. The Trekboer outlook was one of land that was open and unbounded. During the nineteenth century, land tenure changes coupled to new economic forces to do with wool and a global export economy placed a different and more intense burden on the land. Before moving on in the following chapters to consider these changes, I briefly discuss issues around landscape and the method and materials I employed to investigate it.

2.6. Landscape theory and method

The concept of landscape was derived from the arts which described a painting of natural vistas, topography and geology or human structures executed within a given view of the world. The word was adopted to describe a part of the world, a region or area which is of particular interest either visually or intellectually (Johnson, 2007). This concept is used to categorise the study of archaeology that looks at surrounding areas of a site and their interrelationships. The development of the study of landscape archaeology has resulted in many interpretations of what a landscape is and how the concept of landscape is defined.

The early study of ancient and historic landscapes at the beginning of the twentieth century had a romantic view that put into text a description composed of emotion and aesthetic appreciation. This view came from the notion that a bond is formed between the present and the past as one travels through the land of our ancestors. Looking at the landscape in such a way gives more weight to the environmental aspects of an area than the cultural one (Johnson, 2007). Alternatively, landscape was viewed empirically which placed an emphasis on the “facts” of the region and

that these facts speak for themselves and define landscape without the need of theory. Quantifying the land was enough and 'common sense' about the land was in a sense the 'explanation' within which meaning or intention of the remains was self-evident. The problem with 'common sense', however, is that it assumes that everyone will have the same conclusion when viewing the data and that there is only one way to view the information presented. The use of "common sense" is based in the modern world by modern people and not those of the past whose cultural norms and beliefs constructed the features seen on the land. Thus we need to strive to understand the reasoning behind the construction, alteration and perception of the land by those in the past.

The theories of landscape developed in the 1970's focused on the sites and structures that pertained directly to human actions. The result of this was that space within and around which human activities proceeded were passive, a physical backdrop for the places humans used and their resulting artefacts, monuments and debris. Lists of examples were produced and became "case studies" for the use of the landscape yet, lacked a broader question or argument. The result was adding information to what had already been collected, rather than contributing to the knowledge or understanding of the region's landscape.

To break the trend of merely obtaining data archaeologists such as David Clarke (1978), Lewis Binford (1982) and Kent Flannery (Flannery & Marcus, 1996) advocated the use of the scientific method so as to find the relationships between the data and to interpret it (Johnson, 2007).

Processual archaeological theory viewed the space between sites or structures as part of social interactions and thus needed to be integrated into the explanation of the past. The development of post-processual archaeology and the resulting shifts in processual archaeology changed how the landscape was viewed. Thus, the landscape began to be seen in symbolic and conceptual knowledge terms (Robin & Rothschild, 2002).

In applying new views on what the landscape is or was, archaeologists turned to ethnography and history to help gain an insight into the past. This included people's views and intentions behind the utilisation of the landscape. Some of these early landscape archaeologists sought out anecdotes and stories of the area they were investigating.

The use of the scientific method to understand the landscape of the past resulted in the need for new definitions as various issues arose. One of these issues was the understanding of the terminology used by the archaeologists. The exact definition of terms such as 'dispersed', 'typical', 'type' and 'central', among others, were not adequately described. The meanings used varied between disciplines and depended upon the context of use either historical or archaeological. The result was that there was no consensus on what made something 'typical' for an area or how far apart the features had to be in order for them to be labelled as 'dispersed'. This lack of criteria for a term meant that the reasoning behind the term needed to be laid out by the author (Johnson, 2007). Other issues included how the landscape was viewed. This was because the landscape was of interest to other fields such as geography, history, anthropology and architecture which resulted in aspects of the landscape being lost. A holistic view is often advocated (Ashmore & Knapp, 1999), which means that archaeologists look at the natural, geological and human interrelationships.

2.6.1. Viewing the landscape

How people of the past viewed the land they lived on or entered is important in understanding their culture and the relationship between them and the environment. In the past the view of those venturing to a new area looked at the landscape as external and separate from the people. It was seen as the "wilderness" a hostile and alien place that is the domain of nature and not man (Johnson, 2007).

This view was a concept that prevailed as settlers moved to new lands. This, however, was not how those already living on the land saw the area they lived on. To understand these different views the landscape needs to be analysed as not a space which is distinct and separate, but rather as the known world of the people that reside and move through it. This is the result of human cognition not a given reality, which is the environment (Ingold, 1993).

The land on which people lived can be viewed and perceived from a variety of different perspectives altering what the landscape might have meant in the past. There are four themes that are described in current literature that dominate how landscape is viewed (Ashmore & Knapp, 1999). These are landscape as memory, identity, social order and transformation. Looking at each of these individually allows the merits of each view to become apparent.

Using the memories of people to understand the land on which they live builds on the past (Holtorf, 1997) and allows for the post-processual use of culture to be utilised. This also transforms the landscape into a vessel which holds both the memories and cultures of those that lived and continue to live on the land. The use of identity as a view of the landscape looks at places on the land as beacons of sociocultural importance. This is seen in areas of ritual and ceremonial importance as well as features found on the land that help give and strengthen the identity of the people. Examples of this are Mount Rushmore in the United States of America, Stonehenge in the United Kingdom and Great Zimbabwe in Zimbabwe. The marking of the landscape helps enforce and convey the identity of people especially those with strong oral traditions. One of the strongest examples of this is the use of rock art. It is used to indicate the attachment and significance of the land to the people (Bradley, 1997). The result of this is that places acquire an identity and when combined with the memory of the people it enhances their memory and culture (Ashmore & Knapp, 1999). The use of the landscape for activities gives rise to the social ordering of it. Although landscape is more than a space on which people act, it does help to interpret the society and their relationship to the land. This can be done as people become a part of the landscape and use aspects of it for specific

actions. The idea of “nested landscapes” (Bender *et al*., 1997) tries to link all the parts of social interaction to the spaces used by those living on the land and from this gain a broader view of the culture.

The last view of landscape is its propensity to be transformed. This alteration of the land is due to human activity. Although the land changes so too do the people. This change from internal social alteration or external pressure is reflected onto the landscape. Over time the memory or identity instilled on the landscape is altered or destroyed. The destruction of the memory, identity or social order is done by conquers who impose their power in order to give themselves legitimacy. This loss of landscape can also be used for resistance against those same conquers (Ashmore & Knapp, 1999).

The view of the landscape can be varied, but the goal of understanding the past and the relationship people had with the land requires more than a theoretical concept. The active archaeological pursuit requires the view of the landscape to be tied to material or historical aspects from which the past can be understood.

2.6.2. Investigating the landscape

Having a view on how people looked at and interacted with the landscape also requires an approach in which this view can be shown. Any given area has many features, sites and deposits and the method used in analysing them can be very varied. Looking at any one specific aspect can undermine the total view of the landscape.

The use of siteless archaeology, as proposed by (Dunnell, 1992), seeks to not concentrate on this discrete archaeological unit as it hampers the overall view of the area. But instead to examine a site or groups of sites which allows the landscape to become defined in terms of points on the land rather that the entirety of the land

itself. Unfortunately, this method brought its own complications that included the exact definition of a site. What makes a site has been discussed at length and in order to overcome this, the notion of non-sites have been employed to give a wider picture of the archaeology of the landscape (Dunnell, 1992; Lucas, 2001; Hauser, 2007).

Building on this notion of a broad view of looking at an area, the method of Historic Landscape Characterisation (HLC) was developed. This method of understanding the landscape came together in England to better manage and protect their heritage sites. HLC looks at the whole landscape rather than individual points on a map. To do this the land is broken up by characteristic “types” that cover the whole area under investigation. These types make use of time depth and historicity to categorise the landscape rather than define it. This then uses the landscape as a source of material culture that can shed light on the past. When looking at the landscape, HLC realises that the parts of the land can be valued differently depending on the viewer. In order to convey the differing views maps are used as “snapshots” to see how people interacted with the area at that moment in time. This also allows the researchers to explore specific ideas in more detail at a given time point (Turner, 2006).

2.6.3. The use of maps and other methods in understanding the landscape

To understand the landscape in a quantifiable way features and aspects of the land need to be analysed. The use of maps and other visual representations of the land are the most used methods to interpret the data. Merely displaying the data offers no insight into the past, it only reproduces it. By looking at the shared relationships between the history, geology, material remains and structures one can begin to understand the past more accurately. It is the spatial environment as well as the theory that needs to be combined in order to investigate the landscape completely.

Archaeology as a discipline has long placed value on the spatial component of sites and artefacts. Detailed and precise maps can be found dating back to the eighteenth century (Wheatley & Gillings, 2002). These hand drawn maps, though very good, had limited descriptive and analytical information; they only observe differences, similarities and trends. This changed in the 1960's with the emergence of New Archaeology. This brought in a change in perspective on the spatial component of archaeology and the incorporation of other disciplinary tools.

The questions asked of spatial data moved from "are these sites clustered or not?" to, "why are they distributed the way they are?" An explanation of the spatial data was now required. The landscape also changed from being a passive background to an active environment that affected and marked the changes of a group of people. Cultural change became incorporated into the landscape as well. This was because external factors forced changes on the culture and the environment was marked, either by artefacts or settlements. These could then be identified, mapped and analysed as to the root causes and reasons for what is seen in the archaeological record.

Questioning the spatial data resulted in the development and utilisation of spatial analytic techniques and methods. These altered the use of the common distribution maps from merely showing where artefacts and sites are found to a stepping stone to more in-depth analysis of the data.

The utilisation of these techniques meant that the description of the distribution no longer was subject to the archaeologist's feeling of whether sites where clustered or not. The use of hypotheses that could be statistically proven allowed for greater confidence in the analysis of archaeology and for unobserved correlations to be found. The use of quadrat or nearest neighbour tests allowed for the patterns seen to be discerned as statistically significant or not. Other methods have been taken from a variety of different fields such as geography, ecology and economics in order to enrich and broaden the scope of spatial analysis.

Geographical Information Systems (GIS) is difficult to define due to its malleability and its ability to fit many different disciplines, from economics to engineering. GIS can be defined as: "… a powerful set of tools for collecting, storing, retrieving at will, transforming, and displaying spatial data from the real world for a particular set of purposes." (Burrough, 1990: 6)

or

"an information system that is designed to work with data referenced by spatial or geographical co-ordinates. In other words a GIS is both a database system with specific capabilities for spatially-referenced data as well as a set of operations for working (analysis) with data." (Star & Estes, 1990: 2). These definitions show the complexity and variety of views of this one computer program.

Archaeology uses GIS in three main ways. The first is in the capturing and management of sites on the landscape, the second in GIS related inquiries and studies and the final use for the utilisation in understanding issues related to landscape theory (Savage, 1990). Beyond these broad categories GIS is used on three levels. The first being visualisation, the use of the program to create maps and other visual representations of an area. This requires very little analytical capability as it is merely a display of the data with no active investigation of the data. The second level is management which uses some of the editing and manipulation tools of the GIS to alter and update data. This level of GIS utilisation does not go beyond a basic analysis of the data and does not strive to understand past cultures or people. Only in the final level of analysis do the full capabilities of GIS become apparent as this is where theories of the data are tested (Ebert, 2004).

In this project I utilise GIS as a tool to help examine the landscape on a regional scale by looking at 'snapshots' of the Karoo. This computer program maps the distribution of farms and corbelled buildings as well as various additional layers which can be superimposed over them. This allows for correlations to be found between the cultural aspects of the landscape, i.e. farms and corbelled buildings and the environmental features such as geology, temperature, rainfall etc. The

correlations between these different features could then be used to help examine whether the landscape was either open or closed. This will determine to what extent the environment had an impact on the cultural aspects on this landscape. The use of GIS would also build a data base from which further investigations into the history of the Karoo can be used and developed.

The scope of analysis in GIS is as broad as the data entered (Peterman, 1992). Using this tool, archaeologists must also be aware of the problems pertaining to the use of GIS in archaeology. The collection and utilisation of the data that is then entered into the GIS is the first point of concern. This is because the data obtained is done so in the present and as such might not have any bearing on helping understand the past. The use of environmental features such as water sources, climate and vegetation could all have been considerably different from what it is now. This could give rise to predictions or conclusions that are not correct and may be misleading. The GIS only knows what the archaeologist has entered into it and as such bias does enter into the use of this tool. Beyond incomplete data other issues of bias can appear in analysis using GIS. In the construction of a database what constitutes being in one category yet not another can alter the conclusion. The choice of layers to place on the map can also contribute to unintended conclusions. Even with these issues the ability to analyse data in a variety of ways and to come to new understandings of what the data tells us about the past makes it a powerful tool in archaeology (Fletcher & Winter, 2008).

To construct the maps used in this thesis the Geographical Information System (GIS) ArcView ArcMap 9.3 was used. In this program various layers, such as topography, river systems, cadastral and towns etc. were obtained from the National Geo-Spatial Information office in Mowbray, Cape Town. Each layer has an attribute table attached to it which shows different aspects of that layer. For example the river system layer has the names of rivers and whether they are perennial, non-perennial or a stream etc. This allows for various aspects to be displayed when viewing the data. Using the GIS, different attributes can be singled out and displayed for easier

analysis of the layer. By combining multiple layers such as topography, rivers and towns it can be determined if a relationship exists between these features.

2.6.4. Method

Across South Africa there are numerous farms that are currently used for agricultural and livestock farming. The National Geo-Spatial Information office has all these farms as a GIS shape file (a format that allows a visual representation of the data in GIS that is spatially referenced). Having received this data the next task was to determine when these farms where first given their title deeds.

The dates for the first title deeds granted to the various farms were obtained from the Deeds Office in Cape Town. There are issues with some of the farm title deeds that make it difficult to place a single date to it. This was due to the current modern farm being made up of many different farms each granted a title deed at a different time. In cases where more than 50% of the farm area was granted at a certain date, that date was recorded for the whole farm. Where this was not the case the farm date was left blank. This was done to ensure that the farm dates accurately defined the farm. The dates of when the farms were granted their title deed was recorded as a Microsoft (MS) Excel file (See Appendix A). This information was then combined with the cadastral layer of the GIS. The farms could then be attributed different colours depending on the date when the title deed was first granted.

Other features that were added to the GIS were the corbelled buildings. These are displayed as points on the map. To add this feature the location of the corbelled buildings were captured using a Global Positioning Satellite (GPS) in the field. This coordinate data was then entered into MS Excel to make a spread sheet (See Appendix B). Other information about each corbelled building was also entered, such as the name of the farm they are associated with, the type of base structure, the roof shape and whether it has projections or not. Due to the nature of the GPS

coordinates that were entered into Excel further calculations were needed to transform it from degrees, minutes, seconds into decimal degrees.

With this information entered into the GIS, extensive reading was done in order to bring meaning to the data. This was done to place the data of the Karoo in context. Information about the Karoo's natural environment was collected to better understand the geology and vegetation of the area. Information on the history of the Karoo and surrounding areas was important in understanding the fluidity and changes that occurred on this land and how people lived on it. One of the major impacts on the Karoo was the introduction of Merino sheep. To understand why this animal changed the landscape information on its history was examined. To develop ideas of how the land was used, the legislation of farm title deeds and quitrent farms was investigated. This led to information on the structures built on the farms, such as corbelled buildings and wind pumps, being researched. These all showed the change from an open free ranging landscape to a closed segmented use of land. How this landscape changed or resisted change that occurred is why GIS is used. To see how all the aspects fit together and are viewed, landscape archaeology was also researched. In order to obtain these various sources of information a variety of avenues were taken, such as utilising historic books and contemporary research on the Karoo.

All this information was then compiled and interrogated as to whether the Karoo region containing corbelled buildings was an open or a closed landscape as a consequence of the land being increasingly occupied and technology utilised in isolated areas throughout the Cape Colony. How the presence of corbelled buildings relates to this open or closed farming use of the landscape will also be addressed.

Chapter 3: The chronology and distribution of farm title deeds

3.1. Introduction

During the late eighteenth century and the first half of the nineteenth century the boundary of the Cape Colony was progressively shifted eastwards, deeper into ancestral Xhosa territory and northwards, across the Karoo and Bushmanland and by 1847 the area up to the Gariep River had been annexed. Consequently, by the late 1830s all of the land under discussion here had been formally proclaimed as part of the Cape Colony (Figure 2.3). It was in this marginal region that Trekboers adopted a transhumant lifestyle moving as the area allowed in response to the seasonal availability of grazing and water. This transhumant pastoral economy and lifestyle fitted well with the relatively lax control the VOC had over them and their use of interior land. Within this loose control Trekboers still desired legal rights to the land they lived upon. The land changes instituted by the British government from 1813 certainly provided this opportunity. Prior to this date and despite the possession of loan farms, an assumption is that the Karoo would have been a relatively open and easily traversed landscape. Changes to the legal system used by the Dutch East India Company (VOC) and later by the English government meant that Trekboers in the nineteenth century had to apply for farm title deeds in order to claim use of the land. Consequently, as the nineteenth century progressed the amount of untitled or free land decreased significantly. A more extensive approach to livestock farming presumably came under threat when this land ownership through title deed was instituted, as demographic density increased and as more intensive Merino sheep and wool production for export began to dominate Karoo farming from the middle of the nineteenth century. These shifts demanded more of the land and more of Trekboers who must have been confronted by a shift from subsistent transhumant farming to settled intensified farming for profit. The

discussion of the chronology and distribution of farm title deeds that follows is directed at this relationship.

To investigate this relationship the cadastral layer showing the distribution of farms is examined in relation to the dates when each farm in this region was first granted title deeds. There is an expectation that the chronology of the title deeds will geographically follow the progress of the Trekboers and the expansion of the Colony. Thus the earliest farms would be found to the south and east of the Karoo and the most recently deeded farms should be found in the north-west. The raw title deed data is first presented and then assessed in relation to other factors. Primarily title deed date and distribution is compared with key environmental and ecological attributes of the region. Despite the relative homogeneity of the Karoo habitat, subtle variability in key biophysical attributes give rise to gradients with different potentials. Related to the above is how these may complement or not the physiological requirements of the livestock in question. Additionally, prior to the institution of title deeds, much of this area and its livestock management potentials would have already been known and the title deed farms formalised a pre-existing loan farm structure. We can presume at the outset that a north-south trend does not indicate the primary movement of Trekboers given that much of this landscape would have been already in use as loan farms.

It is important to note that no title deeds for farms prior to 1830 were available for this region. It is acknowledged that the land was occupied before the introduction of farm title deeds however ownership of the land was only formally instituted in with the granting of title deeds.

3.1.1. Distribution of farms by title deed date

Examination of the farm title deed data shows a geographic trend in the dates of title deeds. Farms with title deeds granted from 1830 are indeed found in the south of the region, while farms with title deeds granted between the 1870 -1880's are found in the north. The block of farms in the north dating from the 1870's are, however, framed to the east of Carnarvon, by farms that were granted title deed significantly earlier. There are farms with title deeds dating from the 1830's with farm deeds granted in the 1870's to the west of them. Colour coding of the farm title deeds by decade clearly illustrates this distribution (Figure 3.1). The specific date when each farm was granted a title deed is given in Appendix A.

It is important to note that this is a general distribution and that a close look at Figure 3.1 shows that there are exceptions. These exceptions, however, occur almost exclusively in the southern block of farms where most of the title deeds date between the 1830's and 1850's, but there are individual farms and small clusters of later settled farms in an area that is expected to have been occupied at an earlier date. The northern block of farms, although smaller in area, is significantly homogenous in the date of title deeds. I am not concerned with the individual histories of these exceptions, but with the overall pattern. The impression is of a U-shaped distribution of early (≈1830) deeded farms that partially wraps around a block of later nineteenth century farms on its southern and eastern side. In order to discuss this distribution I first outline the history and development of Merino sheep and wool production in the wider region and then briefly address some physiological tolerances that are relevant to managing sheep in this environment. With this background in place I then examine this distribution in relation to the environment and climate. I return, lastly, to historic factors that are also potentially pertinent to changes in the use of land and farming practices in this region of the Karoo.

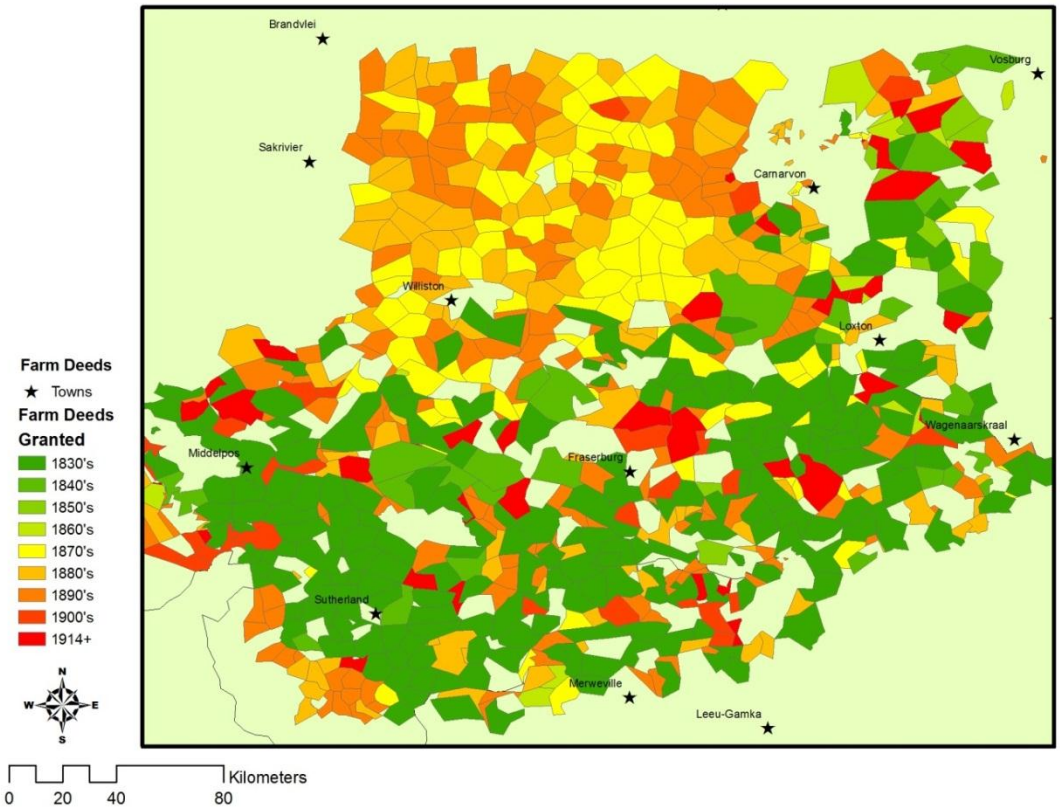

Figure 3.1 Map illustrating the distribution of farms in the Karoo by title deed date and when ownership was first granted.

Before doing this a few comments on the construction of Figure 3.1 are in order. The data sets used in the construction of this map has some limitations. These include the absence of dates of farm title deeds in some areas and the presence of farms with title deeds issued from 1900's amongst farms with title deeds issued in the 1830's (Figure 3.1). This 'speckling' of later (1900+) farm title deeds weakens the impression of the U-shaped distribution, although does not undermine it. The absence of some title deed dates is due to these farms being an amalgamation of a number of different farms of various sizes, each with a different title deed date. In some areas, particularly near towns such as Carnarvon, title deeds were issued on erfs (small household pieces of land) and are not complete farms; therefore are beyond the scope of this project and thus left blank (Figure 3.1). The block of farms with title deeds issued after 1900 is probably due to this land being crown land and thus owned by the government.

3.2. The rise of Merino wool production

While the Karoo is a harsh environment it is suited for small livestock farming and as outlined in Chapter 2, sheep pastoralism for meat was the main source of production, food and perceived wealth in the Karoo. The occupation of the Karoo by European settlers, throughout the nineteenth century, resulted in considerable change in the type and methods of farming used. One significant factor in this change was the introduction of Merino sheep, which resulted in the addition of wool production to the rural economy. Wool production first began in the Eastern Cape and only reached this part of the Karoo in the middle of the nineteenth century (≈1850) (Beinart, 2008). Therefore, the local rural economy can be divided into two broad periods; the predominance of meat production for subsistence and market (before 1850) and wool and meat production (after 1850). The course of this change is important in developing a discussion around the farm title deed dates and the landscape that emerged.

The interactions between the Trekboers, Khoekhoen and San, as described previously, resulted in conflict on the escarpment of the Karoo plateau. The reason for this was due to the environments located to the north, in the Great Karoo and Bushmanland, which lacked the water resources to sustain a large group of people. The escarpment also was one of the few areas the Khoesan could retreat to in the face of European expansion. Furthermore, Khoesan were also pressured from the east by expansionist Xhosa (Anderson, 1985). The encroachment of the Xhosa and Trekboer forced the Khoesan into an environmental corner that resulted in the collapse of their own pastoral economy, a process well advanced by the middle of the nineteenth century (Penn, 2005).

Growing Trekboer dominance, however, was added to by the arrival of the 1820 British settlers. They settled initially in the Albany district (the Dutch already knew this area as the Zuurveld) in the Eastern Cape, particularly in the vicinity of Port Elizabeth and Grahamstown. They soon learnt that the land was not suited for crop

production and after considerable failure those that could afford to, consolidated land holdings and turned to pastoralism (Hockly, 1957). In the early 1830's these new British stock farmers moved north-westerly into the less environmentally favourable areas because the east was already claimed by the Xhosa. This was pioneered in 1823 by Miles Bowker from the Albany district on his farm Groote Pos where he had previously farmed fat-tailed sheep. His success in farming Merino sheep saw a shift in farming practice and the gradual change to Merino sheep was in part due to the change in the wider economy, with wool production being more profitable due to the global demand. The number of Merino sheep increased four times until 1855 when there was estimated to be 6.5 million sheep (Beinart, 2008).

Furthermore, the British farmers obtained land cheaply from the Trekboers who had left with the Great Trek north. As the price of land in the centre of the Colony, around the Karoo, increased there was increased motivation to move to the unclaimed areas of the frontier (Beinart, 2008). The areas settled by these new British farmers became the districts of Fort Beaufort, Cradock, Graaff-Reinet and many others (Beinart, 2008).

These British farmers were interested in intensive farming of animals for profit on large single farms. This way of farming was not possible to the Trekboers living in the more arid parts of the Karoo, particularly the region under investigation. In both the British and Trekboer way of managing livestock, farmers used kraals (small enclosed pens) to ensure the safety of their livestock. This protected the flocks at night from predators and thieves. However, on the negative side, it also meant that flocks were in close proximity with ill or diseased animals which could affect the health of the rest. This could result in the entire flock being lost due to disease. It was believed that the movement of infected herds and the kraaling of animals in the Karoo were the main causes of animal disease and the consequent loss of profit. Additionally, transhumance often led to the loss of animals through predation. To correct these, efforts were made to promote the health of the livestock by increasing the water supplies and enforcing some form of environmental conservation. Those who wished to see these changes to the farming practice implemented in the Karoo and

elsewhere were the wealthy and powerful British descendants who owned large tracks of land, such as Robert Rubidge, the owner of Wellwood farm near Graaff-Reinet (Hockly, 1957). These British farmers wanted to end the migratory lifestyle of the Trekboers for the betterment of all sheep herders without consideration of the environmental limitations found in this region of the Karoo; limitations that intensified westwards towards the Nieuweveld Mountains. The wealthy wool farmers progressively dispossessed 'traditional' but increasingly impoverished white stock farmers, and, the indigenous stock farmers including the Khoesan and Xhosa migrants in the Pramberg and Kareeberg regions (Anderson, 1985).

Victoria West, established in 1844, became the centre around which a wealthy and profitable wool production grew. Poorer white farmers were displaced by the "wool men" and could not financially compete when buying land and their security of tenure was seriously undermined (Anderson 1985:104). With the rise of wool sheep and commercial wool production to the west of the Nieuweveld Mountains, even more marginal land in the Kareeberg became desirable. It is clear that to the east of Beaufort West in the Middelburg and Graaff-Reinet areas, the grazing was better and the carrying capacity higher (Figure 3.2). Here the intensive development of suitably sized single farms for small stock farming could be undertaken. To the west the area required to support equivalent numbers of sheep had to be much more extensive.

Given that the carrying capacity is much lower in the area under consideration there still seems to be a gradient of decreasing grazing potential from the east to the west (Figure 3.2). This did not retard the mid nineteenth century expansion of commercial Merino wool production, and it is therefore briefly worth considering what the biological tolerances of the animals under question actually are.

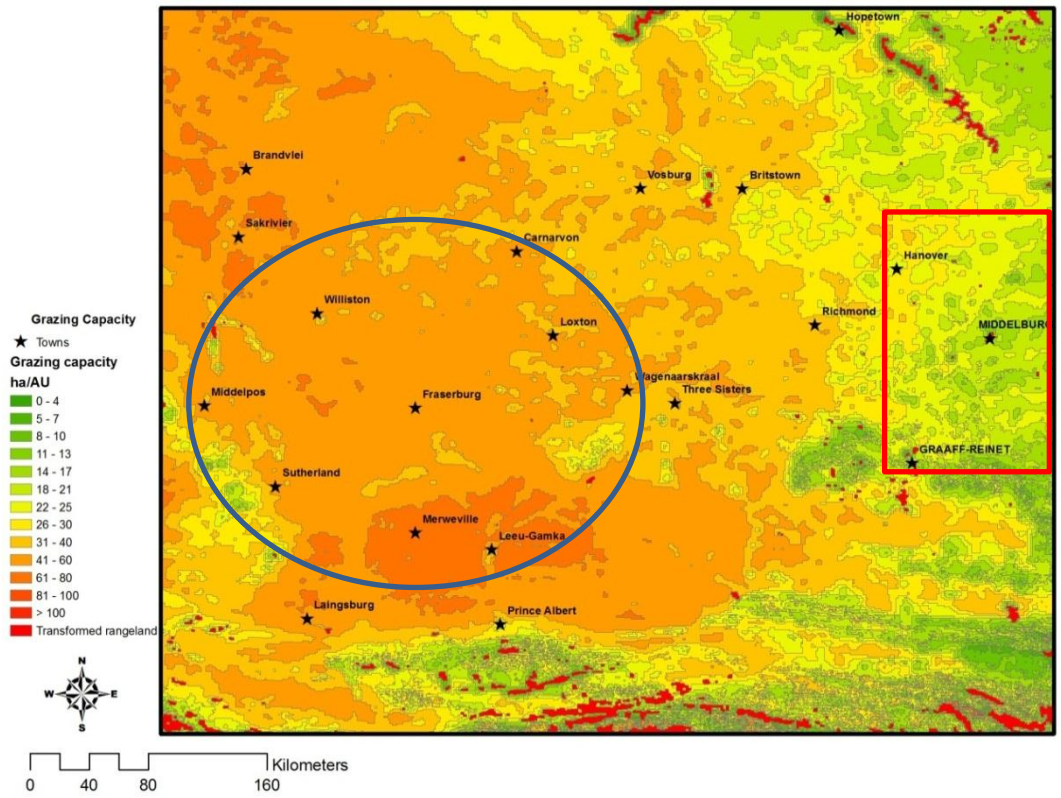

Figure 3.2 Map illustrating the grazing capacity of the Karoo. Green indicates areas of higher/better grazing capacity, while red indicates areas of lower/poorer capacity. The circled area is the region under investigation while the red square area indicates the location of the more prosperous 1820 settler wool barons. (Metadata: http://www.agis.agric.za/agisweb/agis.html)

3.3. Managing fat-tailed and Merino sheep

The fat-tailed sheep, indigenous to this landscape long before Dutch colonisation of the Cape, was the main animal farmed in the Karoo and the interior (Epstein, 1960). This animal was only used for local meat consumption by Khoekhoen and the Trekboer farmers, who adopted this animal and were also successful in farming it, and as noted in Chapter 2, learnt from Khoekhoe how to manage the animal (Epstein, 1960). Transhumance for good grazing led commentators, in publications like the Grahamstown Journal, to remark about “the Trekboer propensity for ‘chasing thundershowers in the wilderness’” (Anderson, 1992; 104).

The biology of this sheep was well suited to this environment. The accumulation of fat in the tails, rather than around their bodies meant that they did not have a layer of fat insulating their organs, thus decreasing their susceptibility to heat stress. This adaptation allowed fat-tailed sheep to perspire and shed heat more easily. Other features such as long legs and their natural tendency to group together when threatened by predators meant that they were well suited to this difficult environment (Beinart, 1998).

In contrast the Spanish Merino sheep that were first introduced in South Africa in the late 1780's were not so well adapted. In the latter part of the eighteenth century Robert Jacob Gordon brought in Merino sheep from Spain, where they were farmed mainly for their wool, which was of a high quality (du Toit, 2008). This new species was viewed with some suspicion by the local Trekboer farmers and was largely ignored and dismissed by them. The reason cited was that the local fat-tailed sheep were already well suited to the environment and thus there was no need for a new breed of sheep to be introduced. Furthermore, early in the nineteenth century there was no obvious reason, attraction or market for wool production and it was only later in the nineteenth century that they were considered a feasible option.

The original Spanish Merino sheep have undergone many changes, mainly due to interbreeding with fat-tailed sheep breeds. The outcome was a breed better suited for the South African environment, and yet capable of producing both meat and wool. To understand the requirements of Merino and other contemporary sheep breeds studies on biological tolerances have been conducted. In light of the above however, these findings may not accurately describe the requirements of the original Merino sheep which were not as well adapted to this environment. Thus the physical tolerances described below would be lower for first Merino sheep that were brought into the Karoo in the nineteenth century (Epstein, 1960).

Obviously the ability and opportunity of farmers to provide adequate grazing for their sheep is essential for a healthy flock and profits. As noted, there are considerable gradients in carrying capacity and various intensive or extensive

strategies to meet grazing requirements that could and would have been employed. Additionally, grazing on dry grass, typical of summer vegetation in the Karoo, increases Merino water intake which is not supplemented by water present in the vegetation (Macfarlane *et al*., 1966b).

Of greater concern is the effect of temperature on Merino sheep as this may influence reproduction, health and wool production. Prolonged exposure to temperatures above 32.2^{0}C can result in lower reproduction rates (Schoenian, 2010). Temperatures above 38^{0}C can result in heat stress which causes smaller and weaker lambs to be born (Brown *et al*., 1977). This suggests that to maintain healthy flocks and to ensure that lambs survive, merino sheep should be herded to cooler regions during summer. In contrast the indigenous breeds such as the Afrikaner fat-tailed sheep were already well adapted to the heat (Pourlis, 2011).

Heat also affects the water requirements of livestock. As the temperature rises so too does the animals need for water which is used to aid evaporative cooling (Degen & Young, 1981). Higher temperatures also increases the amount of water turnover and the loss of total body water (the entire amount of water stored in the body) requires considerable water to supplement this loss (Degen, 1977a). This danger is more acute for pregnant Merino ewes where water turnover increases by 20% (Degen, 1977b). Additionally, increased water turnover is also more evident in shorn sheep compared to those with wool. In summer when midday temperatures of 36-38^{0}C are reached, water turnover rises from 81.5 to 159 ml/kg/24hr (Macfarlane *et al*., 1966a). The wool coat also helps protect Merino sheep from radiant heat, making them less susceptible to heat stress during the hot summers (Parer, 1963).

Access to water is essential for Merino sheep and with higher temperatures more water is needed to keep the animal healthy. As noted, temperature affects water consumption, and when temperatures reach 35^{0}C water intake for Merino sheep is doubled (McGregor, 1986) and when temperatures exceed 38^{0}C sheep become lethargic and abandon their movement to water (Daws & Squires, 1974). Without access to pasture with sufficient water content there is an increase of 25% in the

mortality rate in pregnant ewes (Lynch *et al*., 1972). These statistics show that water sources need to be readily accessible, especially in semi-arid environments like the Karoo.

Thus although Merino sheep are marginally suited to semi-arid environments their heat tolerances limit its productivity. High temperatures adversely affect the animals' ability to retain water and reproduce successfully. As a result areas of cooler climate and with better water availability would be ideal for this breed beyond the primary grazing requirements.

For a Karoo farmer to successfully raise sheep, particularly Merino sheep, he would need to acquire land that is suitable for their management. Given that Merino sheep have physiological limits to healthy reproduction, I outline key biophysical attributes of the region under discussion in order to define areas of greater or lesser potential and then make comparisons with the distribution and chronology of farm title deeds. The general history of Merino sheep outlined above is added to this discussion.

3.4. Topography

To understand the movement of people and animals across this region of the Karoo, topography is obviously an important factor. Topography is also linked to differences in height, affects temperature, rainfall and the movement of animals as well as people and thus I consider this aspect first.

The contour map (Figure 3.3) is dominated by the escarpment defined by the Roggeveld Mountain stretching from the north-west and the Nieuweveld Mountains in the south continuing to a north-easterly direction. These mountains form a border separating the high plateau of the upper Karoo from the lower Karoo, in the south, and rain shadow valley Karoo, in the west.

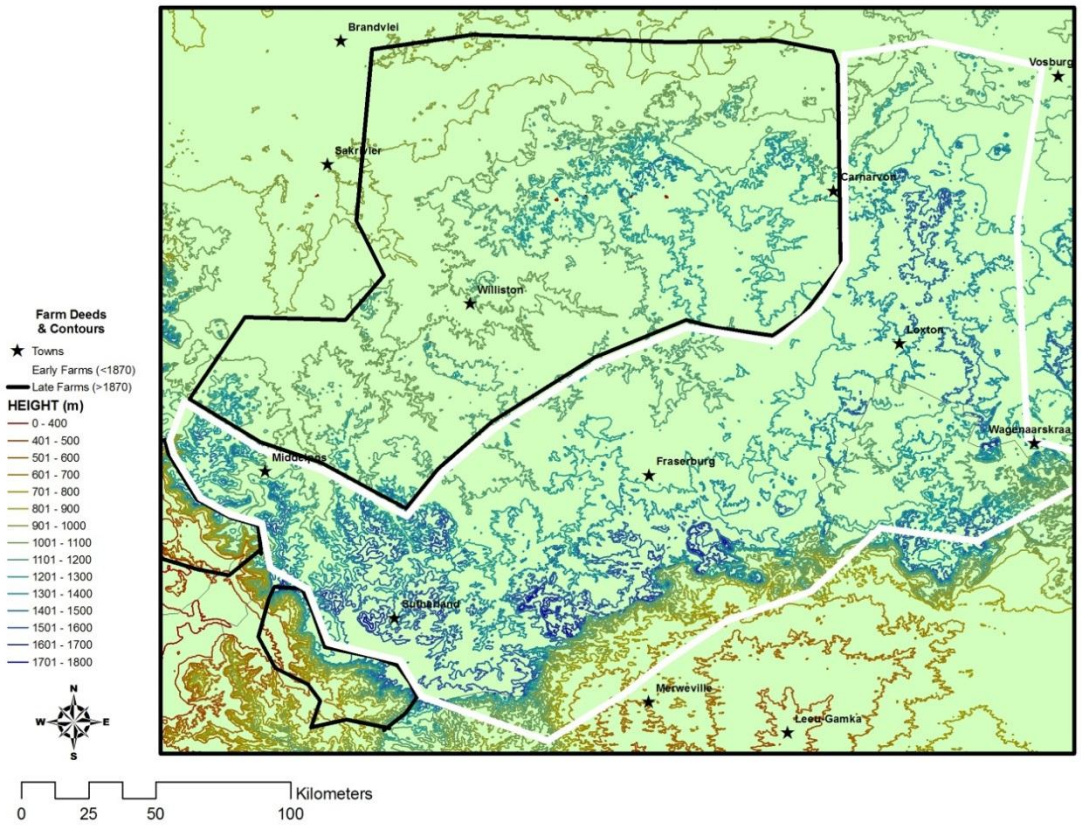

Figure 3.3 Map illustrating the topography of the Karoo region. An overlay of a simplified distribution of farms by title deed date and when ownership was first granted is shown.

In Figure 3.3 the distribution of farm deeds grouped by date are overlaid on the contour map. The early title deed farms dating between 1838 and 1869 (outlined in white), are situated on the escarpment and higher parts of the Roggeveld and Nieuweveld Mountains and on the plateau areas relatively close to the escarpment edge. The majority of these farms are found on ground above 1200m. This broadly, but not entirely, corresponds to the higher ground of the escarpment and an immediate note to be made is that this roughly correlates with the U-shape distribution of these farms. The later farm title deed group, after 1870 (outlined in black), are distributed mainly on the lower parts to the north west of the plateau, typically below 1100m and in the centre of this U-shape. Although there is no distinct topographic boundary dividing these two groups there does appear to be a correlation between height and title deed date.

In the south-west, on the southern slopes of the Roggeveld Mountains, there is a cluster of farms with title deeds granted after 1870. The south westward side of the Roggeveld Mountains overlooks the rain shadow valley Karoo biome. Historical records (Barrow, 1968; Penn, 2005; Legassick, 2010) show that this area was incorporated by the end of the eighteenth century into regional transhumant patterns, where the Roggeveld escarpment in the north and the eastern Cederberg to the west, provided summer grazing and the lower Karoo areas were used in winter. Farmers in these areas today still own winter and summer farms between which they seasonally move their flocks. In the eighteenth and early nineteenth centuries this system would have been based upon loan farms, and title deeds dating to the 1870's may reflect the formalisation of this system based upon owned farms rather than loan farms.

3.5. Water

An examination of the distribution of available water sources is clearly critical in assessing variability in the productive capabilities of an area, especially in this region of the Karoo. Water is a fundamental requirement for residence by both people and animals. This involves available surface water, occurring in natural form or captured in dams and reservoirs, underground water which if extracted is available to farmers for drinking and for irrigation and rainfall, which replenishes these sources but more immediately is critical for plant growth, grazing and crop production.

3.5.1. Rainfall and evaporation

A major requirement for successful farming in this region is adequate rainfall (Chapter 2). Anderson (1992) commented that the Trekboers relentlessly followed the thundershowers because of the growth response of grass and adequate water for drinking.

The map of the mean annual precipitation shows that much of the area under consideration receives an annual precipitation between 0-200 mm per year (Figure 3.4). A second area in the form of a band of rainfall between 201-400 mm per year, follows the higher topography of the escarpment. Most of the early title deeds were granted to farms in the 201-400mm zone and this again highlights the U-shape distribution of the early title deed group as noted for altitude noted above (Section 3.4). The zone of greater precipitation follows the higher contours of the Roggeveld and Nieuweveld Mountains as seen in the topography map (Figure 3.3). This distribution suggests that the first granting of title deeds were in areas of higher rainfall to ensure adequate water and grazing for livestock.

The later farm title deed group is located in the centre of the lowest (0-200mm) rainfall zone (Figure 3.4) and it is clear that none of these later farms are found in the higher annual rainfall areas. My general division between this group and the earlier farm title deed group is clearly not defined by rainfall, but the block of farms with later nineteenth and early twentieth century title deeds to the north are located in the lower rainfall zone.

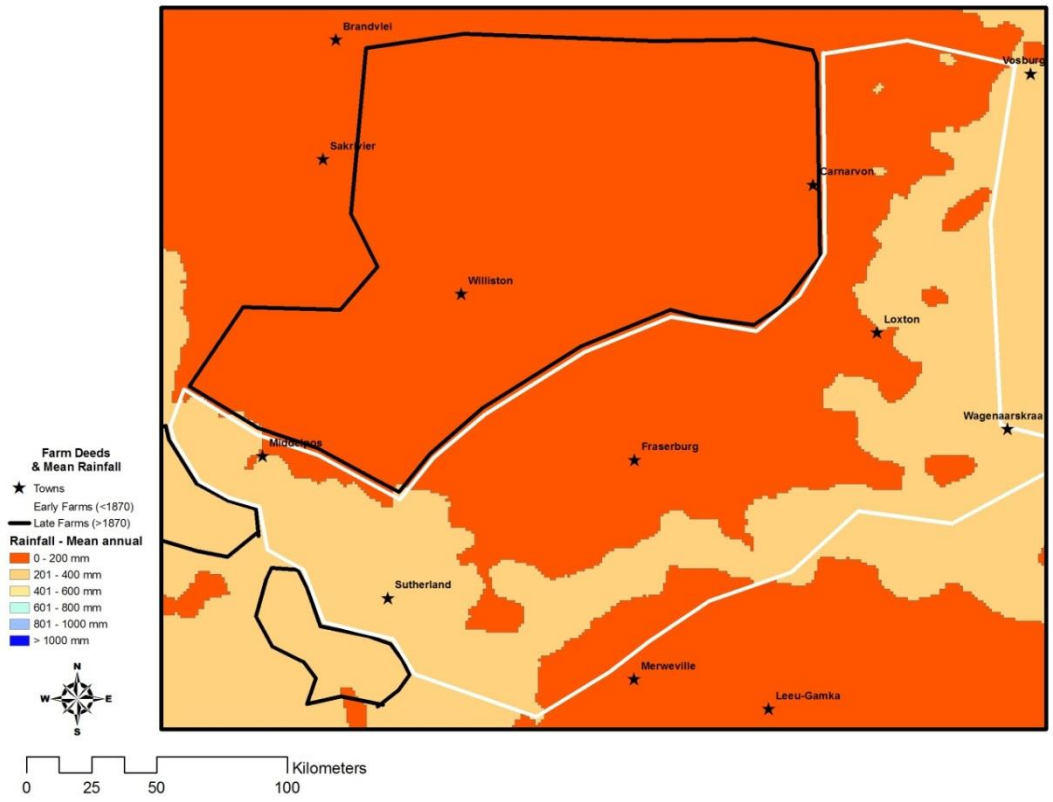

Figure 3.4 Map illustrating the mean annual rainfall of the Karoo region. An overlay of a simplified distribution of farms by title deed date and when ownership was first granted is shown.

The topography of this region is a major factor influencing the rainfall, and there is a good correlation between early title deed farms within the high rainfall escarpment area and the marginal rainfall areas of the north, where the more recent title deed farms are located. In relation to altitude and rainfall, these two variables obviously are closely interlinked and contribute to define the escarpment areas as areas that were purchased first. Rainfall and resultant lack of agricultural potential and grazing capacity in a region is not the only limitation. Evaporation rates may shed more light in understanding why farmers settled areas when they did.

Rainfall is obviously an important factor for any form of farming, but intensity and rate of evaporation can negatively affect the value of absolute rainfall and adversely influence the suitability of the land for occupation. Areas with high evaporation rates are drier and obviously impact the longevity of surface water. Evaporation also

affects the vegetation which, in adapting to the environment, would consist of more succulents and other hardy shrubs, mitigating water loss.

In Figure 3.5 it is clear that much of the northern part of this Karoo region has the highest evaporation rate of more than 2400mm per annum, with pockets of lower evaporation rates along the western part of this region. The evaporation rate decreases in the south-east. As one can expect, the lowest evaporation rates are found along the mountains bordering the upper Karoo. This again shows the importance of the topography on the climate of an area.

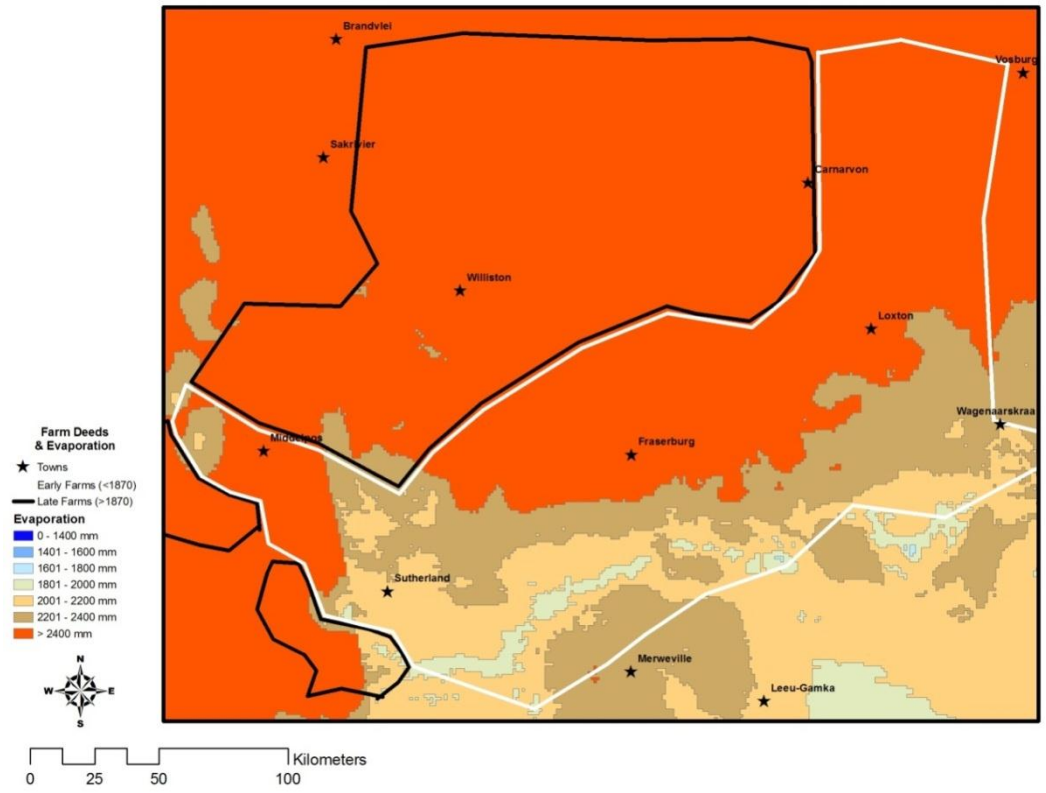

Figure 3.5 Map illustrating the evaporation rates of the Karoo region. An overlay of a simplified distribution of farms by title deed date and when ownership was first granted is shown.

When comparing the overall potential of precipitation in this region, it is evident that the northern parts are significantly water stressed. The low rainfall (0-200mm) coupled with the extremely high evaporation rates (>2400mm) make this the driest area. Along the mountain ranges in the south and west, there is an improvement in

the amount of rainfall (201-400mm) and a decrease in the evaporation rates (2001-2200mm), and despite the modest shifts in these factors, should in theory make this more suitable for farming.

3.5.2. Grazing capacity

From the 1830's, Merino farming was increasingly successful to the east of the Nieuweveld around Graaff-Reinet, for example where there is a high carrying capacity for grazing. From the 1840's and 1850's there was a subsequent spread westwards of the Nieuweveld into the region of the Karoo under investigation with environments of lower grazing capacity. Compared to the grazing capacity in areas to the east, around Graaff-Reinet (Figure 3.6) the grazing carrying capacity of this Karoo region, circled in blue, is low.

Grazing capacity is expressed as a hectare/animal unit (AU), which is defined as the amount of land (in hectares) required to support one animal. An animal unit is arbitrarily defined as an animal weighing 450 kg, which gains 0.5 kg/day on forage with a digestible energy percentage of 55% (Smit, 2009). The areas around Graaff-Reinet have grazing capacities of less than 17 ha/AU, compared to the area circled in blue (Figure 3.6) which has a grazing capacity of 41-60 ha/AU. Clearly, well over double the land is required to feed one AU. The poor Karoo grazing is linked to the lack of water, in particular rainfall.

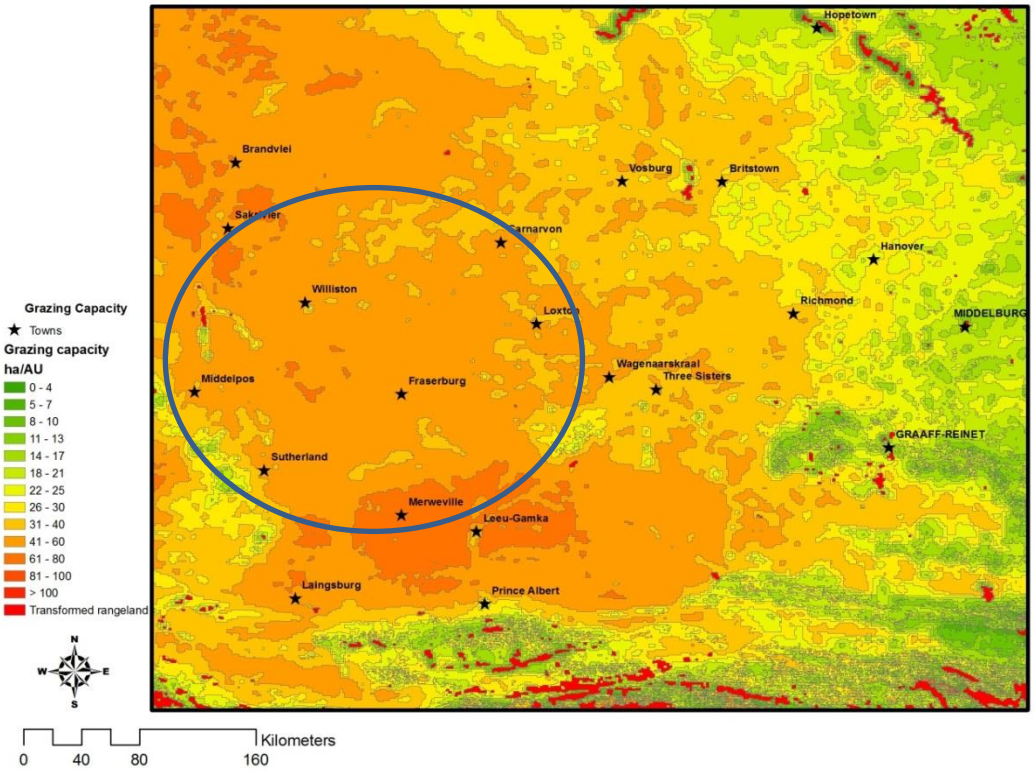

Figure 3.6 Map illustrating the grazing capacity of the Karoo region. Green indicates areas of higher/better grazing capacity, while red indicates areas of lower/poorer grazing capacity. The circled area is the region under investigation. (Metadata: http://www.agis.agric.za/agisweb/agis.html)

More specifically, an examination of the grazing capacity of circled area of the Karoo (Figure 3.6) indicates that there are areas of higher and lower carrying capacity. The highest grazing capacity is found in the south, south-east and east with the lower carrying capacities being found in the north. This is linked to the more suitable grazing areas with a greater carrying capacity for livestock in the range of 20-30 ha/AU. Over most of the area, however, the grazing capacity is much lower, in the range of 41-60 ha/AU. Clearly, the areas of better grazing broadly correlate with the higher areas of the escarpment where better rainfall is experienced and this distribution follows the U- shape seen in the topographic map (Figure 3.3) that partially encloses the central plateau lands.

I have already established that there is a broad correlation between farms with title deeds granted before 1870 and the fringing escarpment areas with a concentration on the slopes and higher ground of the mountains. Once again, if we assume that

earlier title deeds represent land that would have been purchased earlier in the nineteenth century because of its greater pastoral potential then the higher carrying capacity there further compounds this correlation. However, it is clear from Figure 3.7 that the earlier 1830 title deeds extend northwards into the poor grazing areas and similarly the farms that were granted title deeds after 1870 are also located in areas of poor grazing and consequently this correlation applies only broadly.

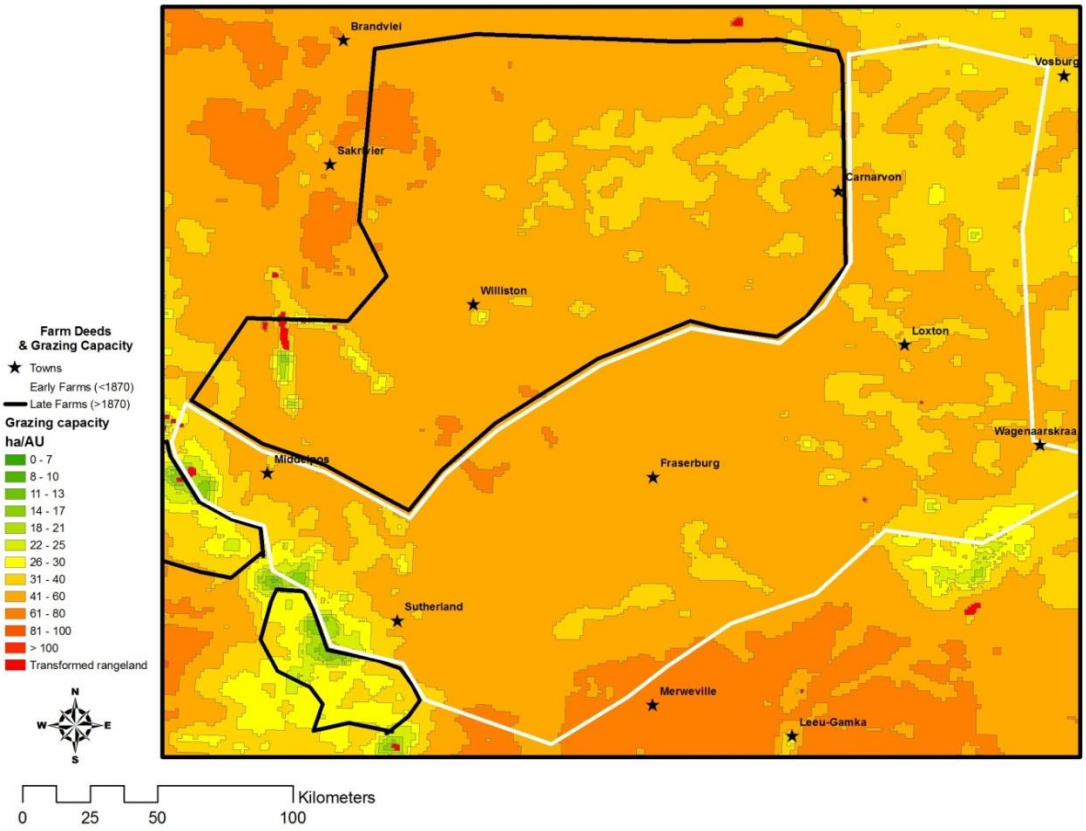

Figure 3.7 Map illustrating the grazing capacity of the Karoo region. An overlay of a simplified distribution of farms by title deed date and when ownership was first granted is shown (Metadata: http://www.agis.agric.za/agisweb/agis.html).

The later farm deed group is located in an area with poor grazing. However, to the west and north of Carnarvon, is a 'tongue' of land with better grazing capacity on which some of the later farms were deeded. This belt of better grazing correlates with a mixed topography that is higher in altitude (Figure 3.3) and the two are correlated. In keeping with the assumption that areas with better conditions for pastoralist management would have been purchased earlier it is of interest as to

why farms on this belt of better grazing date later in the nineteenth century. This is a valid question and one that I return to below with a consideration of other variables.

In general the grazing capacity of this region is comparatively homogenous, with small localized areas of better or poorer grazing conditions and there is clearly no categorical correlation between the distribution of better grazing and the distribution of farms with later title deeds from those settled earlier. Although grazing capacity is calculated independently form potential rainfall, rainfall is still vitally important for livestock and agriculture to be viable. A high grazing capacity may be unusable due to the lack of adequate water supplies for livestock, thus making the area in question unsuitable for farming. Thus while it is naïve to identify grazing capacity in isolation as a factor that does not account for the title deed separation, a consideration of the availability of rainfall and surface water, in particular rivers, clearly influences the productive potential of the land and it is to this that I now turn.

3.5.3. Rivers

In the Karoo obviously the availability of water is essential for livestock and people. As this is a semi-arid region, that is prone to droughts, I only consider perennial rivers and pans/dams (Figure 3.8).

There are three major rivers in this region, the Vis, Riet and Sak, each of which flows north-west and have tributaries in the south that arise on the watershed caused by the escarpment mountains that fringe the area in the east and in the south. The general flow of these rivers is a result of the topography of the escarpment, seen in Figure 3.3, where the gradient of the plateau dips in a north- westerly direction.

It is clear from Figure 3.8 that the main rivers and their tributaries are concentrated in the south of the region and consequently, mainly flow through the areas with early farm title deeds. The majority of farms with early title deeds (1830) are found

along these rivers, indicating that access to water was of primary concern to the early settlers. The later farm deed group is framed by the Sak and Vis rivers and by pans in the north-east. There are only a few tributaries of the Sak River that cut through this area making access to a perennial water supply difficult. Additionally, there is a lower density of pans or dams in this later grouping. As noted above, while there are areas of higher grazing in this northern region, a scarcity of surface water may have reduced its value, until artificial means of harnessing water later in the nineteenth century were developed.

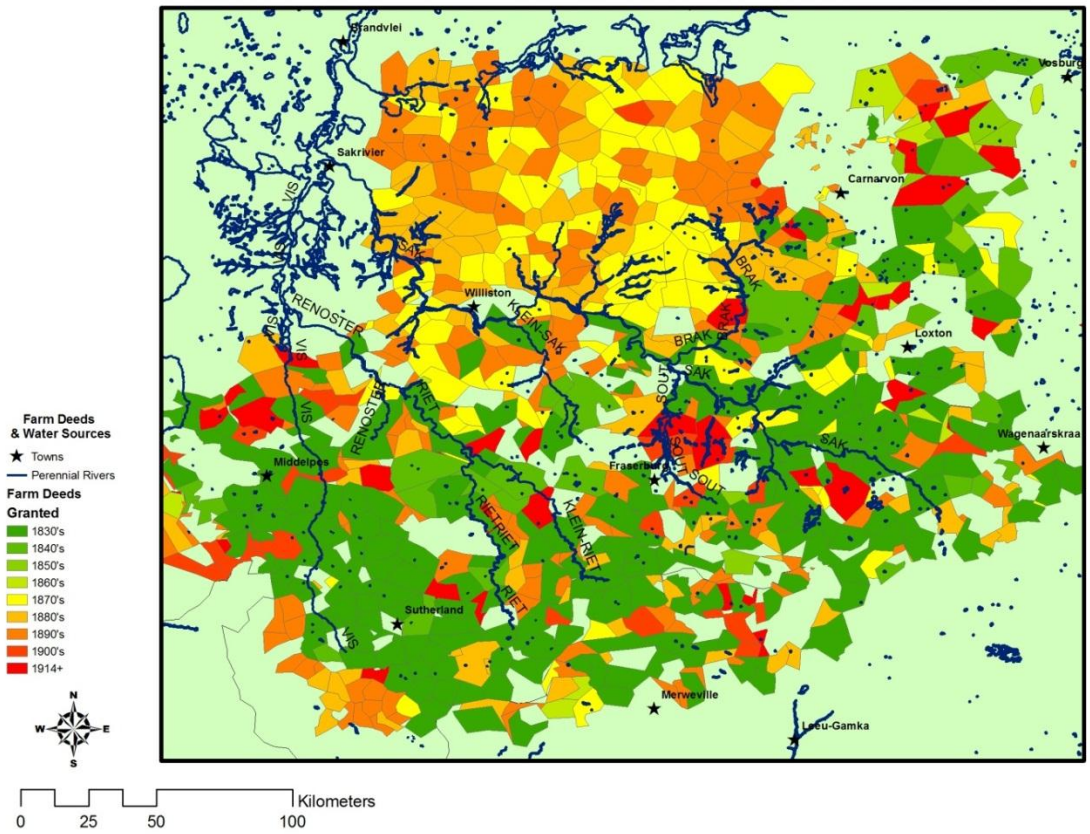

Figure 3.8 Map illustrating the distribution of rivers and dams or pans (black dots) of the Karoo region. An overlay of the distribution of farms by title deed date and when ownership was first granted is shown.

It is interesting to note that Brak and Sak rivers follow the border between the early and later farm deed groups in the centre of the map (Figure 3.8). The distribution of pans and dams is of a scattered nature, with many of the early title deed farms having one or more of these features located within their borders. The construction

of dams to capture rainfall runoff and store water from springs and was a simple method of retaining water for farming and domestic use. The first dams were of simple construction and were built by farmers at the beginning of the nineteenth century (Barrow *et al*., 1807) and it was only later in the 1880's that larger dams were constructed by farmers to improve availability of water (Beinart, 2008).

Rivers do not seem to have been used as features to define farm boundaries, but for the most part, farms straddle them. An example of this can be seen along the Vis River where none of the 20 farms have borders defined by this river (Figure 3.8). This pattern may indeed reflect earlier loan farm boundaries, deliberately defined to ensure optimal use of the water flowing through the property. A consideration of access to river water downstream clearly created tension and to mitigate conflict over water, particularly over rivers, riparian law was introduced by the British when they gained control of the Cape Colony in 1806. It seems however, that it was from the mid nineteenth century onwards that this law was increasingly used to address disputes. Riparian law treated water rights in the same way as land rights which stated that land was owned by individuals who had legal documentation supporting their ownership. This occurred because land was seen as a scarcer resource than water which resulted in less stringent laws being placed on water. Although this was the case, in 1856 a judgement by Judge Bell laid out that riparian rights extended to all owners of a river course (Tewari, 2009). Additionally, there was a hierarchy in the use of water which was that only after the vital criterion was fulfilled, namely the use of water to support human and animal life, could it then be used to increase vegetable life, and finally extracted and transported by a mechanical device (i.e. a water mill) (Tewari, 2009). It is important to note that only water flowing through a farm was subject to these hierarchy criteria, while water arising on a farm, such as springs, was privately owned (Tewari, 2009).

3.5.4. Geology and wind pumps

The distribution of surface water suggests that there is a slight link between the density of this resource and the date of farm title deeds and underpins the imperative of access to water in this semi-arid region. Another source is the subsurface water provided by fountains and springs scattered across this region of the Karoo. While rainfall is obviously critical for grazing, and to provide natural, and more dispersed sources of drinking water, it is around springs and fountains that farm erfs were developed and the close relationship between farm erfs and springs is almost universal in the Karoo.

The Karoo has large deposits of underground water and the presence of ground water and the specific points at which groundwater emerges is determined by the underlying geology and the presence of particular rock types. A growing knowledge of the presence of these subsurface water resources freed stock farmers from a dependence on spring and fountains especially with the advent of wind pumps.

The underlying geology is dominated by three main rock types, shale, arenite and mudstone (Figure 3.9). The main concentration of mudstone is in the south-east with the arenite band separating it from the shale in the north. Shale and arenite retain less water, compared to mudstone (Hodgson, 1987). Other rock types such as tillite and dolerite are scattered in small pockets across this region. When viewing this geology against the farm title deed overlay, the early farm deed group is located mainly on the mudstone rock type, while the later farm deed group follows the arenite band. This factor may additionally have contributed to some of the early nineteenth century settlement in the south where mudstones clearly dominate with their ability to retain water and from which stock farmers could obtain ground water (Hodgson, 1987). The characteristic U-shape of the earlier farm deed grouping, which does roughly correlate with other variables (Figures 3.4, 3.5, 3.7), does not seem to be influenced by the geology because earlier deeded farms also occur in the north-east and are located on rocks less suitable for groundwater retention.

Early attempts to access ground water were made by digging wells near or on natural fountains. It is likely that the introduction, in the late 1870's, of new drilling techniques and other technologies allowed for the settling of land with a geology not conducive to ground water retention. In this regard, it may be significant that the farms in the north, in an area with less surface water and a geology less conducive to subsurface water retention, date from the 1870's, when drilling technology and wind pump technology liberated groundwater for use.

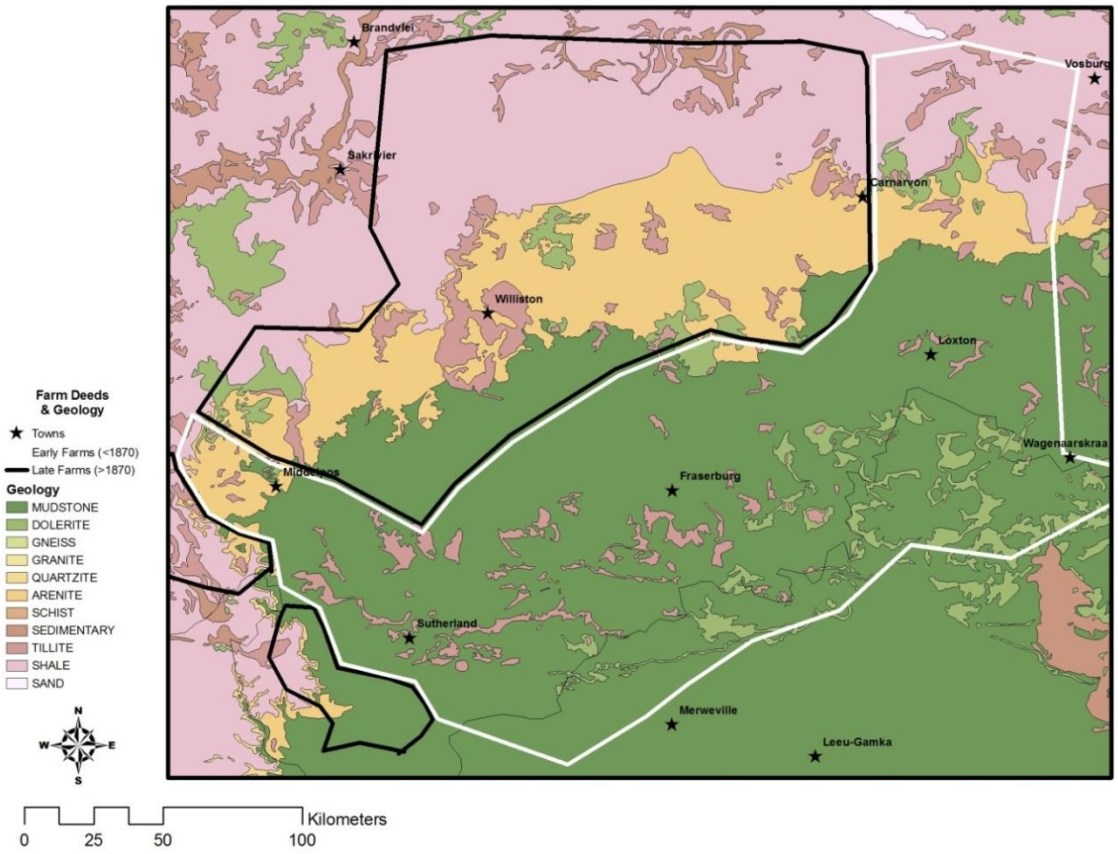

Figure 3.9 Map illustrating the different rock types of the Karoo region. An overlay of a simplified distribution of farms by title deed date and when ownership was first granted is shown.

Access to ground water became viable as technological developments in drilling for water improved. The introduction of the wind pump resulted in more of the landscape becoming available for farming and grazing. The first imported wind pumps, the Halladay Standard Wind pump, arrived in 1874. It was manufactured in the United States and imported by P.J. du Toit of Hopetown (Walton & Pretorius, 1998). This wind pump was a wooden construction and was popular in the town of

Graaff-Reinet. An indication of the spread of this type of wind pump is seen in a drawing based on a photograph of two Halladay Standard Windmills on a Karoo ostrich farm published by the South African Illustrated News in 1884 (Walton & Pretorius, 1998). Other types of windmills such as the Marvel Windmill were also constructed to pump water. This windmill, also made of wood, was first installed around 1897 on the Adendorp farm in Graaff-Rienet (Walton & Pretorius, 1998). It was only with the advent of an all-steel frame wind pump that imports increased dramatically and spread more widely over the Karoo. While this new type of windmill was patented in 1855 by the U.S. Wind Engine and Pump Company, this type of steel wind pump was only introduced into South Africa in 1895 by the Aermotor Windmill Company (Archer, 2002). As with every new technology, it was not cheap. What encouraged this spread was the boom experienced by the ostrich feather industry to the east of the escarpment (Archer, 2002). This had the effect of lowering wind pump costs allowing poorer farmers in the western Karoo to afford this technology.

The lack of surface water obviously made the advent and import of wind pumps vital in expanding and intensifying small stock farming in the Karoo. Although springs are scattered across this region they were not evenly distributed and areas in the north had fewer surface water sources to draw on (Figure 3.8). Consequently, the development and importation of a technology to exploit underground water may have been a factor in opening up the northern areas of the research region, where there is a dense block of later nineteenth century land purchases.

3.6. Temperature

One of the main factors for livestock management in this region is temperature. Merino sheep in particular, while relatively hardy, will die if exposed to extreme temperatures beyond their physiological tolerance. Although these extremes are

less likely to occur in most regions, high and low temperatures do however affect the animal's productivity and ability to successfully reproduce.

The mean maximum temperature of this Karoo region varies considerably with altitude (Figure 3.10). The Roggeveld Mountains in the south have a temperature range (27.1 - 29 ^{0}C) that is lower than lower altitude areas to the north, while to the south and west there is a more pronounced increase in temperature. The 29.1 – 31 ^{0}C temperature zone follows the lower contour lines to the north of the plateau. It also correlates with the areas of better grazing seen in the grazing capacity map (Figure 3.7), above.

The general trend of the earlier farm title deed group to follow a U- shape of the more favourable farming areas is seen to some degree in the mean maximum temperature map (Figure 3.10). The early farm title deed group is located along the 27.1 – 29 ^{0}C band (light green) from the east and in a northward direction. The majority of this early farm group is however, located in the 29.1 – 31 ^{0}C zone (light orange), bordering the later farm title deed grouping. This zone is more suitable for livestock farming due to the maximum temperatures being lower. It is only in the south-west that this early farm grouping is found in zones of high temperature, 33.1 - 35 ^{0}C (red). An explanation for this is that this zone is also in a more favourable rainfall and grazing region (Figures 3.4 and 3.7). It is of interest that the early farm title deed group does not follow the more equitable 29.1 – 31 ^{0}C temperature zone westwards along the high ground/better grazing 'tongue', while some of the early farms in the north are located in the hotter 31.1 – 33 ^{0} C zone.

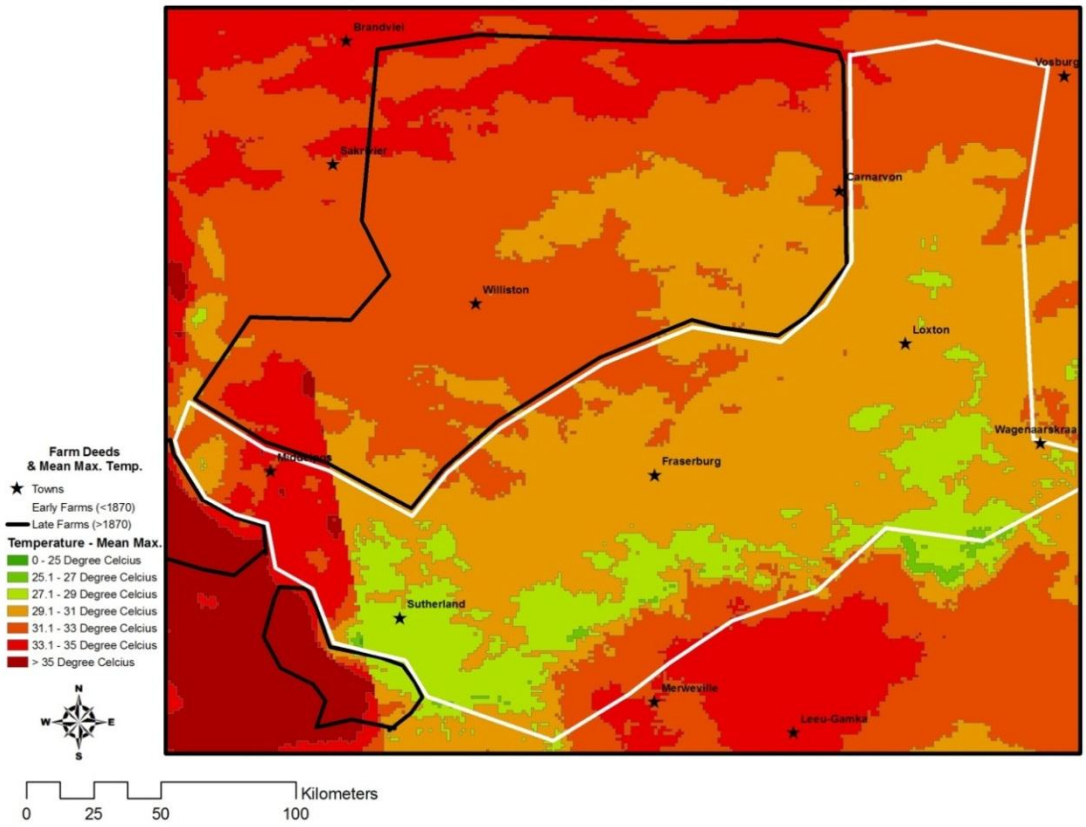

Figure 3.10 Map illustrating the mean maximum annual temperatures of the Karoo region. An overlay of a simplified distribution of farms by title deed date and when ownership was first granted is shown.

The later farm title deed group is primarily situated in the 31.1 – 33 ^{0}C zone (dark orange) in the centre of the mean maximum temperature map (Figure 3.10). This group extends north into the hotter temperature zones, as well as to the east into the 29.1 – 31 ^{0}C 'tongue'. Trekboers moving to this northern area would have very limited access to other areas with cooler temperatures. This coupled with the temperature tolerances of Merino sheep would make it difficult to successfully farm here, especially when the productivity of the sheep is compromised by the climate during the hot summer months.

The mean minimum temperature map shows a large cool zone (0.1 - 2 ^{0}C) in the north, with slightly warmer temperatures (2.1 - 4 ^{0}C) in the south (Figure 3.11). Within this cooler zone, to the east, is a large region characterized by colder temperatures (-1.9- 0 ^{0}C). The warm temperature band in the south (green) contains another belt of even warmer temperature (4.1 – 6 ^{0}C) (yellow). These warmer zones

of mean minimum temperature follow the mountain ranges in the same way that the rainfall and evaporation rates do (Figures 3.4 & 3.5). There are other pockets of different temperatures that are probably due to local conditions, which for this description are ignored as they do not add to the general trends affecting this region.

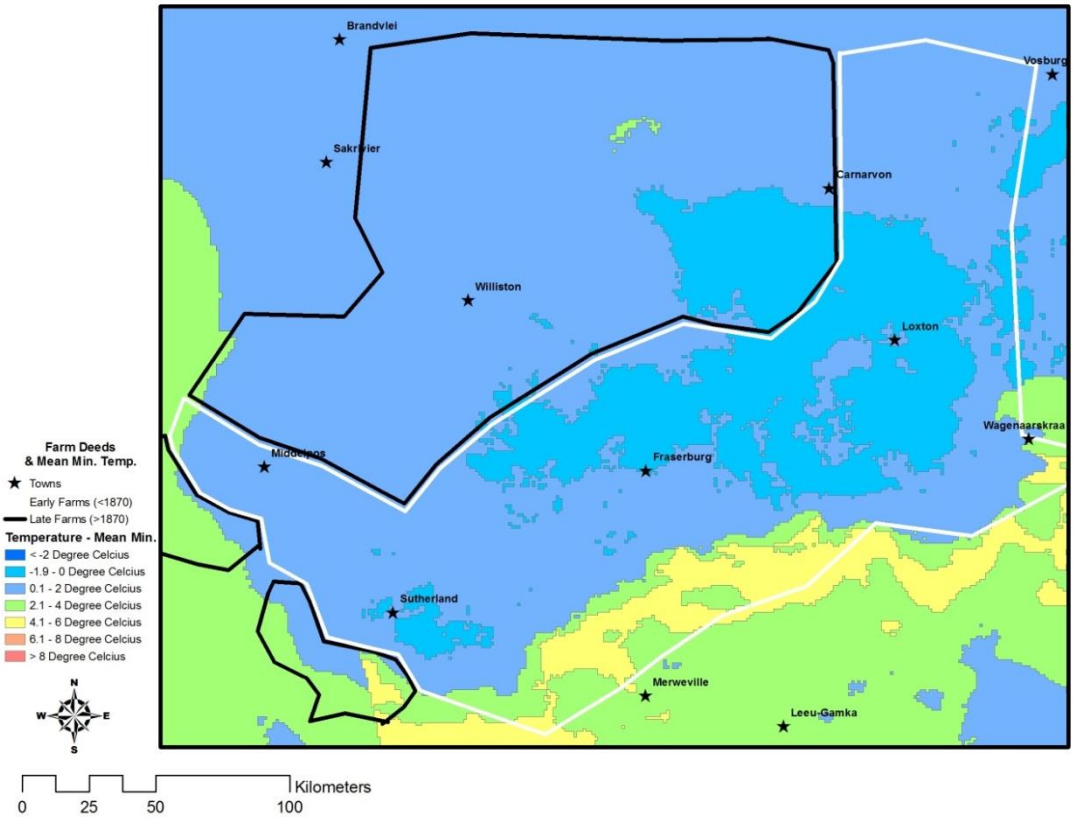

Figure 3.11 Map illustrating the mean minimum annual temperatures of the Karoo region. An overlay of a simplified distribution of farms by title deed date and when ownership was first granted is shown.

The early farm title deed group is not located in any distinctive mean minimum temperature band. Those farms found in the warmer band have no particularly strong trend that can be commented on. Thus the overall trend of the mean minimum temperature adds no additional information on the distribution these farm deed groupings. Thus the maximum temperature of this region of the Karoo is more pertinent to when the first title deeds for farms were granted, as this has a greater effect on the health of sheep. The influence of temperature could be mitigated against by herding livestock to more equitable areas.

The purchase and establishment of farms would encourage farmers to invest in the land to which they had legal rights and greater permanence would also encourage farmers to supplement their diet and grow crops and vegetables. This could be true of the first farmers establishing themselves on this Karoo landscape as they would try and recreate a version of their past European lifestyle (Beinart, 2008). Farming for food other than sheep would have been another consideration that would contribute to certain areas being more favourable than others.

3.7. Food on the frontier

The main source of food in the nineteenth century Karoo was the by-products of pastoralism, mainly meat and milk. This production was geared to mobility and transhumance and generally this would have discouraged a greater residential permanence required for crop production. However, where favourable land, with suitable soil and climatic conditions was found, Trekboers were quick and eager to plant crops both for their own consumption like onions, rice, pumpkin and pepper and for their livestock (Burchell, 1824; Barrow, 1968).

Grains such as wheat and barley were also planted, but due to the nature of the environment these often failed. This was mostly due to poor and unpredictable rainfall and unproductive soil (Howison, 1834). Not surprisingly farmers were less interested in growing cereals, especially where their energy could be better used caring for their flocks (Barrow, 1968). However, the presence of corbelled building *kafhokke* (chaff storage buildings) and associated *trapvloers* (threshing floors) suggests that where the conditions were favourable cereals were intensively farmed (Kramer, 2012). In the east around Graaff-Reinet mealies (corn) was grown (Theal, 1897). These crops were often sold rather than kept back and stored for personal consumption. As reported by Lichtenstein (1928), bread was a scarce foodstuff and was only given to honoured guests. Thus there are indications that where possible

people invested time and energy into crop farming but the general environmental conditions of this region of the Karoo meant that pastoralism was still the main farming industry.

While there are zones with different soil potentials scattered across this landscape, the soil potential map (Figure 3.12) shows that much of this Karoo region is not suitable for arable agriculture. In the south and east the mountain ranges of the Roggeveld and Nieuweveld are not suitable for agriculture (orange) because of rock and shallow soils associated with mountainous regions. To the north are pockets of soil with no dominant soil class. Scattered between these zones are areas of suitable and intermediate agricultural potential; green and light green, respectively. The soils most suitable for crop farming are mainly found along river courses such as the Vis River in the west (Figures 3.6 and 3.12) where the soil is deeper and more nutrient rich. In the north, between the towns of Sak River and Carnarvon are soils of intermediate suitability for agriculture but any potential they may have is limited by the availability of water (see Figure 3.4).

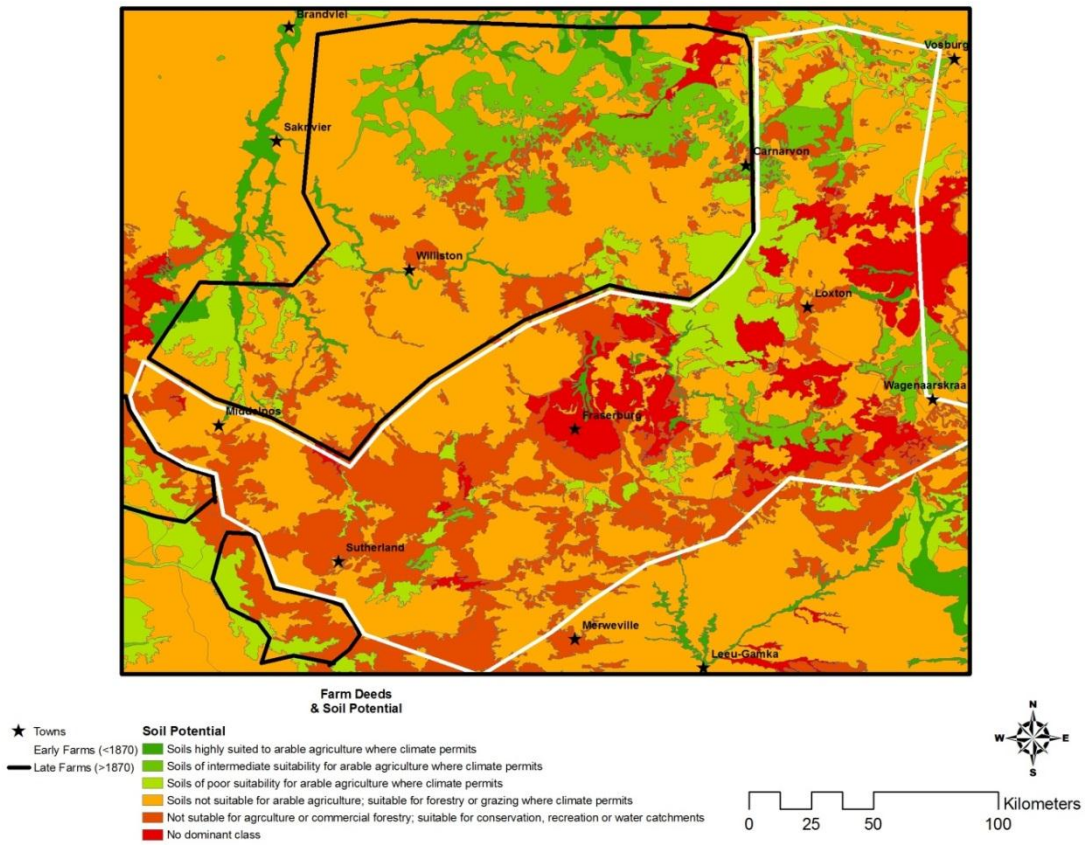

Figure 3.12 Map illustrating soil potential of the Karoo region. An overlay of a simplified distribution of farms by title deed date and when ownership was first granted is shown.

Given that small stock pastoralism, adapted to a marginal habitat, was the dominant part of the rural economy it is not surprising that soil quality has little or no bearing on the ranking of land and the sequence in which nineteenth century farm purchases were made. Indeed, a consideration of Figure 3.12 shows that the region of early nineteenth century farm purchases is covered generally by soils of limited to no agricultural potential. Different soil types of variable potential are scattered across the area. As crop farming was a secondary pursuit, in the nineteenth century the rural economy of agriculture obviously did not influence these decisions to any degree. Although many farmers did plant small gardens to provide some crops for personal consumption, these were usually located near the essential water sources, and were simply a bonus and secondary to the conditions selected in the first instance for sheep production and the establishment of a homestead.

3.8. Merino wool production

In this last section I return to the U-shaped distribution noted earlier of farms that were granted title deeds up until the 1860's. As noted, this earlier phase of land purchase generally follows the escarpment area including the Nieuweveld Mountains immediately to the west of Beaufort West. There are ecological reasons as to why this area may have been formally purchased earlier compared to areas at a similar latitude further west into the Great Karoo.

As described above, these focus on higher rainfall, higher grazing capacity and moderate temperatures being more favourable for the production of sheep, especially the less well adapted Merino. Furthermore, in this last section I also want to revisit the block of farms in the northern research area, that were granted title deed from the 1870's. The later date for these farms most certainly can be linked to a more marginal habitat that was less favourable for small stock farming compared to the escarpment and the southern areas of the Great Karoo that could have been reached from the escarpment and its fringes in complementary seasonally transhumant patterns. However, I want to return to the history of Merino production and the introduction of new technologies and farming strategies in considering the relatively early formal purchase of farms in the Nieuweveld Mountains and the block of late nineteenth century farm purchases to the north. While this discussion focuses on the history of animal production and technology, these changes and innovations fundamentally map onto the ecological and climatic gradients outlined above. This discussion is also relevant to a discussion of corbelled structures that follows in the next Chapter.

The primary product from Merino sheep was wool, and as the global market for wool expanded through the nineteenth century it was obvious that South African small stock farmers would turn their attention to production for this more profitable export market.

The shift to include wool-producing sheep began in the Graaff-Reinet district in the 1830's (Hockly, 1957). With the adoption of Merino sheep by the 1820 British settlers there was a steady increase in the number of wool-producing sheep in the Cape Colony throughout the mid 1800's (Figure 3.13). This increase showed that wool was becoming a valued export commodity and it was natural that this advantage be extended by the search for more suitable grazing land and expansion into it.

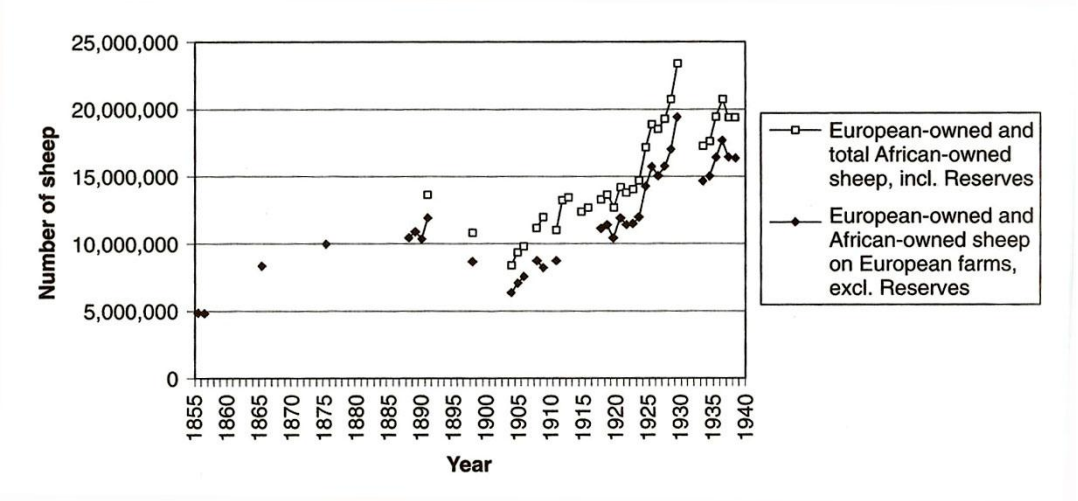

Figure 3.13 Number of wool-producing sheep in the Cape Colony between 1855 and 1939 (Beinart, 2008: 10)

The use of farm land for production of wool for the export market was an attractive option for farmers. Fat-tailed sheep needed to be herded down to Cape Town or a major town in order to be sold. This meant that farmers were absent from their farms for months, leaving families and remaining herds vulnerable to attacks by Khoekhoen or Bushmen. This was also a dangerous journey for the farmer or butchers servants and there was also attrition and death of sheep due to stock theft and predation by wild animals. Thus the trek to the Cape was expensive and sometimes unprofitable (van der Merwe & Beck, 1995).

Wool production was for export and not for domestic use, while meat was for the local economy. This introduced a significant change in transport as mutton sheep were driven to the market place. Wool was sheared in early spring and bailed on the farm and then transported by wagons to the coast (Beinart, 2008). The wagon traffic

between Cape Town and the Eastern Cape was restricted to the rainy winter months when food and water for the oxen and other draft animals was more abundant then (Beinart, 2008). The transport of wool to Cape Town could also be done by middlemen, alleviating the need for the farmer to leave his farm unattended. As more wool needed to be transported, transport companies were formed to capitalize on this growing market to the ports, e.g. Port Elizabeth (Beinart, 2008). These were often set up by the sons of the wool farmer (Beinart, 2008).

By 1870 over 40 million pounds of wool was exported from the Cape Colony (Figure 3.14). Although the price of wool continued to increase and peaked between 1872 and 1875. Cape farmers could not take advantage of this lucrative export market as production declined due to livestock diseases that occurred at this time. To manage these disease outbreaks and maximize the production of wool the Department of Agriculture was established in 1887 (Beinart, 2008). Various methods to curb disease outbreaks were instituted including dipping (Beinart, 2008). Thereafter there was a significant increase in wool production and export even though the price of wool dropped substantially (Figure 3.14). More importantly despite the inability to fully capitalize on the increased wool price, as noted from Figure 3.1 there was still a large number of people obtaining title deeds.

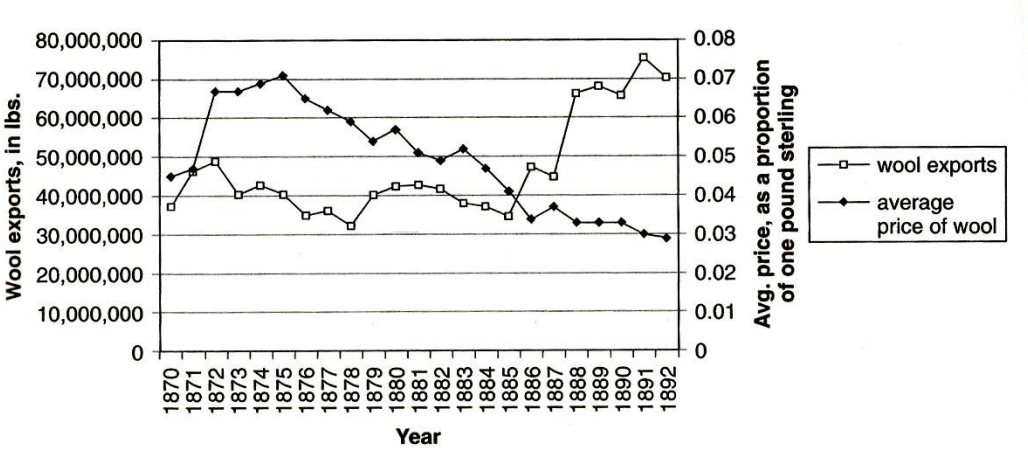

Figure 3.14 Price and exports of wool from the Cape Colony between 1870 and 1892. (Beinart, 2008: 21)

Over the latter part of the nineteenth century most farmers relied heavily on an extensive system of animal management and depended upon the natural veld for grazing and thus suffered if the land was compromised by adverse climatic conditions. As continually noted, transhumance was a key strategy where flocks were moved to other areas to prevent overgrazing and the spoiling of water resources (Beinart, 2008). These sheep farming systems, were however increasingly curtailed by other approaches to farming and different types of farming. Elsewhere, for example, other livestock farming of ostrich feathers, a highly profitable commodity in the 1880's, required far more intensive irrigation for the farming of lucerne which was needed for fodder. Areas around Oudtshoorn became significant ostrich farming regions due to the suitability of the land to grow lucerne.

The result of this was that sheep farming either expanded using an extensive system into more marginal lands where open grazing systems still applied with quality grazing still needed or turned to more intensive management strategies (Figure 3.6) (Beinart, 2008). The introduction of fencing and wind pumps in the 1870's contributed to the shift towards more intensive management of livestock throughout the Cape Colony. However in the case of fencing, this was first accepted and applied in areas with relatively high carrying capacity and where farmers could afford it. Ultimately, wire fencing changed the way farms operated and over time also changed the Karoo landscape itself.

Both these technologies came from outside South Africa and on the experience of Merino farmers elsewhere were seen as ways to increase the amount of livestock that could be supported on a single piece of land. Despite the initial expense of acquiring them these innovations were seen as positive in relation to profits made by farmers,

The use of wire fencing arrived in southern Africa after its widespread use in Australia, where much of its semi-arid areas were fenced after 1856, and the same applied to other countries with semi-arid habitats. In Australia, which had much larger grazing units compared to South Africa (Archer, 2002), fencing reduced labour

costs. With the increase in Merino numbers in the Colony it was appreciated that fencing could facilitate an increase in productivity and maintain the sustainability of farms. Between 1865 and 1891 the number of cattle, sheep and goats increased from 13 million to 26 million (van Sittert, 2002). As the government was unlikely to expand the Colony's borders, better utilization of current farm land and a new system of farming was required.

As in the Australian case, the introduction of fencing increased sheep farming profits by reducing the labour costs of looking over after sheep as fencing kept out predators and sheep were confined within fixed kraals (camps) (Rolls, 1984). The long established form of sheep farming was the "shepherd and kraal" system, where livestock was moved out to pasture in the morning and then returned to a kraal in the evening. This was viewed as inefficient as it was labour intensive, time consuming and utilized at lot energy. The continual movement also increased erosion and led to overgrazing around kraals and in pastures near water sources (Grove, 1989). Fencing facilitated livestock rotation between paddocks thereby limiting the effects of soil erosion. The survival of the animals using the "shepherd and kraal" system was directly proportional to the alertness of the shepherd to predators. Attempts were made in the 1880's to exterminate predators that killed livestock, but with little success. To solve this problem many farmers turned to vermin-proof fencing. Stock theft was another issue. Proponents of fencing suggested that fences would act as barriers to stock thieves as this would restrict their movement and ability to take animals away. Thus erecting fences diminished the concern about predators, stock thieves and unskilled shepherds (van Sittert, 2002).

The intensive use of kraals, however, forced innovation in other areas in response to an increase in infections and parasites found in the animals and their spread. To prevent the spread of disease amongst sheep and other animals, dipping of livestock was instituted. It was powerful individuals like John Frost, who came to South Africa in 1849, bought land in Queenstown, and worked on the Scab Commission of 1892-1894 who eventually made dipping of all livestock compulsory

and also attempted to restrict the movement of animals. This was a measure to prevent disease and contain outbreaks or ill animals, a practice that is obviously still enforced today (Beinart, 2008). Additionally, confining sheep to kraals also resulted in the sheep getting dirt and manure on the wool which reduced the quality, and lowered the selling price. With the introduction of compulsory dipping in 1895 there was a need to keep clean flocks quarantined and fencing facilitated this. In addition, and more importantly, higher stocking rates could be maintained and the market value of the farm increased (Archer, 2002).

The exact date and location of the first wire fencing introduced in the Karoo is not known, but there are references to its use on some farms. Wellwood, a farm just north of Graaff-Reinet, has documentation of wire fencing in 1877 (Rubidge, 1979). Other sources such as the *Descriptive Handbook of the Cape Colony its condition and resources* also notes the use of wire fences in the late 1870's (Noble, 1875). What is clear from these sources is that there was a chronological and geographic trend as to where fencing started and its subsequent uptake (van Sittert 2002). The epicentre of early fencing lay to the east of the Nieuweveldberg towards Graaff-Reinet. Many early loan farms would have been circular tracts of land that were isolated from neighbouring farms (Chapter 2; Sampson, *et al*., 1994). From the early nineteenth century purchased farms premised on earlier loan farms obviously increased and a landscape of isolated farms would have changed to a patchwork of conjoined farms, defined through legal boundaries. The result were regions that started to become conceptually 'closed'. Although there was less crown land as the nineteenth century progressed, it was only in 1883 with the promulgation of the Fencing Act that conceptual or mapped closure was to be more systematically and physically stated and by 1889 the Select Committee on Fencing heard that many districts had already been fenced (Figure 3.15) (van Sittert, 2002).

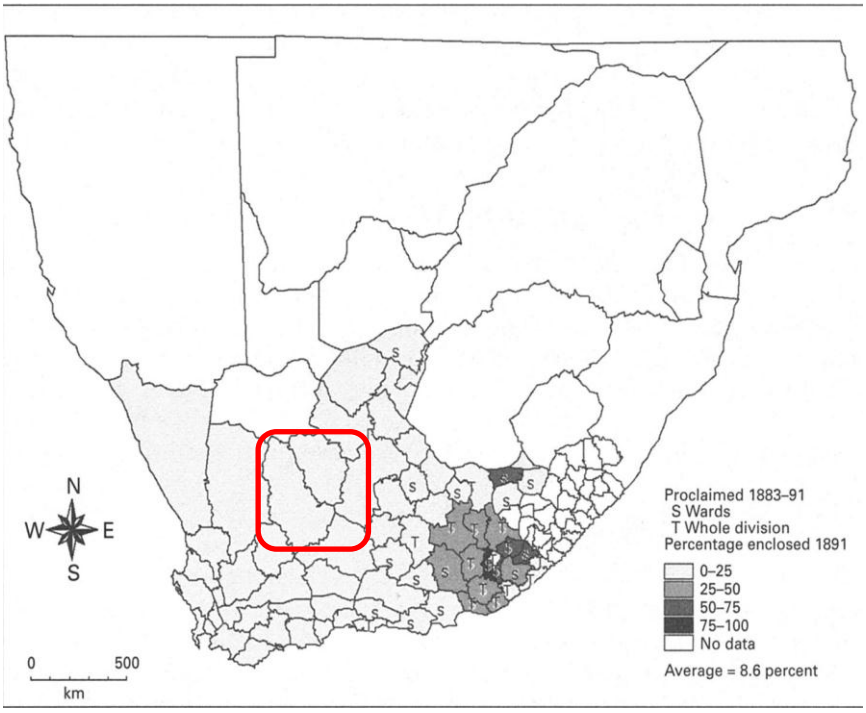

Figure 3.15 Map illustrating the Cape Colony with the extent of area enclosed with wire fencing by division, 1891 (van Sittert, 2002: 102).

While this was the case in the east, the western upper Karoo seems not to have been as affected by fencing as only 0-25% of the districts had fencing. This is at odds with the fact that by 1891 much of the land in the region under investigation was owned by farmers who were in possession of title deeds. Even by 1911 this Karoo region had little to no fencing (Figure 3.16) yet most of this land was privately owned.

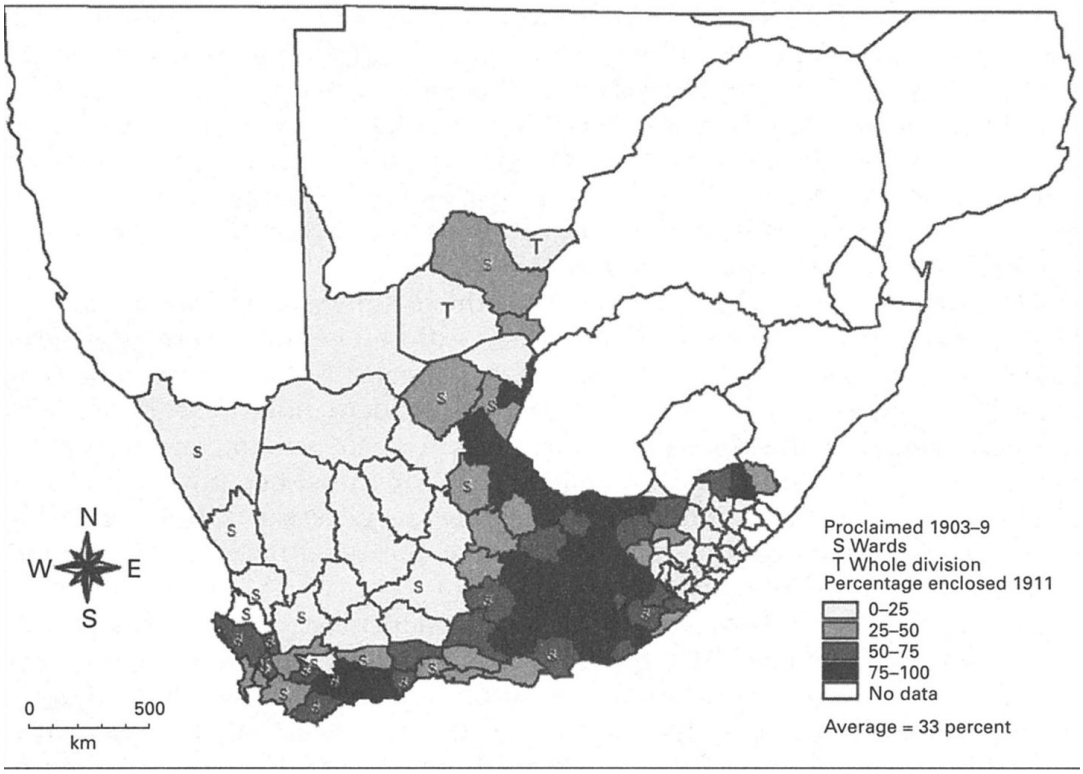

Figure 3.16 Map illustrating the Cape Colony with the extent of area enclosed with wire fencing by division, 1911 (van Sittert, 2002: 106).

The use of fencing spread quickly across the eastern Karoo and the rest of the Cape Province and fencing, with its many advantages, was advocated by a group of progressive farmers, but was met with some resistance by more traditional farmers. To ensure that the use of wire fencing did not negatively impact them, the Select Committee of Fencing held hearings in 1889 (van Sittert, 2002). The appeal made by the committee to fence off farm areas and use new farming methods associated with wire fencing is reflected in the First Agricultural Census of 1918 where it lists 15 000 farms “wholly fenced” and 13 000 “partially fenced” out of a total of 31 000 farms in the Cape Province (van Sittert, 2002).

The traditionalists were unable to see the advantages and saw only the problems. The demarcation of land and the assertion of ownership of the land was one issue. As described above there were few formal borders between farms and a forced division of land was seen as negative on traditional transhumant patterns, and additionally on the cultural structure of the migrant farmer’s way of life. With little natural materials except stone for kraal construction around farmsteads, the only

feasible and practical means to enclose large areas was to import wire. The cost of installing fencing, however, was obviously another concern. The amount of wire needed varied depending on what livestock were involved. Fencing of sheep required six strands, while for cattle only four strands were needed. Additionally, to strengthen the fence as a barrier, fencing posts, barbed wire and lacings were needed which all added to the cost. Other aspects that needed to be taken into account were the type of wire and what wood to use for the posts. Cheaper options were available and the farmer could put up the fence himself without the need of a contractor, but in the long run this often led to greater maintenance and up-keep costs (van Sittert, 2002). The cost of fencing, consequently, was a major issue for the traditionalist farmer and placed undue pressure and costs on the smaller farmers. In order to ease the monitory burden, it was argued that neighbours should pay half the fencing costs as each obviously benefited from it and they would also have a shared interest in maintaining it.

Legislation to enforce the payment of fencing was put forward to parliament in 1872, but was rejected as the traditionalists saw the cost for the farmer as unreasonable, especially the small farmers (Cape of Good Hope, Report of the Select Committee on the Fences Bill, 1872 [AI18-72] from van Sittert, 2002). Efforts were made to make the fencing bill more equitable to the small farmer, such as repayment for the installation of the fence over a 15 year period with a fixed interest rate. This revised bill also failed in 1874 despite these changes (Cape of Good Hope, Report of the Select Committee on the Fences Bill, 1874 [AI14-74] from Archer, 2000). It was only in 1883 that the Fencing Act was introduced (Cape of Good Hope, 'Fencing Act' No.30, 1883, from van Sittert, 2002). There were still problems with the Act, however, namely that the fencing of crown land was not paid for by the government, so farmers bordering these tracts of land had to pay for the fence themselves (van Sittert, 2002). The colonial government was forced in later years to fence railway lines, yet in the amended Fencing Act of 1891 efforts were made to reduce the financial burden on the treasury for paying for further fencing (Cape of Good Hope (South Africa), 1889 evidence of Surveyor-General A. de Smidt 1-6, from Van Sittert, 2002).

Overall, however, when the 1889 Select Committee on Fencing or Enclosing Lands took testimony on the effect that fencing had on the farming, the overwhelming consensus was that it was immensely beneficial as the following responses shown:

> 121 *Do you think that it would pay to fence any kind of land? - Yes, and I think that the poorer the veld the better it would pay.*
>
> *122 How many sheep could you graze on a morgen of land in your district [Queenstown]? - Three.*
>
> *123 Where you require two morgen of land for one sheep [as in the Karoo] do you think that it would pay to fence such land? - Yes, it would pay the owner of such land better than it would pay me, because sheep tramp about the country, and have to be brought home every night. In a few years the farmer, instead of having to take two morgen of land for one sheep, would be able to double his stock....*
>
> *126 Will you again state the advantages of fencing? - Yes, in the first place it assists in finding out any stock which may have been stolen, seeing that the thief must either destroy your fence or go out at your gates. In the second place, it allows your stock to run at large, owing to which they are healthier and produce better wool. In the third place, there is returned to the soil a great deal of that which is now wasted and injurious to the homestead - I allude to the manure - and this increases the productiveness of the farm, and enables you to raise more stock; and you also save in the number of [shep]herds who look after your stock...*
>
> *171 Are the advantages of fencing great? - The advantages of fencing are very great. It increases the amount of stock which land can carry, it prevents the spread of contagious diseases amongst animals, it checks thieving, and civilizes the country, as there can be nothing worth calling a farm until the country is fenced and the farmer has his stock thoroughly under control. (Cape of Good Hope (South Africa), 1889 from Archer, 2000: 686)*

These types of responses encouraged the use of wire fencing and led to its increased use. Despite all the advantages of fencing it did carry some unforeseen and unanticipated consequences. The ramifications of these were identified and over time are now obvious. Fenced land trapped non-domestic animals on either side where one of the reasons for fencing was to keep predators out and domestic animals secure. The main predators were jackal and leopard, and the latter, though difficult to find, was easy to trap and often hunted. Jackals presented a bigger problem. There are many accounts which mention the intelligence of the jackal, often imbuing the animal with human attributes like cunning and sometimes mystical abilities. “They could dodge poison and traps; they supposedly developed ploys to attract curious sheep by rolling onto their backs; they knew how to mislead dogs by crossing water …they would feign death or injury when caught … . A farmer suggested that 'the wily jackal’ has a trick of rendering himself invisible to the human eye and that he whisks his brush as he moves along so as to obliterate his spoor.” (Beinart, 1998: 188). To combat these predators, farmers made their fences jackal proof by either sinking them deep under the ground, to prevent jackals from burrowing under them, or by making them high, approximately 4 feet, to stop them jumping over. Other non-pest animals, such as aardvarks, were often killed by farmers due to their propensity to dig holes under fences through which jackals and other predators would enter. The result of reducing aardvarks numbers was that vegetation damaging termites increased in and this negatively impacted grazing (Beinart, 1998).

Fencing helped protect livestock and allowed for the more intensive livestock farming in certain areas. It was quickly adopted, for example, by the British wool farmers in the Eastern Cape. In comparison with the more marginal grazing area under consideration here, fencing lagged significantly behind and despite farmers holding title to land with fixed boundaries the absence of fencing presumably encouraged the continuity of transhumance for the management of livestock, in this region of the Karoo. I return to this issue in the concluding discussion below.

3.9. Diamonds and mines

With an influx of more people to the Karoo and an increase in the number of people moving across the region with the discovery of first diamonds and then gold, in the latter part of the nineteenth century, the expansion of the farm economy was encouraged and more areas were fenced. The Karoo was a place that rapidly changed from being a frontier zone to a place to be traversed in order to get to the north.

The beginning of the rush into the interior began with the discovery of diamonds along the banks of the Vaal and Gariep rivers in 1867 (Ross, 2008). Later, volcanic pipes containing many more diamonds were discovered and this resulted in the diamond rush in the early 1870's. The settlement that sprung up was called New Rush, but renamed Kimberley, after Lord Kimberley, on 5 July 1873 as he wished the settlement to have a proper name (Roberts, 1976). Kimberley quickly grew and by the end of 1873, was the second largest town in the Colony (Ross, 2008). This new economic centre took many labourers away from the agricultural sector as it was believed that better prospects were to be had on the diamond mines. This did not affect pastoral farmers in the Karoo where fencing was constructed as they did not require many workers. There was now an increased demand for food and maize farmers in the Eastern Cape, for example, had a new market to sell their produce (Slater, 1975). How the growth of Kimberley affected farmers in the Karoo is not clear, but as they bred mutton sheep there was probably an increased demand for their livestock.

The diamond rush to Kimberley subsided towards the end of the 1870's, but was soon followed by another influx of people wanting to strike it rich in the mid 1880's with the discovery of gold on the Witwatersrand. The first gold was discovered in 1884 and within two years the Government of the Zuid-Afrikaansche Republiek (Transvaal or Boer Republic) had proclaimed the area a goldfield. Again, there was a need for more labour on these new mines which took manpower away for the

farming sector. This did, however, provide another market for food producers (Feinstein, 2005).

Overall these two occurrences resulted in many new people passing through the Karoo, although probably only a few settled in the region. The prospect of increased wealth also meant the some farmers went looking for their fortune in the north (Roberts, 1976). The formation of new towns added new markets for the sale of meat, but as this was a luxury food item, it is uncertain to what extent these new markets influenced sheep farmers of the Karoo and their relationship to the land. In the final section of this chapter I draw all of these factors into a discussion of the farm title deed chronology and distribution.

3.10. Discussion

The purpose of this chapter has been to develop a discussion that is based primarily on the chronology of farm title deeds in an area of the Great Karoo north of the Roggeveld and west of the Nieuweveld Mountains (Figure 3.1). This chronological distribution is not unexpected and a general south to north trend is noted, that at face value, would correspond with the unfolding of the new legal status for land introduced by the British, that saw farms closer to the Cape being granted title deeds earlier in the nineteenth century and farms further to the north only formally purchased later in the nineteenth century. It has also been noted, however, that the distribution of farms that were surveyed and purchased in the first half of the nineteenth century are distributed in a shallow U-shape that curves around from Middelpos in the south-west to Vosberg in the north east (Figure 3.1).

In order to interrogate this distribution further I outlined key environmental and climatic variables and compared them to title deed distribution. This comparison shows that the distribution of title deeds issued in the first half of the nineteenth century runs parallel to the Roggeveld and Nieuweveld escarpment. When the

physiological tolerances of sheep including Merino are considered, this distribution may be further explained because rainfall is higher in these escarpment areas but it seems that the key variable is the better grazing associated with the escarpment. Consequently, I have suggested that the pattern of earlier farm title deeds maps onto areas better suited for the management and production of sheep. This correlation recognises that in the sheep management system prior to the formal purchase of land through title deeds, transhumant strategies were employed, in which loan farms and grazing licences were acquired to take advantage of seasonal grazing shifts. The escarpment areas were good for summer sheep management and in winter sheep would have been driven down to lower areas, for example, the southern Karoo. The early title deeds north of the escarpment spine might reflect these earlier transhumant strategies whereby the marginal status of the land was compensated for through seasonal movement out onto the plateau areas. Such a system logically means that farmers acquired several title deeds for farms that were strategically located to optimise transhumant management patterns, although this detail is beyond the scope of this research. With regard to the earlier title deeds north of the Roggeveld it is also noted that this area has a higher density of perennial river systems and the availability of water for consumption and supplemental agriculture may also be a factor in extending the distribution of early farm purchases into this area.

The suggestion that the shallow U-shape distribution of earlier nineteenth century farm acquisitions maps onto the relatively higher ranked habitats of the escarpment and its adjacent areas is strengthened by the much later block of farm acquisitions made in the northern parts of the research area (Figure 3.1). On most counts, this area is more marginal to the escarpment highlands and adjacent areas.

With no defined physical boundaries how was the land divided? Although the land was not rigidly segmented the rights to the land and where these farmers chose to have title deeds to land is still of importance. The question that arises is how did the landowners manage access to their natural resources when the landscape was still open.

The nineteenth century can be divided roughly into two periods with the divide being the introduction of Merino sheep into the Karoo west of the escarpment from the 1850's. The period before 1850 was defined by transhumant movement across this region of the Karoo by Trekboers in search better farming areas for their sheep. It was in second half of the nineteenth century that new developments such as the introduction of new technologies, wind pumps and fencing in the 1870's, which began to alter how this landscape was used. Regardless of the changes that occurred, the factors that defined where people chose to establish their farms was based on the requirements of their livestock, namely sheep.

The primary criterion governing the establishment of farms was water. The distribution of the earlier farms situated in the U-shape support this as they follow the rainfall zones and rivers of this Karoo region. The later farms found in the water scarce north echo the importance of water as these are only granted title deeds after the introduction of wind pumps in the 1870's. The other environmental factors such as grazing and temperature seem secondary. To expand their flocks and to maximise profit it seems likely that farmers would only move to more marginal lands if there was an incentive to do so. The boom in the market for sheep products may have been such a contributing factor (described above 3.8). The advent of new technologies, later in the nineteenth century, may have encouraged expansion into these less favourable farming regions. The transhumant lifestyle of the Trekboers could overcome the lack of grazing land and high heat by moving to better suited areas but these needed to have an adequate supply of water for both farmers and sheep. It is with the fencing that this migratory way of life began to change. This open free roaming landscape became settled and stationary.

This change probably started with the movement of the 1820 British settlers into areas to the east of this region of the Karoo with their progressive ideas on how farming could be improved. The introduction and adoption of Merino sheep and subsequent need to protect and increase their production with the aid of new technologies became more evident as the nineteenth century drew to a close. This

resulted in the gradual closing of the landscape with fences and the reduction of tracts of free land.

The nature of this region then is one of openness despite the changes in farming and land ownership. This is likely due to the environment as shown above. With the lack of water, poor grazing and difficult climate it seems likely that to survive and prosper farmers needed to move across this landscape. This ephemeral and temporary lifestyle would leave different archaeological traces on the landscape. One such trace is the presence of corbelled buildings. There are no large formal dwellings or structures found in this time (Burchell, 1824), but these corbelled buildings are present. What does the presence of these buildings mean and is there a link to the environment as well as the people of this region?

Chapter 4: Exploring the distribution of corbelled buildings

4.1. Introduction

The Trekboer construction of the Karoo landscape throughout the nineteenth century can be seen as a conceptually open and borderless region despite the many changes that occurred, namely the shift towards Merino sheep wool farming and a greater emphasis on enclosure and fencing. The introduction by the British of the legal requirement for farms to have title deeds and the introduction of fencing may lead to the expectation that this region became physically partitioned and enclosed. This, however, was not the case as discussed in the previous Chapter (van Sittert, 2002). Despite the fact that the land was in the hands of individuals who were granted title deeds and the demarcation of the land became institutionalised from 1850 onwards, the relative lack of fencing in the region still implied a degree of openness, and presumably an earlier concept of landscape premised on transhumance.

This Chapter, consequently, explores this ambiguity through a focus on the vernacular architecture that provided residences to the Trekboers and which were at the core of their domestic domain. Vernacular architecture is defined as an informal building style by local people who built their own houses from the available material around them. It is architecture that is usually functional and built to meet the needs of those dwelling within them, but which makes implicit reference to how people see themselves and as part of the landscape (Johnson, 1997).

This discussion is premised on the general chronology of these corbelled structures as established by Kramer (2012). They appear on a limited portion of the Great Karoo from the 1830s and more probably from the 1840's. The precise chronology of corbelled structures, however, is still uncertain (Kramer, 2007), but there are

sufficient documented reports by travellers such as Burchell (1824) and Lichtenstein (1928) who fail to mention these in their journals, despite travelling through farms which currently have corbelled buildings. Furthermore, while they were clearly premised on indigenous architectural forms and a much longer indigenous tradition (i.e. Khoekhoen pastoralist *matjieshuis*) Trekboers earlier in the eighteenth and nineteenth centuries did not build in this way. Their rapid appearance correlates with the shift to farm purchase and title deeds, the expansion of ambitious Merino sheep production and the tension between extensive transhumant systems and intensive systems in which fencing and enclosure were an important part.

Corbelled structures are unique to the sample area previously described, which is between the towns of Brandvlei in the north-west, Carnarvon in the east and Sutherland in the south. Any reference to the Karoo or region of the Karoo will refer to this area. The discussion first describes the form and construction of the corbelled buildings, then goes on to discuss their distribution and explore whether farm title deed dates provides a more concise chronology for them and whether the environmental factors discussed in Chapter 3 affected their location.

4.1.1. Construction of a corbelled building

The corbelled buildings of the Karoo are stone structures built mainly without the use of mortar (Figures 4.1 and 4.2). Although these are uncommon in South Africa they are not unique to this country and are found across Mediterranean Europe, Portugal, France, Greece, Italy and Spain. The shape and overall design of these corbelled buildings vary from a “pile of stones”, in the *bombo* of Spain, to refined pointed-roofed houses, the Trulli of southern Italy (Walton, 1960; Kramer, 2012).

Figure 4.1 Corbelled building with round base, round roof and no projections (Kramer, 2012)

Figure 4.2 Corbelled building with square base, pitched roof and projections (Kramer, 2012)

The architectural feature of these buildings is their dome shape. The issue of building a dome in the European corbelled buildings is solved by having both an inner and outer layer of stones. The intervening space is filled with rubble and debris. The result of this double layer is a typical dome-like shape on the interior of the house with a different façade formed by the outer layer. The South African

domed-shaped corbelled buildings have typically only one stone layer (Kramer, 2007).

The construction of a corbelled building requires specific construction techniques as Juvanec (2003) outlines: “Corbelling is a construction system in which one stone lies above another, with the position of the upper stone not exceeding its centre of gravity. This rule however only applies to two stones. A third stone must not exceed the centre of gravity common to all three. If the ground plan is a small circle, or if a counterweight is applied on the rear part of the stone, then the structure works.”

As described above, corbelling requires some experience and understanding of what is required and the expected end result. The general shape of the building is that of curved walls merging into a domed roof at the apex and the overall shape is like a beehive. For the structures to be built correctly, the placing of stones required a builder to have a mastery of this technique. The buildings in the central Karoo have a height of between 1,8m to 5m and the walls can reach a thickness of 78cm. As the building rises from the ground smaller and thinner stones are used and the ‘roof’ consists of 6-7cm thick stones. The building typically has a small entrance door with usually one narrow window. The location of the window varies but a frequent position is on the left side of the door as one faces the building. In most corbelled structures, doors and windows face east away from the prevailing wind. There are distinct features on some of these buildings, one being the protrusion of some stones from the dome making a “hedgehog”-like appearance. This, both Walton (1989) and Kramer (2012) suggest, was to act much like scaffolding and to give workers a footing to place the higher level stones, and to apply whitewash and for subsequent repairs.

Corbelled structures are, in their original construction, all single roomed. The inside features are simple with a keeping-hole in the wall and a few beam trusses that connect to the walls at cords and which were also to dry meat, and hang clothes, etc. Horns mounted to the walls were used to hang guns, powder flasks and bridles. The floor was typically made from clay smeared over with cow dung and water

known as a *misvloer.* Fireplaces are uncommon in these dwellings and critically, the use of fire for cooking was done outside behind a *skerm* (screen) (Walton, 1989). The absence of fire places is significant as this indicates that the main area of living was outside, on the land, and not in the structure. The actual structure was only one part of a wider household and in this regard is the same as a Khoeknoe(n) or Sotho/Tswana household.

In South Africa the Trekboer style of building appeared during the nineteenth century (Walton, 1951; Walton, 1960; Kramer, 2012). Stone corbelling was however used earlier in the later seventeenth and eighteenth centuries where corbelled structures were part of Type V Sotho/Tswana homesteads in the eastern Free State Province (Maggs 1976; Esterhuysen & Smith, 2007). The Sotho corbelled structures are positioned within a low stone circular courtyard/*lelapa* wall with a corresponding stone boundary behind. This further intensifies the explanation of the nineteenth century appearance of Karoo corbelled buildings, associated with the Trekboers, as premised on a deep entanglement with an indigenous architectural form where the central concept is the dome. These buildings are found in the areas surrounding Carnarvon, Loxton and Fraserburg in the central Karoo. According to Walton (1989: 16) these buildings are "very similar" to the corbelled buildings found around the Mediterranean. He suggests that "some itinerant builder from a Mediterranean country, possibly Portugal, wandered inland from the West Coast and seeing easily quarried stone, decided to build a corbelled dwelling" (Walton, 1989: 17). Walton suggests that the skill was passed onto Khoekhoen who then helped construct them on the Trekboer farms. Kramer (2012) seriously doubts this and posits a serious continuity from indigenous form into the Trekboer form and the observation that a Khoekhoen builder constructed a corbelled building on the farm Vischgat in 1960 (Walton, 1989), simply makes this point. The prospect of a single individual introducing this building style seems trite and unlikely given that other indigenous groups, including the Sotho/Tswana also constructed corbelled buildings (Maggs, 1976). The origins of the Karoo corbelled structures and the timing of their appearance must have been based on indigenous forms and even indigenous skill.

As these structures are vernacular, each building has a unique overall appearance, yet there are some basic shared attributes of these corbelled buildings that are held in common (Kramer, 2012). On the basis of form and these attributes Kramer (2012) has constructed a typology. The typology is based on two obvious sections to these buildings, namely the form of the base and the roof. The base is the lower part of the structure in contact with the ground and through which the doorway is pierced. The roof begins above the lintel of the door where the tapering begins and extends to the top of the structure. There are two types of base forms - round (Figure 4.1) and square (Figure 4.2). The roof forms can also be divided into two categories- round with a steady curve forming dome-like shape (Figure 4.1), and pitched with a straight-lined decreasing angle forming a trapezoid shape (Figure 4.2). Kramer's basic typology was formed by a combination of base form and roof form. There is a third attribute in the typology, that being the absence or presence of projections or rock slabs jutting out from the building (Figure 4.1 and Figure 4.2, respectively) (Kramer, 2012).

There are three basic types defined by Kramer (2012). These are:

Type A = round base and round roof (RB, RR)

Type B = square base and round roof (SB, RR)

Type C = square base and pitched roof (SB, PR)

The projection attribute (Figure 4.2), found in all types, will not be examined in detail. (See Appendix B for a list of all attributes associated with each corbelled building)

The importance of these corbelled building types and their distribution is that it is reasonable to assume that they represent a chronological progression that sees a sequence of development from simple to more complex or from purely round forms to the later addition of rectangular forms and pitched roofs. The round forms also are closer copies of indigenous domed vernacular forms, with which it is argued, the

corbelled structures are entangled. In this scenario the earliest type is that with a round base and a round roof (Type A; RB, RR). Following this logic, the next type in this sequence is Type B (SB, RR) in which there is the use of straight lines for the base. The third type in the sequence is Type C (SB, PR) in which rectangular bases are topped by pitched roofs. Thus the postulated relative chronology from oldest to most recent is Type A followed by Type B and lastly Type C. It should be noted that Kramer (2012) also gave considerable attention to the way corbelled structures of all types were added onto with additional rectangular rooms with monocline roofs and not corbelled domes. She argues, that this indicates a late nineteenth century date when timber was more readily available in the Karoo for roof beams.

As noted the appearance of corbelled buildings in the Karoo is in the first half of the nineteenth century (Kramer, 2012). It is argued here that this correlates with a number of events and the buildings mark a fundamental response to those events by people who moved into the region or were already resident there. The postulated chronological sequence of the corbelled buildings may relate to an initial movement of Trekboer settlers into this region but equally, they may also represent a dwelling response by people of European decent who were already resident there or who had a deeper history of inland living on the fringes of the Cape Colony.

The expectation is that the distribution of Types will mirror the chronology and distribution of the farm title deed dates (Chapter 3). Thus corbelled types will progress through Types A, B and C from the south-east to the north-west. One outcome of this enquiry is additionally to see whether the title deed date for a farm on which a corbelled building is located, provides a more precise chronology for these structures.

4.2. The general distribution of corbelled buildings

The general distribution of corbelled buildings shows a discrete concentration (Figure 4.3) encompassing the districts of Carnarvon, Sutherland and Williston. This concentration is not a function of sampling by Kramer (2012). The edges of this distribution are real and more corbelled buildings await recording within this distribution.

In the north are a cluster of corbelled buildings which contain the majority of these structures, found between Carnarvon, Loxton and Williston (Northern Group). A second group to the south of Fraserburg is smaller, containing a central denser cluster of buildings (Southern Group). There are two small clusters to the west in the vicinity of Sutherland and Middelpos (Western Group) (Figure 4.3) and isolated corbelled buildings that fall outside of these groups. These individual structures are found in the far east and north, near Wagenaarskraal and Vosberg. What is of interest is the absence of structures in 'hole' seen in the centre of Figure 4.3. This is to the north-west of Fraserburg, where only two isolated corbelled buildings are situated. This 'hole' is not an artefact of sampling.

More specifically Type A (RB, RR) is distributed throughout the region, from Carnarvon, Williston and south of Fraserburg, yet are predominantly located in the Northern group. The Western group also has Type A structures. The corbelled buildings with round bases and projections (WP) occur mainly in the Northern group, with only two out of a sample of twenty six found in the Southern group.

There are only five Type B structures (SB, RR) and three are located in the Southern group and two in the Northern group. These are in close proximity to each other in both groups (two are obscured by other building types in Figure 4.3). It is notable that Type C structures (SB, PR) are only found in the Northern group and distributed in a band along an east-west axis. Although the general distribution of the Northern group also reflects this east to west orientation, the Type C structures are more concentrated in this orientation. I return to this later. The presence of projections is

strongly associated with square-based buildings in the Northern group, and in particular with Type C structures (those with pitched roofs), and only one building with projections out of a total of seven is located outside of this group (Figure 4.3).

Due to collapse, the base form is the only identifiable attribute for some buildings (Figure 4.3) and structures with no discernable attributes from which to identify Types are shown as query marks. Both these categories are scattered throughout the region, but more buildings with square bases occur in the Northern Group.

The central 'hole' has only two buildings which are in poor state of preservation. One has no discernable attributes, while the other has only one attribute, a round base form (Kramer, 2012). The relative absence of structures in this central area is an issue that will be explored further in relation to the environmental conditions.

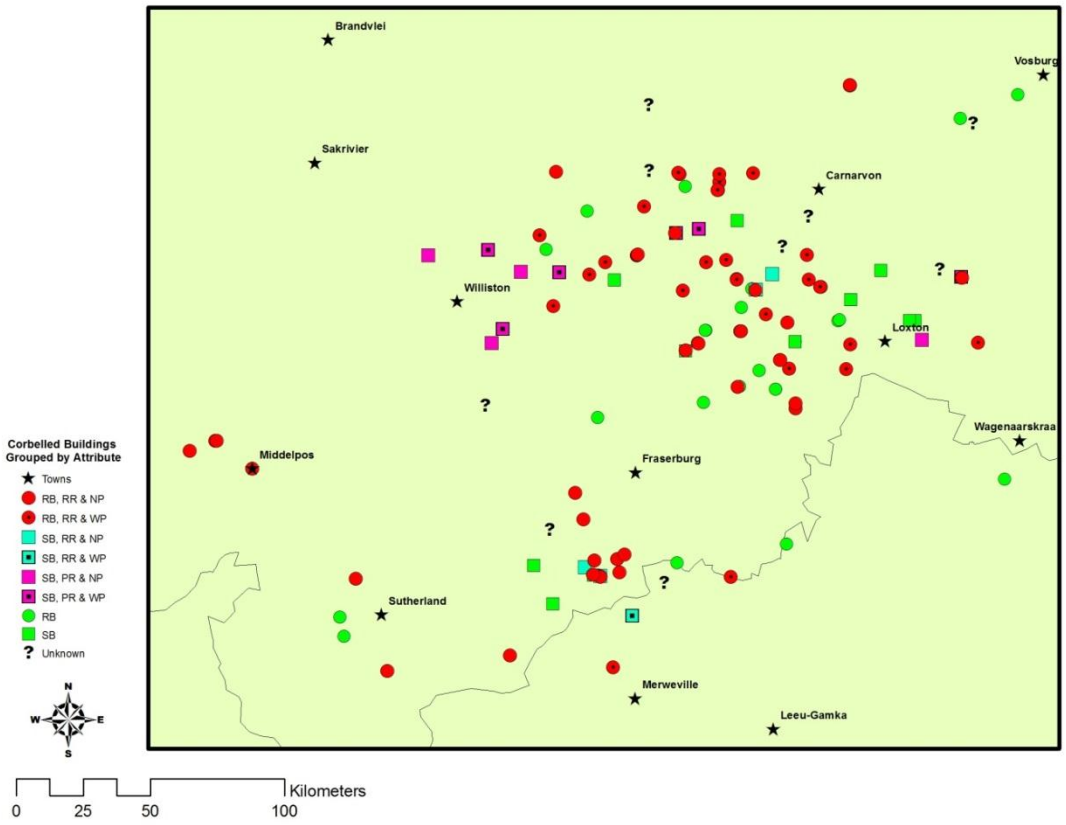

Figure 4.3 Map illustrating the distribution of corbelled building types in Karoo region.

The corbelled building distribution layer as depicted in Figure 4.3 is used repeatedly to compare with other aspects of this landscape in order to explore possible chronological relationships and correlations with the biophysical setting.

The first overlay is with the geology of the region. While the use of stone was probably a response to the lack of any other building material in this part of the Karoo, such as wood for roof beams and for pitched roofs, this is not an explanation for the date of their appearance or the specific form that these buildings took. The type of stone used needs to be 'dressed' to meet the construction requirements outlined above. There are two relevant geological groups, in the region, the Ecca and Beaufort Subgroup, which contain the appropriate rock types. The principle rock types used in the building of these structures is a form of sandstone or mudstone. Due to the nature of this rock, portions that have been baked by intrusive igneous rock are better suited for construction because this rock fractures easily and cleanly. This rock is found in exposed outcrops around the Karoo and is easily quarried (Maguire, 2008). The general distribution of the corbelled buildings (Figure 4.4) overlain on the geology, shows that these structures are found on three main rock types, mudstone, arenite and shale. Examining the three corbelled building groupings, the Northern group is equally distributed on both mudstone and arenite rock types. The Southern group is predominantly situated on the mudstone with a few buildings located close to the shale and dolerite intrusions. The Western group structures are on mudstone, while those situated around Middlepos are on arenite near patches of tillite. Isolated corbelled buildings to the north are located on shale bedrock (Figure 4.4).

The distribution of corbelled buildings correlates strongly with the geology of the region. More specifically, however, buildings that use rectangular base forms and pitched roofs may have required specific stone for more building precision, such as regular and flat rectangular blocks as described by Juvanec (2003). The stones used for the walls do not require any special consideration as mortar could be used to facilitate their construction despite the shape of the stone. Consequently, I briefly

consider whether buildings with different roofs are located on or near specific rock types.

Of the 52 Type A structures (RB, RR) 34 are located on the mudstone, with the remainder on other rock types. Half (8) of all square-based corbelled buildings and 4 out of the 5 Type B structures (SB, RR) are found on mudstone. The majority of pitched roofed square-based buildings (7 of 11; 63%) (Type C – SB, PR) are located on arenite (Figure 4.4).

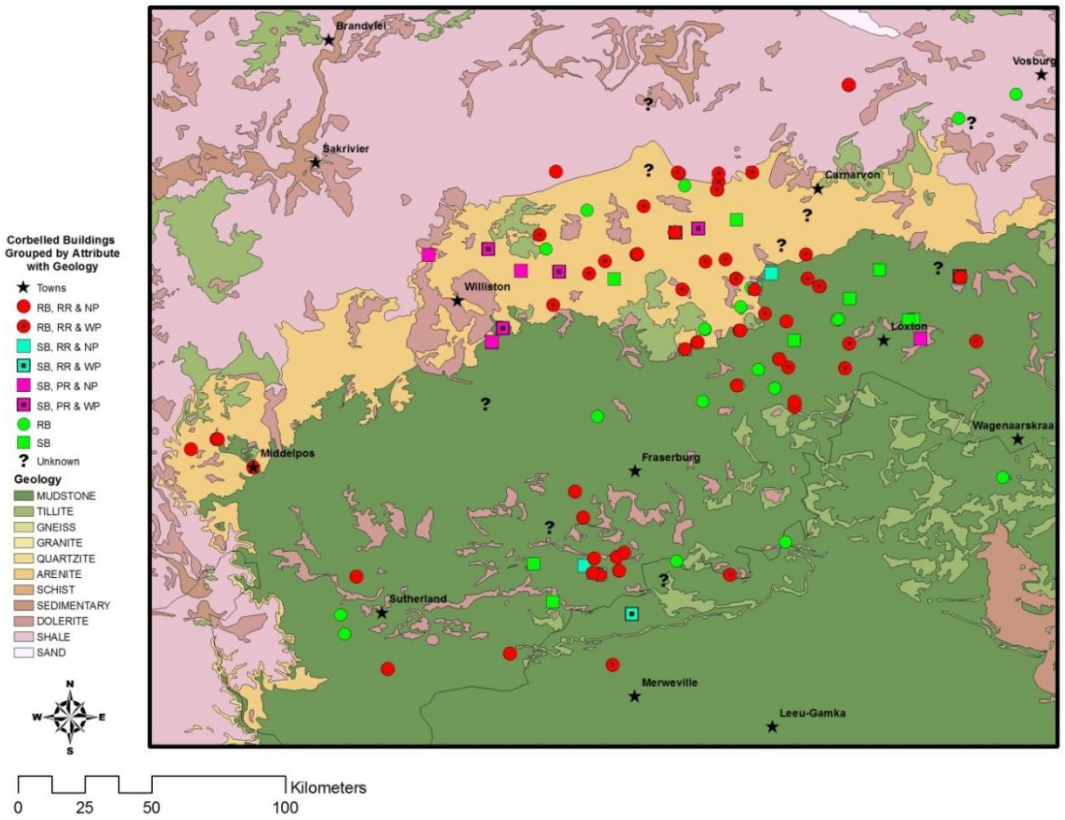

Figure 4.4 Map illustrating the distribution of corbelled buildings and geology of the Karoo region.

This analysis suggests that the general geology of the Karoo did not play a role in the location in different corbelled types. The only possible exception is that of Type C (SB, PR) that is mainly found on the arenite rock type, but a number of round roofed buildings are also present, indicating that rock type did not determine the engineering and construction of roof form. The absence of structures in the 'hole'

cannot be explained by the geology of the region. However, for all corbelled building types well bedded rock with defined fracture points is important in providing well-dressed stone for the construction of drywalls and roofs. There is a possibility that localised rock features or rocky outcrops which are not evident at the scale of the general geology map may have influenced the location of these structures, but this is doubtful.

4.3. Exploring the chronology for corbelled buildings

To examine any relationship between the distribution of corbelled building Types and title deed date, the distribution of building Types is further assessed by plotting them onto the farm title deed map (Figure 4.5). As indicated above this comparison is done in order to assess whether the farm title deeds provide a chronological point of reference from which to explore the hypothesis that Type A predates Types B and C. Underpinning this comparison is also the possibility that those who obtained the title to a farm would have constructed permanent or semi-permanent structures soon after taking ownership.

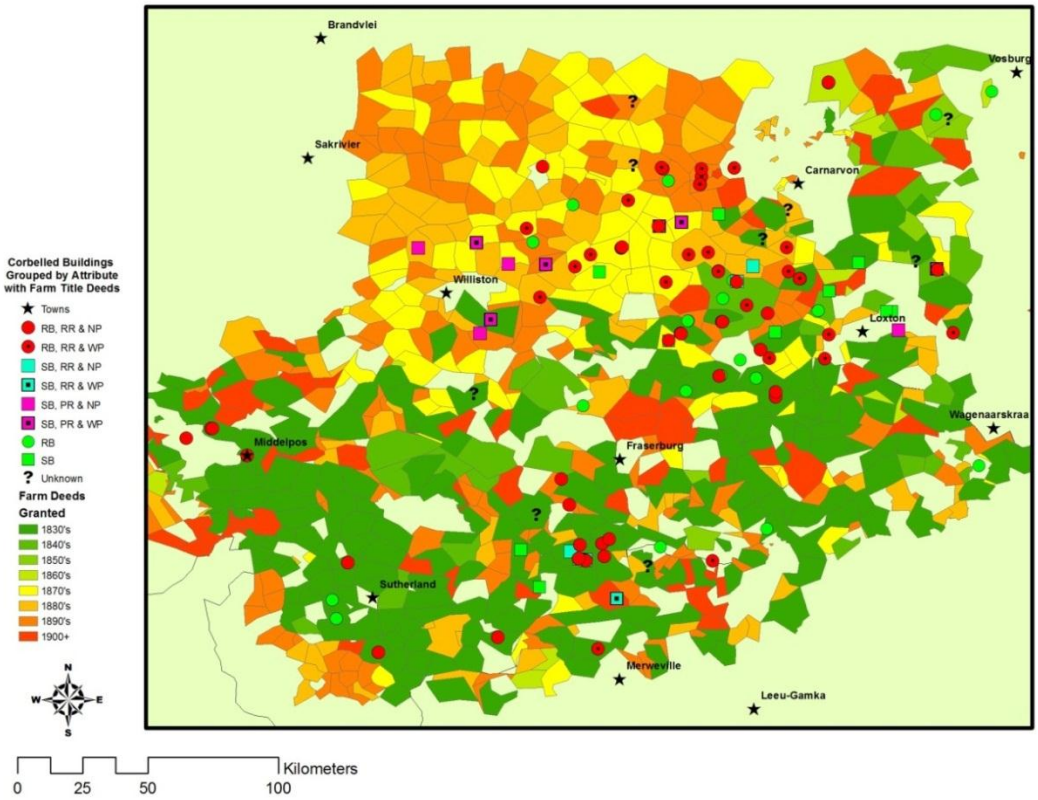

Figure 4.5 Map illustrating the distribution of corbelled buildings and farm title deed dates from 1830.

Figure 4.5 shows the general distribution of the corbelled building Types overlaid on the farm title deed date layer. The general distribution shows that many of these structures are located on farms with title deeds dated after 1830. This is particularly evident in the Western and Southern groups. The Northern group can be divided into two, with the western half of this group located on the later farms (after 1870) while the southern half is on earlier farms (≈ 1840) (Figure 4.5). Additionally, the distribution of corbelled buildings in the Southern and Western groups appears to be linear even though the sample size is small. A linear distribution is more evident in the Northern group where most of the corbelled buildings are spread linearly, from east to west, and this could be tied to the farm dates. The absence of corbelled buildings in the middle of the overall distribution (the 'hole' noted above) cannot be explained in relation to farm title deed date because corbelled buildings are found to the north on farms dating to 1890, while this 'hole' is located on farms dating to 1838. Corbelled buildings are dispersed across all title deed dates and the overall distribution of the corbelled buildings does not suggest a chronological progression.

More specifically, I now examine the distribution of corbelled building Types outlined above, against the farm title deed dates. As mentioned previously there is an expectation that these Types represent a sequential development from round-based to square- based structures and the date of farm title upon which a structure was built may help explore this postulated sequence (Type A to B then C). (See Appendix B for list of all attributes associated with each corbelled building).

In Figure 4.6 I have plotted the percentage occurrence of corbelled building Types by the date of the title deed of the farm on which the structures are located. The first issue to note is that distribution of these buildings along the time line is not continuous throughout the nineteenth century, but that are found in four clusters (Figure 4.6). The first cluster is in 1838, a second cluster falls between 1843 and 1844, a third in the 1870's and a fourth cluster in the early 1890's. It would be logical to suggest that the first cluster is linked to the first issuing of title deeds and that the second cluster is a continuation of this. Similarly it would be easy to correlate the third cluster with the increase in wool prices and a more intensive settlement of the region and exploitation of it to capitalise on the Merino wool boom. The latter two clusters appear shortly after the discovery of diamonds (1867) and gold (late 1880's) respectively and again could be linked to more intensive farm activity spurred on by demand. These correlations, however, are potentially spurious when the distribution of specific Types are examined across this time line.

As this graph demonstrates a significant percentage (32.5%) of all corbelled building Types are found on farms with title deeds first granted in 1838. Although Type A (RB, RR) buildings are found on all farm title deed dates, there is nevertheless a predominance (39/52; 75%) on the earlier farms (≈1840). This is even more pronounced when looking at those buildings without projections, which apart from one, are all found on the earlier deeded farms. This Type, however, is also found on farms with title deeds dating throughout the nineteenth century but the data may support an earlier origin.

Type C structures are also predominantly located on the later deeded farms, with only two of the eleven of this Type (18%) being situated on earlier farms (Figure 4.6). There is some support for the assumption that square-based buildings are of later construction because Type C buildings (SB, PR) are predominately located on farms dating after 1870, but some also occur on farms with earlier title deeds, and it is possible that these Type C buildings on earlier farms were built well after the title deed was first granted.

The stone projection attribute is also plotted in Figure 4.6. While this shows that this attribute is found on corbelled buildings situated on farms with title deed dates spread over the nineteenth century, square-based buildings with projections, however, are also mainly situated on farms with title deeds given after 1870 (7/8; 87.5%), with only one found on an early deeded farm. The only exception to this is a Type C structure found in the Southern group which does not fit the expected pattern. The general pattern of these Type C structures, however, is that they date later in the nineteenth century and that the buildings of this Type in the south were built well after the deeding of these farms. The square-based corbelled buildings are also distributed together with Type A buildings on farms dated to the same time period but this does not necessarily negate the sequence.

In summary, the expectation that the three building Types developed in a chronological sequence as suggested by the dates of the title deeds upon which they occur is not clear cut. The distribution of round-based buildings shows that they are found scattered throughout this region. This, however, does not preclude that this Type was first in a developmental sequence and that it continued as a Type throughout the nineteenth century. Perhaps more secure is that the square-based buildings are mainly located on the later deeded areas to the north, but others are found in a small cluster in the south, but they could significantly post-date the original farm purchase. The data hints at the possibility that Type A preceded Type C and logically, although the sample is small, Type B would chronologically overlap with both A and B.

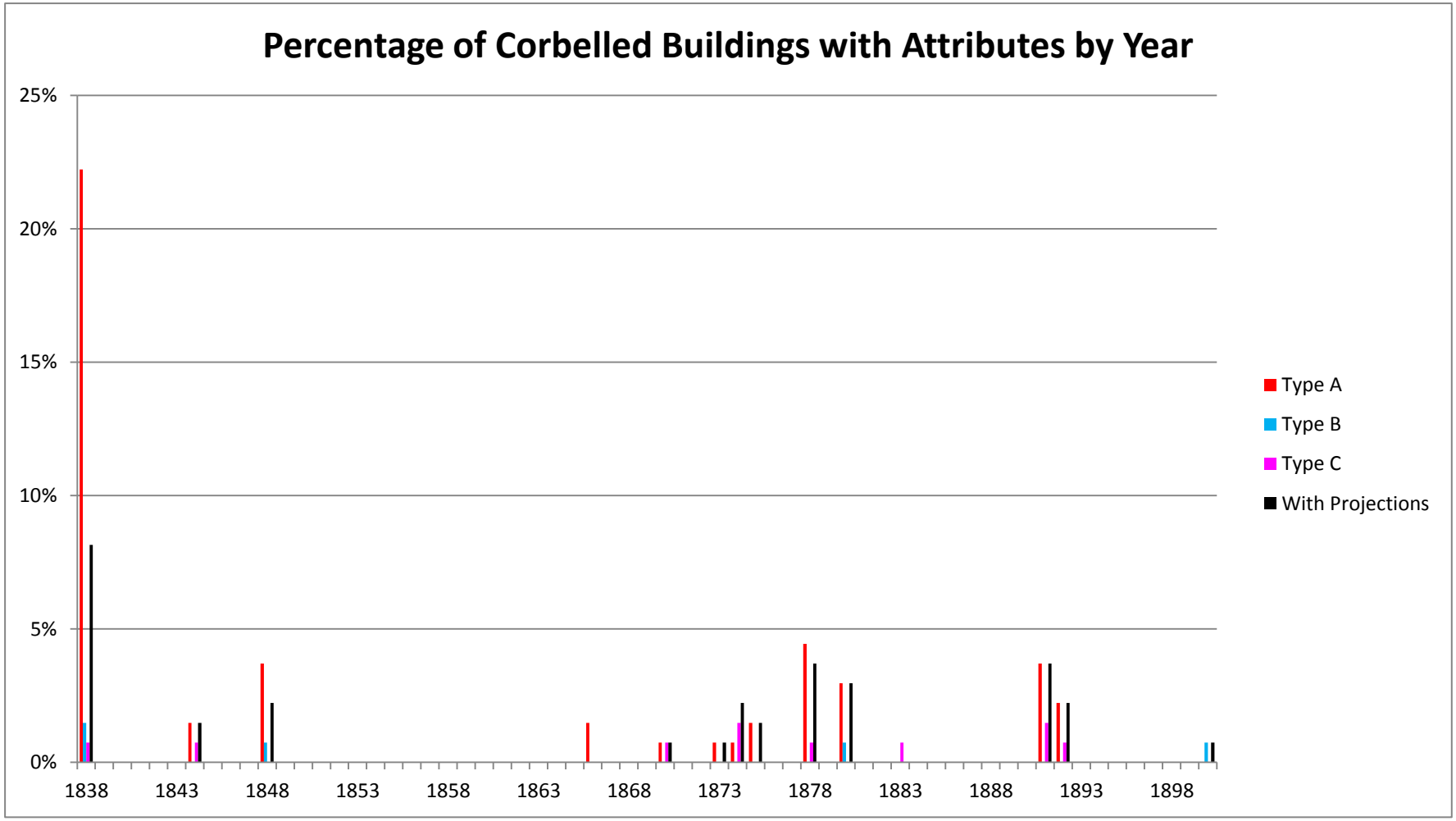

Figure 4.6 Bar graph showing the percentage of corbelled building Types A, B and C plotted against the title deed date of the farms on which they occur.

4.4. Environmental variables and corbelled building distribution

The discussion so far has been based solely on a possible corbelled structure building sequence suggested by the dates of the title deeds of the farms upon which they are located. In Chapter 3 I compared the distribution of title deed dates with environmental factors and this suggested that farms in less marginal habitats were formally purchased earlier in the nineteenth century. I reintroduce some of these variables here and compare them to the distribution of corbelled structure Types.

The primary occupation of people living in this marginal region was that of small stock farming, in particular sheep, as described in Chapter 3. This was at the core of the Trekboer economy, and consequently, because of the seasonal fluctuations in grazing the location of corbelled buildings may relate to transhumant management.

4.4.1. Topography and grazing

In Figure 4.7 the distribution of corbelled buildings is plotted on the contour map of the region. The main feature is the Roggeveld and Nieuweveld Mountains forming the escarpment that curves around from the north-west to the south-east and then to the north-east. To the north of the escarpment is the inland plateau of the Great Karoo. For the Western and Southern clusters of corbelled structures there is a relatively direct correlation between their location and the higher ground (above 1300m) of the escarpment and the more broken ground on the escarpment fringes. The Northern group is situated on the raised plains (1100m) of the inland plateau with little variation in height over this area, although it does slope downwards slightly to the north-west (to 800m). At the scale of the contour map there is no clear preference for locations on higher ground, although the general impression is

that most corbelled structures are on the margins of higher ground, particularly the Kareeberg between present-day Williston and Carnarvon. The 'hole' in the middle where there are few corbelled structures, is generally the most featureless and flat area in the overall region.

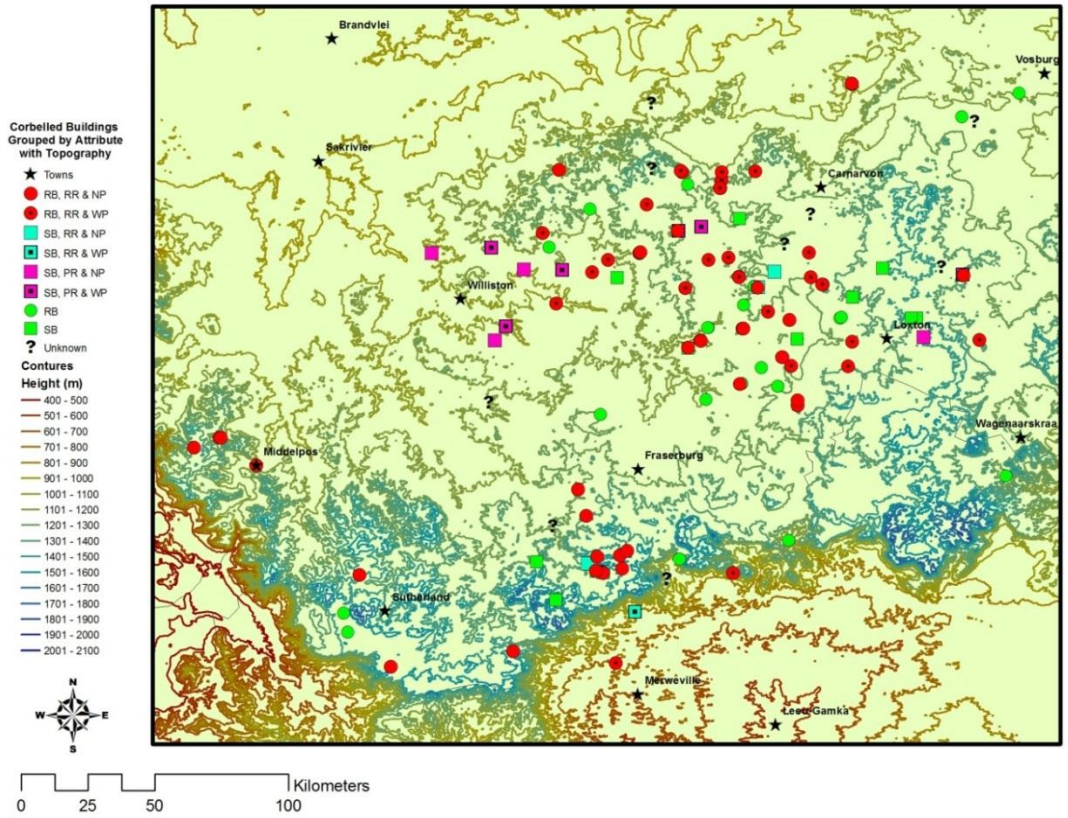

Figure 4.7 Map illustrating the distribution of corbelled buildings and topography.

Taken as an undifferentiated group, the general distribution of these corbelled structures suggests a preference for high ground or perhaps terrain that is broken and varied. It is clear that there are no buildings on the plateau or escarpment below 800m, apart from one exception in the far south which is located at 400-500m. It is possible that the distribution of corbelled structures in the Southern group relates to a core domestic domain within a seasonal transhumant strategy which emphasised an optimal summer location. Those farmers who inhabited the

corbelled buildings on the southern escarpment could move to lower altitudes in the south or the north in winter, providing their flocks with suitable winter grazing on either side of the escarpment. The postulated early nineteenth century date for these structures would mean that if the occupants of these structures owned the land upon which they were built, then seasonal movement elsewhere was onto land that they may or may not have owned.

Pursuing this line of reasoning stock farmers who used the Northern group of structures would appear to have had fewer options in terms of gradient and landscape variability. As noted, there are almost no dwellings in the central 'hole' and this may suggest that this area did not have the required environmental diversity provided by sharper altitude gradients evident elsewhere and that the relative absence of corbelled structures there reflects this.

These suggestions consider the corbelled structures as a single group but the discussion above indicates that different Types, especially Type C, were built later in the nineteenth century, and consequently the distribution by Types must be examined. The distribution of the three corbelled building Types (Figure 4.7) shows that the Roggeveld escarpment is dominated by Type A structures and are located on the potentially optimal high lying areas of the escarpment. An examination of Figure 4.7 shows that Type A structures also occur in the northern area intermingled with Type B and especially with Type C structures. While this is so it is however significant that there are only four Type B structures and most significant is that, in the south there are no Type C structures. There are no square-based buildings in the Western group and the round-based forms which are found on the escarpment very close to the Roggeveld Mountains. Type C structures are specific to the Northern group and as noted, this generally correlates with the later nineteenth century dates for title deeds. While these Type C structures are generally located on the fringes of the higher ground in this region, especially around the southern end of the Kareeberg, this correlation is not specific to these structures. It may be inferred that

all Types in the north express a similar preference in their location, irrespective of time.

The variable correlation between corbelled building distribution and altitude, and the suggestion, based on historical records, that the escarpment was utilised seasonally, obviously indicates that while the correlation is with topography and altitude, the key is how this relates to grazing and carrying capacity and the potential for migrating livestock and employing transhumant strategies. Equally, it must be considered that as the nineteenth century progressed there was an increasing shift towards enclosure with the potential to manage sheep from a single point for the whole year.

As noted in Chapter 3, the grazing capacity of this region is poor, with a range between 41 and 60 hectares per animal unit (ha/AU) (Figure 4.8). Within this range better grazing is found to the east and west and is correlated with the higher altitudes of the escarpment as seen in Figure 4.7. A closer examination of Figure 4.8 is instructive. It is once again significant that all corbelled structure Types to the south and west are located on or within relatively close proximity to higher grazing associated with the escarpment and small pockets of better grazing, (11-13ha/AU) along the Roggeveld and Nieuweveld Mountains. The Western group has buildings situated near to good grazing (11-13ha/AU), but none of these structures are actually on this land.

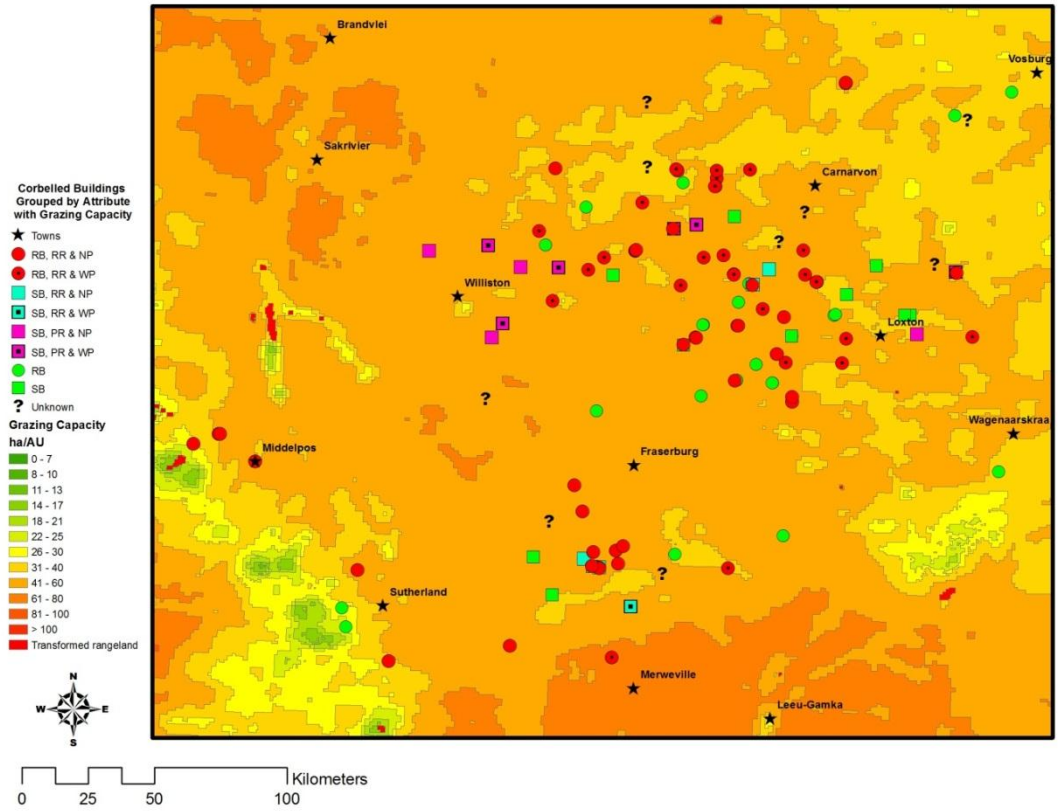

Figure 4.8 Map illustrating the distribution of corbelled buildings on a grazing capacity layer (Metadata: http://www.agis.agric.za/agisweb/agis.html).The overall distribution of the corbelled buildings shows that the majority of these structures are found on the 41-60ha/AU grazing zone and along areas of better grazing (31-40ha/AU) (Figure 4.8). It is instructive, however, to see that the northern corbelled structures of all Types fall with an area of variable grazing that corresponds to slightly higher ground. From Carnarvon and to the west there is a 'tongue' of good grazing that also includes parts of the higher lying Kareeberg. While the majority of corbelled buildings in the Northern group are located on the poorer 41-60ha/AU grazing area, it is important to note that they are within a zone where access to pockets of better grazing are not too far away. It appears that all corbelled building types here are situated within 25km of better grazing. While this applies to all Types in this northern area it is notable that most of the Type C structures (the most recent in the developmental sequence) are the furthest to the west and are distributed around Williston. It is also significant, that in the central area that is relatively devoid of corbelled structures, from a grazing perspective the area is poor and uniformly so.

What this suggests in relation to grazing is that the location of corbelled buildings was, at face value, a compromise between access to grazing and other environmental factors. The location of these buildings allows for seasonal use of better grazing land relatively close by and access to a variety of different grazing zones. The value of this assessment may be supported by the 'hole' in the middle that has no such grazing variety. Grazing, consequently, was important, but the push and pull of other variables also needs to be considered, including historical events, in a consideration of where people chose to express some form of dwelling permanence through the construction of corbelled buildings.

The two main groups in the north and south appear to be on land with varied grazing potential. The distribution of most corbelled buildings in relation to grazing capacity suggests that there is no obvious correlation between different building Types and grazing capacity. Although there are regions of better grazing most of the corbelled building Types are not found immediately located in these areas but are nevertheless not far away. This may also help explain the 'hole' in the centre of this region because there was nowhere to go that would have been significantly different or better. Location therefore reflects the ability to have access to a variety of grazing areas. The presence of all Types of structure within and near to areas of slightly higher grazing capacity in the north and on the escarpment, obviously held the potential for stock farmers in these areas to move their flocks with seasonal changes. Of course this assumes that with the increasing legal, conceptual and physical compartmentalisation of the region through the nineteenth century movement and transhumance on the scale reflected in the descriptions from early in the century, was still possible.

4.4.2. Water: rain, evaporation, rivers and dams

Where people located their corbelled buildings was most likely a compromise that had to consider other environmental features that were needed near a dwelling. I have up to this point considered factors that were important for the management of sheep and considered the location of corbelled structures with that in mind. The issue of settlement and domestic dwelling, and within the vernacular concept and the kind of dwelling that these buildings imply, settlement compromises would consider other needs domestic and practical needs, and water clearly is critical.

Rainfall is obviously essential for the occupation of this Karoo region and will determine the quality of the grazing and also surface water availability for both animal and human consumption. Therefore a consideration of rainfall and water relates to settlement in terms of both human and animal needs.

The distribution of corbelled buildings in relation to mean annual rainfall (Figure 4.9) shows that most of the structures are found in the 0-200mm rainfall zone, with a few located in the slightly wetter western and eastern zones. The Northern group is also primarily located in the 0-200mm zone, and a few corbelled buildings in the east are situated in the higher 201-400mm rainfall area. The Southern group of structures are close to a band of higher rainfall (201-400mm) and 9 of the 27 (33%) corbelled buildings are located there with the remaining buildings in the drier 0-200mm area. The Western group is also situated within the 201-400mm rainfall zone.

For the most part the general distribution of corbelled buildings shows no significant relationship to rainfall boundaries and most buildings are found in the large area of uniformly low rainfall to the north and west of the escarpment. The band of slightly higher rainfall (201-400mm) in the south does relate to the better grazing area seen in Figure 4.8, and obviously the topography, grazing and rainfall relationship would have been to the advantage of the dwellings in the vicinity.

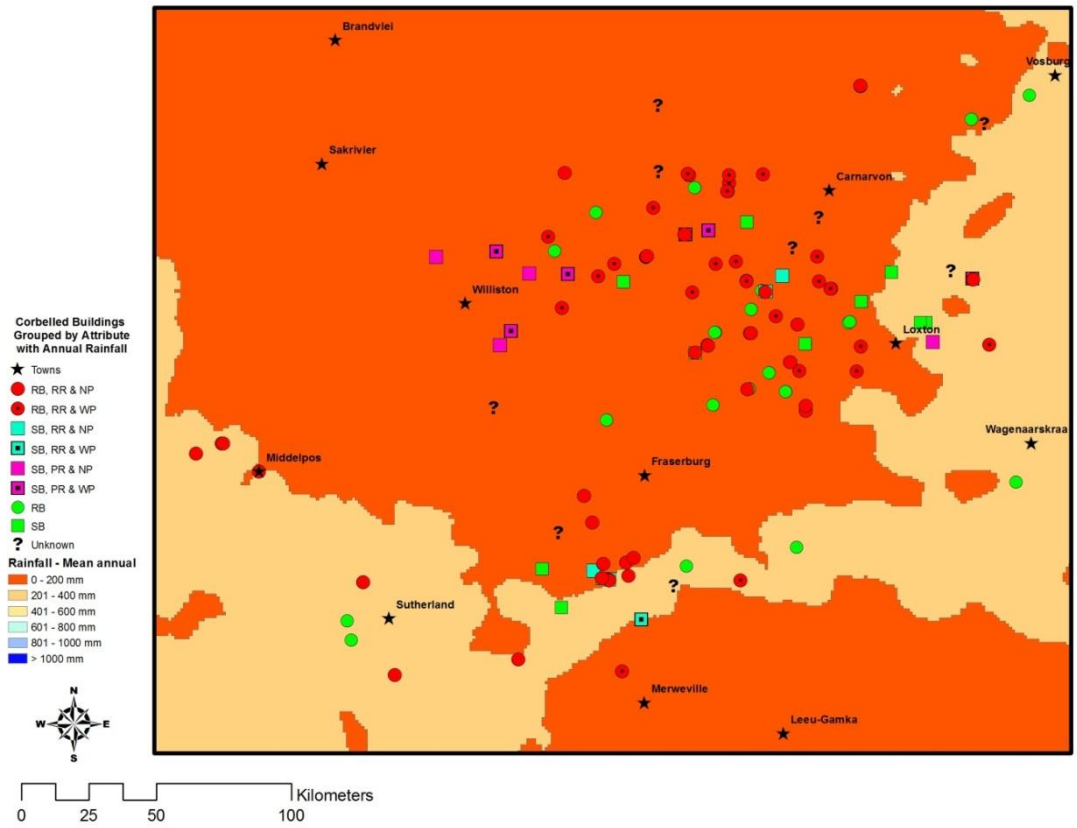

Figure 4.9 Map illustrating the distribution of corbelled buildings and mean annual rainfall.

The 'tongue' of better grazing in the region of Carnarvon and Williston noted above is not mirrored in the rainfall map and this better grazing area could be related to other factors such as altitude. Apart from the southern buildings, it is not surprising that there is no obvious correlation between rainfall and the distribution of the building Types. Rainfall over the whole area is low and relatively homogenous.

The marginality of this region in terms of effective rainfall is exacerbated by water loss through evaporation. This affects not only vegetation, but also the availability of surface water for consumption.

The evaporation rate of the Karoo is very high, particularly in the north. When added to the low rainfall of this region the distribution of corbelled buildings of the Northern group, in the >2400mm evaporation rate area (Figure 4.10), marks this region as one that was still used for livestock farming. Elsewhere, the evaporation rate adds nothing to the location of corbelled structures that has not already been emphasised by the other key variables.

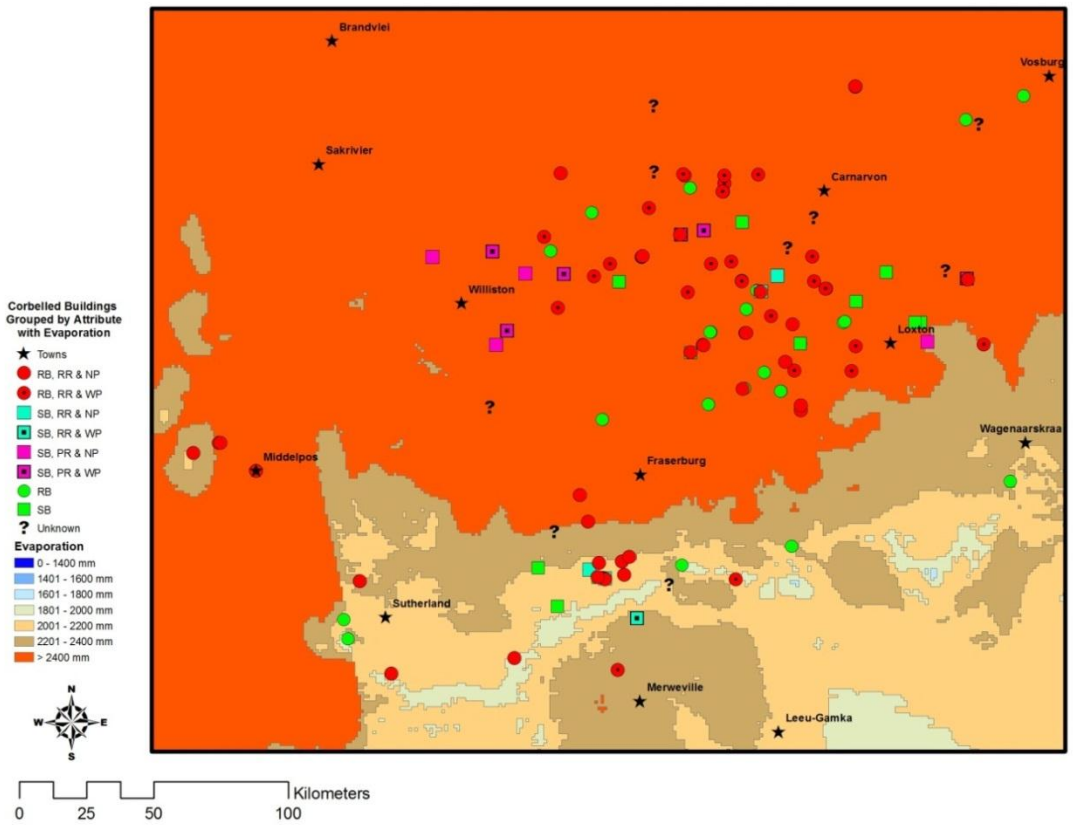

Figure 4.10 Map illustrating the distribution of corbelled buildings and evaporation rates

Temperature is also linked to rainfall and evaporation and high and low temperatures affect stock farming through heat exhaustion of animals in summer and frost in winter. It is not surprising that the temperature ranges in this region are extreme and for the maximum temperatures, the general distribution of corbelled buildings shows that most structures are found in the 29.1-31°C area (Figure 4.11). It is perhaps even more extreme in the north and on the western edge of the

Northern group where maximum temperatures are in the 31.1-33°C range. Most of the Southern and Western structures are found in the slightly cooler 27.1-29°C band where summer temperatures are moderated by the higher altitude associated with the escarpment.

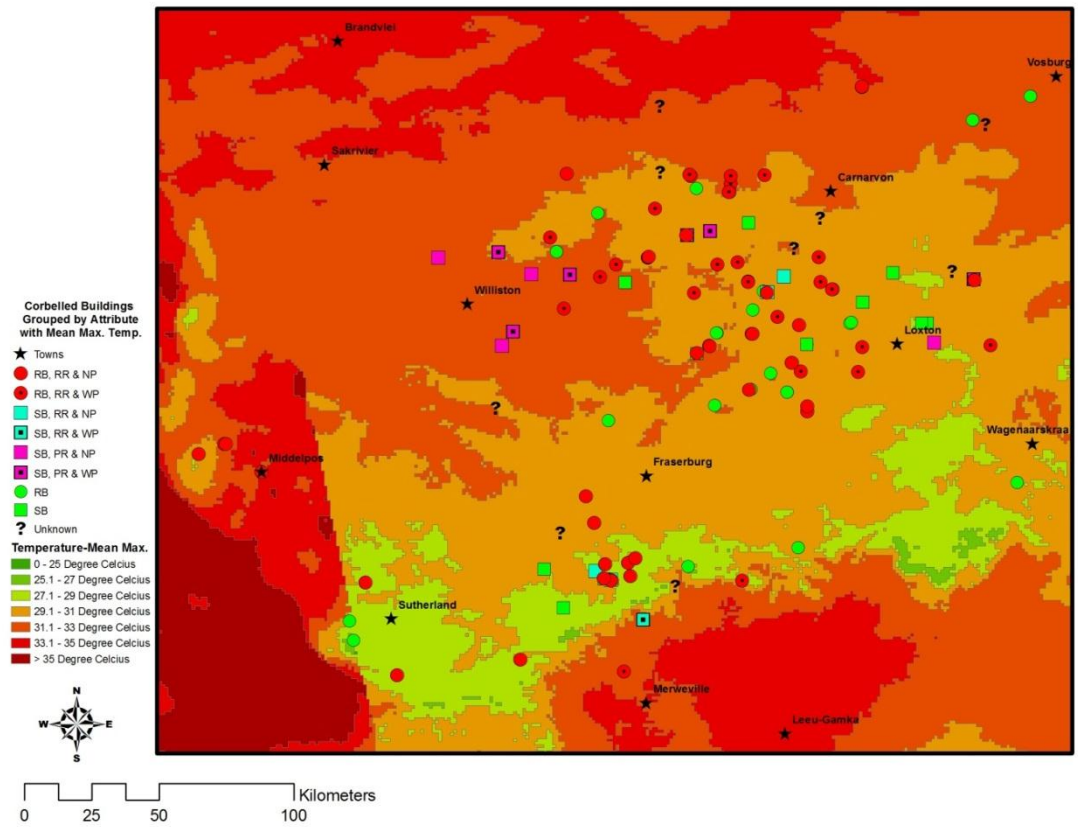

Figure 4.11 Map illustrating the distribution of corbelled buildings and the mean annual maximum temperature.

Minimum temperatures also affect both people and their livestock. Frost can damage the few crops that are grown, resulting in food loss for domestic consumption and fodder for sheep. As previously discussed in Chapter 3 the traditional transhumant patterns along the Roggeveld escarpment is to lower and warmer areas during winter, such as the southern Karoo to the west (Figure 4.12) (Penn, 1986; Guelke & Shell, 1992; van der Merwe & Beck, 1995). The location of corbelled structures in the vicinity of the escarpment may indicate that the

occupants employed this strategy, assuming that there was access to land when the winter transhumant cycle came around. The overall distribution of corbelled buildings shows that over the whole region the mean annual maximum and minimum temperatures are extreme irrespective of where stock farmers were located. In relation to the Roggeveld escarpment and seasonal movement, temperature was not necessarily the dominant variable, and others must have also been considered, including social aspects.

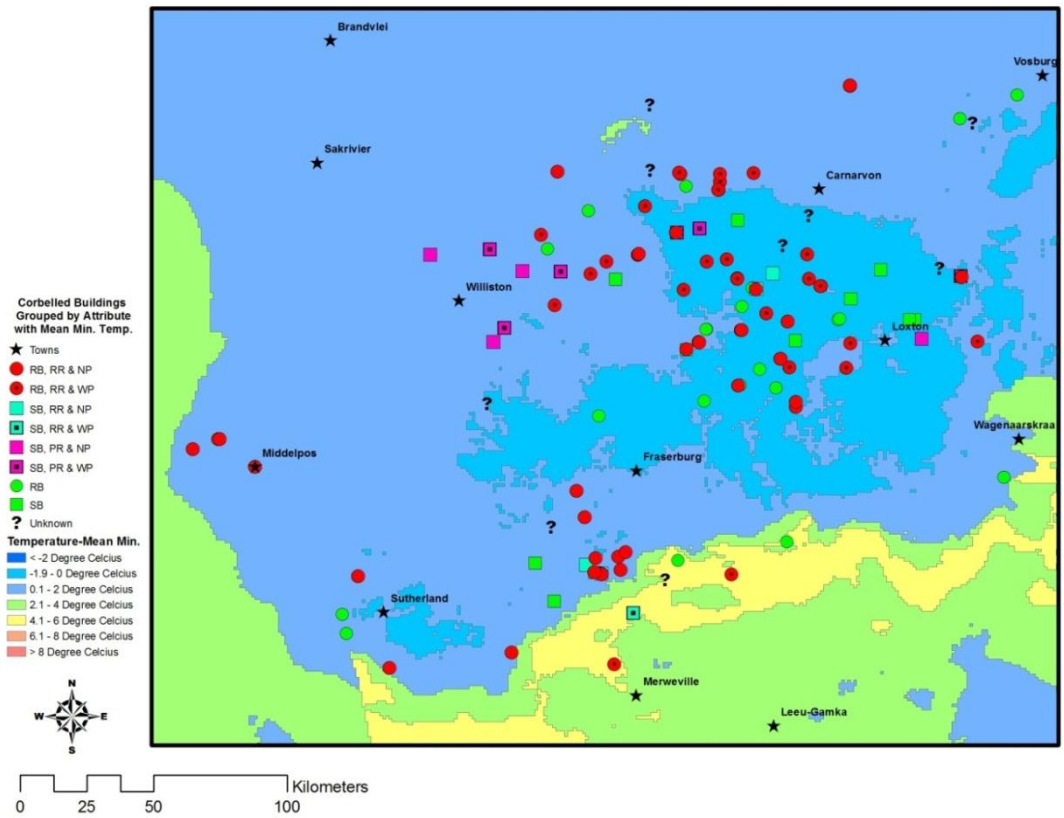

Figure 4.12 Map illustrating the distribution of corbelled buildings and the mean annual minimum temperature.

As discussed in Chapter 3, the main concern for sheep farming is adequate water supplies both for livestock and people. Access to perennial/constant water sources would be of chief importance when choosing a site to construct a dwelling. A

compromise must have been reached between temperature and other environmental factors such as water. In this regard, while Figure 4.10 simply reinforces what is already known and that despite the moisture stress and marginality of this region, small stock farming was viable. Once again, however, I draw attention to the Type B and especially the Type C buildings that are located in the low rainfall and high evaporation area to the north and furthermore on the far western edge of the corbelled structure distribution. As domestic dwellings these buildings were built later in the nineteenth century and their rectangularity underpins this. However, within the general category of this humble vernacular form, these Type C buildings are grander, clearly more complex from an engineering point of view and mimic the form of a more conventional pitched roof dwelling. The scale of these structures suggests that whatever the legal relationship was between occupants and the land, they were possibly attempting to project relative status and success. This would have been relevant considering that the other corbelled types especially Type A may well have continued to be built and occupied continuously towards the end of the nineteenth century and so were contemporary with the Type C buildings. Whatever the case, the implication of the location of these buildings in a region of extreme marginality, is that they project relative status within a developmental sequence, which is underpinned by factors other than environmental ones.

Access to water is an important consideration when establishing any form of dwelling, especially in the semi-arid environment of the Karoo. Therefore the Trekboers first concern was finding an adequate water supply for themselves and their livestock and the specific location of corbelled buildings must reflect this. As Anderson (1985) has documented, the mid-nineteenth century conflicts between 'wool men' and their expansion of land purchases and the Pramberg Xhosa focused primarily on access to and control of the three strong water sources and fountains there. Once acquired, homesteads and farm erfs were established around these natural water sources and continued a deep indigenous use of these same sources. The same may have applied to strategic points along the perennial rivers, as they

offer a fairly constant supply of water, although this was not certain as described previously.

The geology affects access to water, as described in Chapter 3 because certain rock types, namely mudstone, can store and dam ground water resulting in springs. Knowledge of the water courses and where year-long access to water resources could be found, enabled farmers to move their livestock to better grazing areas knowing that drinking water would be available. Obviously this factor was important in this hot environment where high temperatures can result in a loss of livestock due to dehydration. The location of dwellings and the establishment of a farmstead reflect this absolute necessity.

In this regard the general distribution of the corbelled buildings, shows that approximately half of the structures are closely associated with a perennial water source (Figure 4.13). What is more interesting is that this is particularly evident in the Northern group where most of the structures, especially those further to the west are found close to the Sak River and its tributaries such as the Brak River. It is important to note that in the north most of these rivers are considerably braided, with more tributaries compared to the southern areas. To the east of the Brak River however, there are buildings that are not associated with a perennial water source and this may indicate less water stress, and the availability of more predictable surface water. This correlation makes sense given the increasing marginality of the region to the west.

The Southern group of buildings does not place a particular emphasis along the Klein-Riet River, and seems to be scattered away from any of the major river sources. This is also true for the Western group where none of the buildings are on or near a perennial water river or *vlei*/pan. Additionally, these structures are located within a band of higher rainfall as described in Figure 4.9. This also applies to corbelled buildings to the east where there is higher rainfall and where smaller non-perennial rivers may retain water over a greater portion of the year.

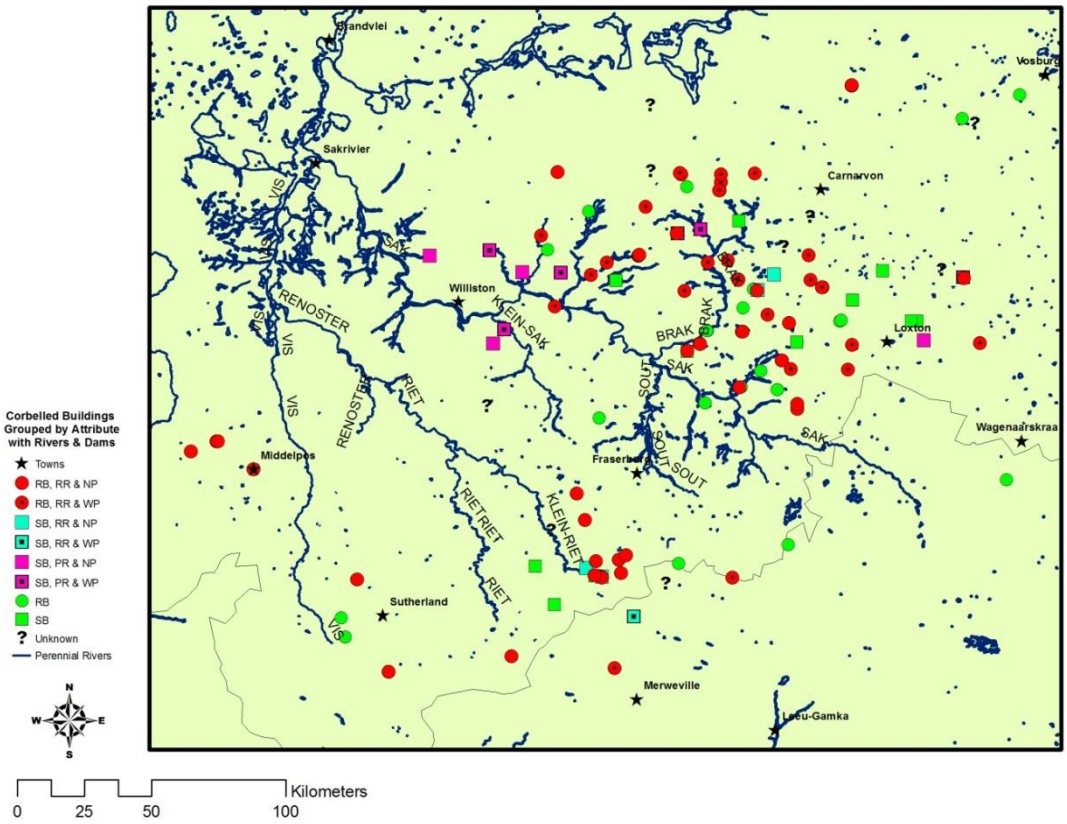

Figure 4.13 Map illustrating the distribution of corbelled buildings and main perennial rivers together with dams/reservoirs.

It is not worth considering the distribution of different building Types in relation to river systems as there is an even distribution of corbelled building Types near or on the various water sources (Figure 4.13). The general pattern for the Northern group applies to all Types in particular to Type C structures that are found close to perennial rivers. This also applies to Type A structures but the larger sample shows that those buildings further to the east in the Northern group are perhaps more dispersed away from rivers, a feature already noted above.

The correlation between the general distribution of corbelled buildings and their proximity to a water source, especially in the Northern group, again raises the issue of compromise in the selection of a place for a domestic dwelling within this vernacular type. The focus of these buildings near to perennial water sources potentially makes sense of their distribution to the south of the 'tongue' of higher

ground, that includes the Kareeberg, and hence better grazing as shown in Figures 4.7 and 4.8. I have noted that the buildings are not generally located directly on higher areas with better grazing. This indicates a choice for a location that had to prioritise and rank variables and in this case the critical issue, not surprisingly, seems to be immediate access to water. The inference from this compromise based on the pastoralist emphasis of the corbelled building occupants may indicate that access to these pockets of better grazing on the higher ground, if needed, was achieved through transhumance. Even at the scale used in the Figures, it is clear that these pockets of better grazing would not necessarily fall within the boundaries of single farms and that moving livestock would have required movement across farm boundaries. As noted above, despite the purchase of farms, enclosure and fencing was patchy in this region, even towards the end of the nineteenth century. The Type C structures that potentially date to this period, and their specific locational preferences on the western edge of the corbelled building distribution and associated with river systems suggest that their builders and occupants may have employed this system.

4.5. Subdivision of farms

Before concluding this Chapter I change the scale of analysis and examine two farms in detail where there are several corbelled structures that in each case fall within the boundaries of these farms. I noted when plotting the corbelled buildings onto the maps that several of the farms had more than one corbelled building located on them. The investigation of the farm title deeds revealed that over the history of these farms the land was subdivided several times. The close clustering of several corbelled structures on a single farm raises additional questions about the historical continuity of family and kinship ties focused on one area. This is especially interesting if these structures were used simultaneously, when for example, sons or

other members of the family were given a portion of land or farm sections were sold off for monitory gain. Additionally, it also raises questions about how multiple stock farmers in close proximity negotiated their individual access to resources through mobility. The question raised by these subdivisions and discussed here is simpler, and looks at whether the corbelled buildings correspond with the subdivisions and whether the date of the subdivisions provides a more accurate date for the construction of these structures. The prime focus of this discussion is to investigate the farms of Gansvley 554 in the north and Driefontein 464 in the south (Figure 4.14) as both farms have several corbelled buildings of different Types.

As mentioned previously, the names given for the different corbelled buildings (Appendix B) are those of the subdivisions on which they are found. Each subdivision was established at a different time after the original granting of the title deed and may provide a more precise date for different Types. This could also elaborate the sequence of corbelled building types from round-based to square-based. Equally, the subdivision of the farms infers that the environment was suitable for more intensive farming of the land, and consequently I also consider a few environmental factors at the single farm scale.

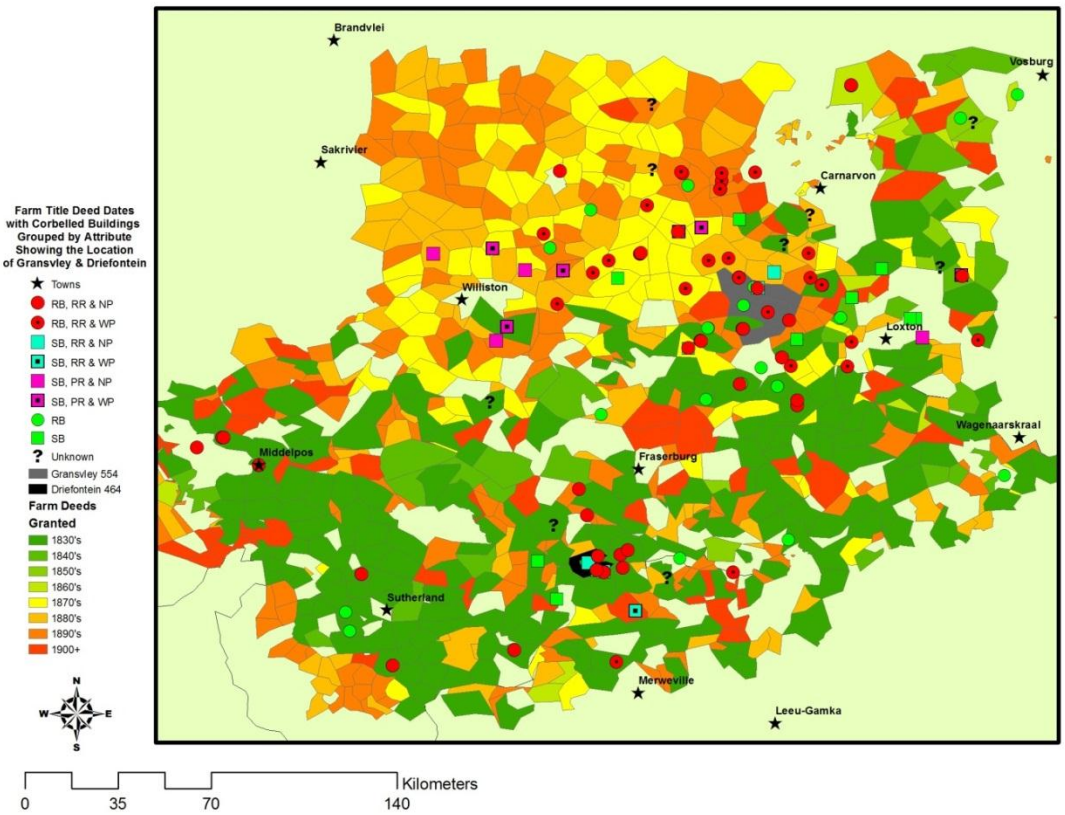

Figure 4.14 Map illustrating the location of Gansvley farm 554 (Grey) and Driefontein farm 464 (Black) on the farm title deed map.

4.5.1. Gansvley farm 554 subdivisions with corbelled buildings

Gansvley farm 554 in the Carnarvon district has seven subdivisions (Figure 4.15). The most eastern subdivision is dated to the first granting of the farm in 1848, while the western parts of the farm were portioned off at later times. These divisions took place in two episodes; the first was in the 1890's and the second in the early twentieth century. The first episode saw the selling off of four portions of the farm in four years (van der Merwe & Beck, 1995). It is interesting to note that this took place 40 years after the title deed to the farm was first granted. The second episode occurred almost 30 years later. The reasons for these land sales can only be answered with a more in-depth study of this farm which is beyond the scope of this project.

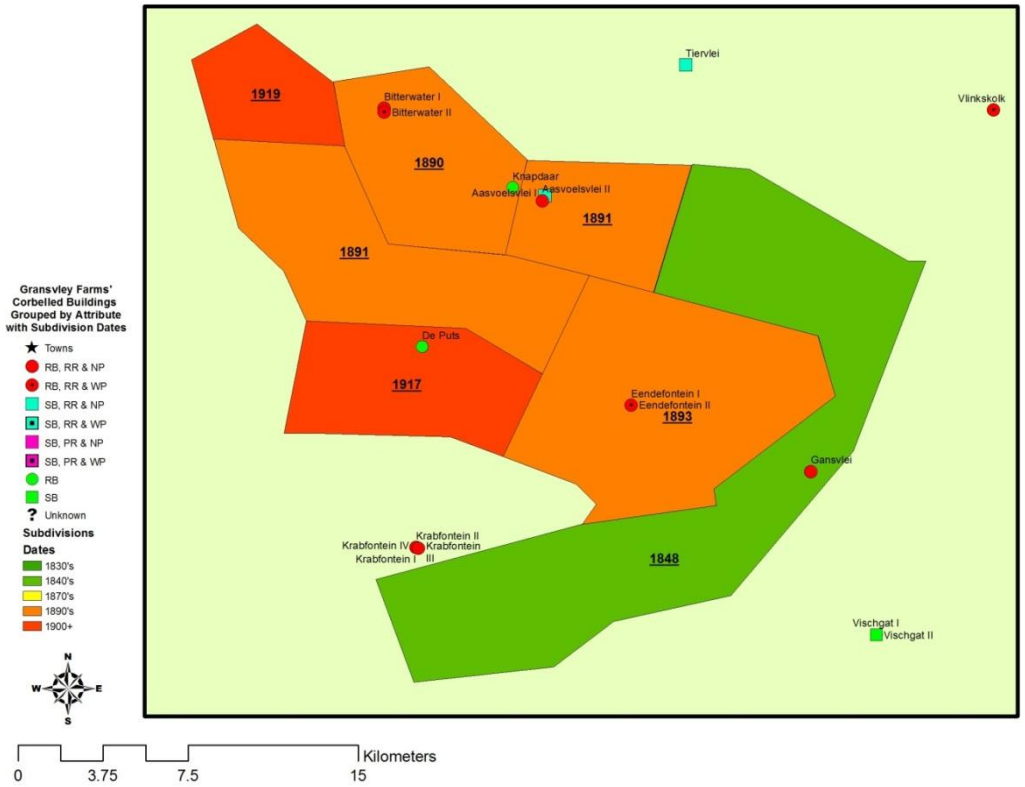

Figure 4.15 Map illustrating the distribution of corbelled buildings on Gansvley farm 554 showing the dates of when the subdivisions on this farm occurred. The names of each of the corbelled buildings are displayed next to their respective buildings.

The corbelled buildings situated on this farm are found on five of the subdivisions and the majority, seven, are located on the subdivisions dating from the 1890's. All but one of these corbelled buildings has a round base and these are widely dispersed across the subdivisions (Figure 4.15). The sole square-based building (Type B – SB, RR) is found on a subdivision that occurred in 1891 and is close (≈260m) to a round-based corbelled building in the same subdivision. This distribution of buildings potentially supports the expected chronological sequence with Type A being constructed at various environmentally important points shortly after the deeding of the farm in 1848 and the subdivision in 1891 may date the Type B structure. Even if the subdivisions were drawn around pre-existing Type A structures this still indicates that they are earlier in date.

4.5.2. Driefontein farm 464 subdivisions with corbelled buildings

The farm of Driefontein (464) in the south is in the Fraserburg district and has eight subdivisions. The farm was granted a title deed in 1838. Of the eight, four could not be assigned a date as to when the subdivision occurred (Figure 4.16). The remaining subdivisions were sold off in 1895, 1901 and 1921. It is interesting to note that the first subdivision took place more than 50 years after the first title deed to the farm was granted.

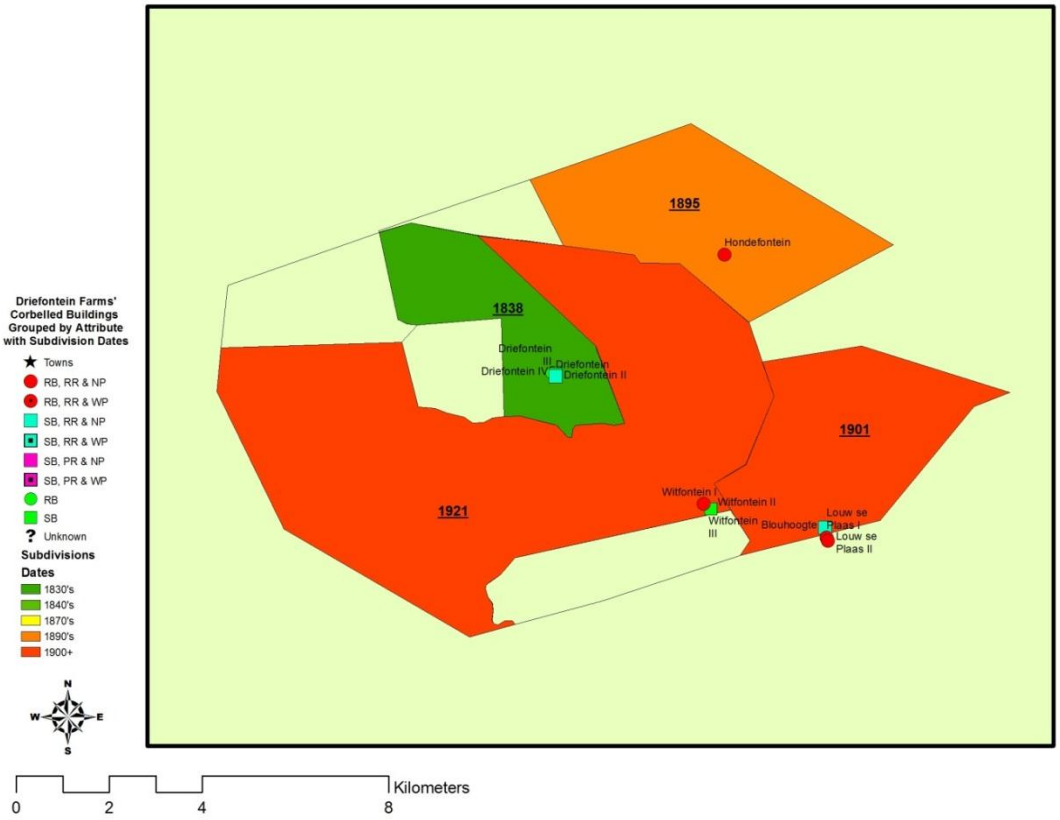

Figure 4.16 Map illustrating the distribution of corbelled buildings onDriefontein farm 464 showing dates of when the subdivisions on this farm occurred. The names of each of the corbelled buildings are displayed next to their respective buildings.

The distribution of corbelled buildings on the Driefontein farm is scattered on each of the subdivisions. Three of the subdivisions have round-based corbelled structures. Blouhoogte subdivision in the south has a Type B building and it is

situated close (220m) to two Type A corbelled buildings found on the adjacent farm Lous se Plaas in the south. The subdivision of Wittfontein (subdivided in 1921) has two square-based buildings (Wittfontein II and III) and one round-based building. Honderfontein (subdivided in 1895) has only one round-based building; while the subdivision of Driefontein has four structures of which three are square-based (one of which can be assigned a Type B and one that is round-based).

Consequently, there are two types of corbelled buildings found on this farm - Type A and Type B. Round-based buildings are located on all of the dated subdivisions and Type B is found on both the earliest portion of the farm (granted in 1838) and in 1901. In terms of the Type sequence the presence of a Type B structure on the original 1838 section suggests that it was built well after this date.

The examination of these two farms shows that it there is no simple, consistent and straightforward relationship between the dates of the subdivisions, the date of the buildings and the building sequence. The subdivisions appear to help the chronology of corbelled buildings in some instances. Some Type A structures appear to correspond with earlier subdivisions and the later Type B structures relate to the later partitions after 1890. Searching for correlations must also be influenced by the presence of pre-existing infrastructure on the land of which corbelled buildings could have been a part. This brief enquiry into the chronology of these corbelled buildings on subdivided farms also raises the issue as to why different Types of corbelled building are found so near to each other? While I believe the Type A, B, C sequence to be valid, the development of rectangularity in the later Types does not mean that Type A structures were no longer built. These questions require a much closer look at the history of each farm, which is beyond the scope of this project.

4.5.3. Other environmental features

The extent to which the local habitat may have played a role in the placement of the corbelled buildings or the definition of the subdivisions is briefly examined. The large scale map of this region (Figure 4.14) shows only the perennial rivers, but in Figures 4.17 and 4.18 more detail is shown.

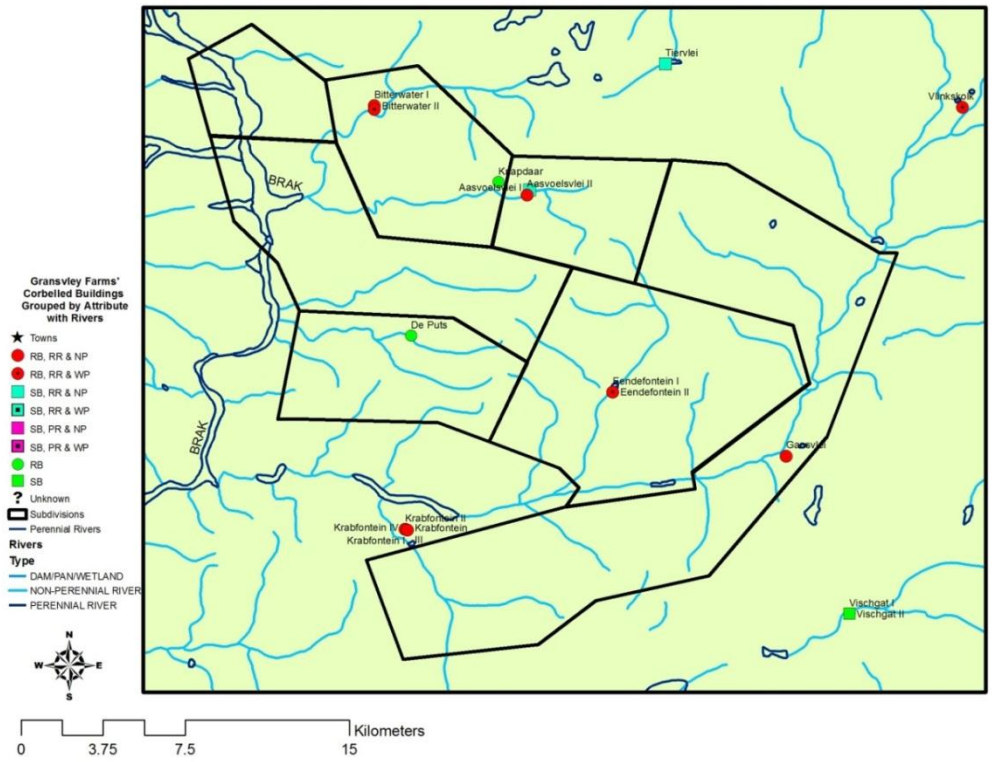

Figure 4.17 Map illustrating the distribution of corbelled buildings on Gansvley farm 554 showing their relationship to rivers and dams/reservoirs.

As Figure 4.17 shows there are numerous small non-perennial drainages cutting across the various subdivisions of Gansvley farm 554. All of the corbelled buildings are situated on or near (<150m) one of these rivers (not at sources) and this is a distinctive and repeated feature. None of these rivers, however, either perennial or non-perennial, appear to have acted as boundaries that defined either the complete farm or any of the subdivisions. Either by default or through deliberate choice all

subdivisions are well served by a number of these small drainages. However, it is also evident that all structures were within relatively close proximity to the larger perennial drainage of the Brak River, yet none of the structures were actually built on its banks.

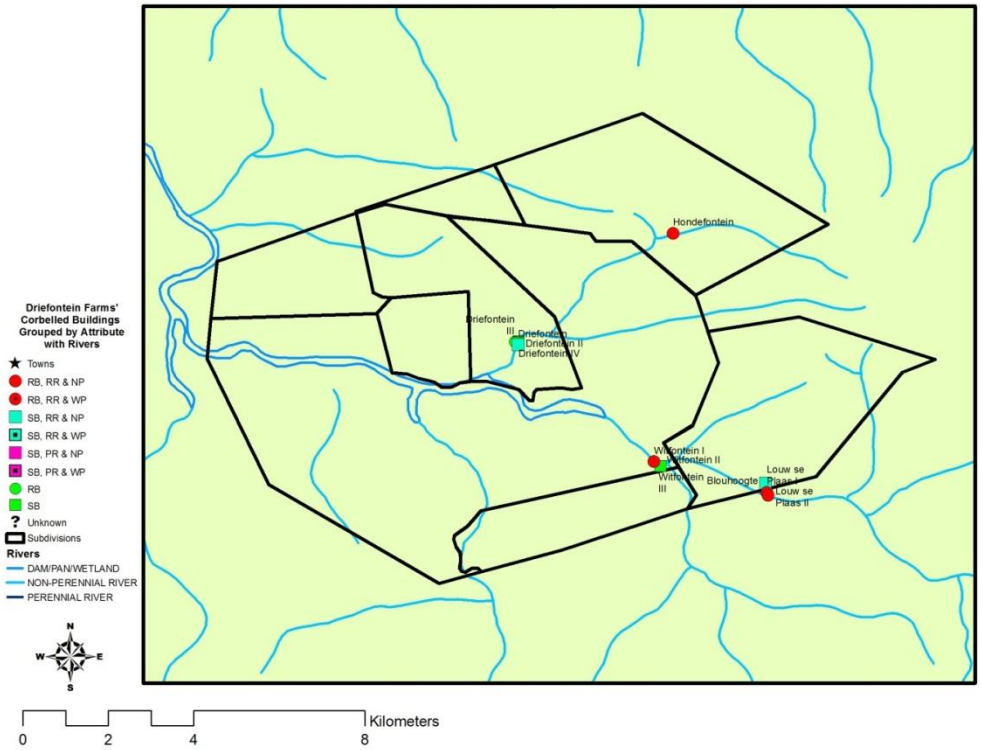

Figure 4.18 Map illustrating the distribution of corbelled buildings on Driefontein farm 464 showing their relationship to rivers and dams/reservoirs.

The farm of Driefontein has fewer rivers running though it but does have a wetland, which is part of the Klein Riet, running from east to west and which is to the south of the Driefontein corbelled buildings (Figure 4.18). Although this is a major perennial river, none of the corbelled buildings are found along its banks, but rather further away on its tributaries (<110m), with the exception of Blouhoogte which is found 300m away from a water source. It is evident that in the upper reaches of the Klein Riet River, the northern bank defines one of the boundaries for two of the subdivisions. As a result three of the subdivisions, including the largest, had direct access to the Klein Riet River.

The location of corbelled buildings on these two farms matches the pattern seen in the larger distribution of these structures. The corbelled buildings are situated within a few hundred meters of a water course which is to be assumed in this semi-arid environment. An expectation would be that corbelled buildings and subsequently farm homesteads would be situated either at the rivers source or at the joining of two streams to maximise the availability of water. This is the case for some corbelled buildings e.g. Aasvoelvley and Wittfontein although not for others e.g. De Puts and Honderfontein. None of the rivers act as boundaries to either the farms or the subdivisions, possibly indicating that these were either too small to be adequate border markers or that water, being a valuable resource, was shared along it course. The correlation, therefore, between rivers and the location of corbelled buildings seems supported although not in the expected locations.

An examination of other environmental features that may have influenced the way subdivisions were made and the location of corbelled buildings suggests that these are homogenous (See Figures 4.8 - 4.12), and that there little to no variation. However, there may be relevant finer details, but it is not possible to make any meaningful comments about the corbelled building location on this smaller scale. To obtain such data would require a specific and detailed examination of each farm.

4.6. Discussion

The main focus of this Chapter has been on the unique corbelled houses of the Karoo that are located to the west of the Nieuweweld Mountains and to the north of the Roggeveld Mountains. This vernacular architecture has been audited by Kramer (2012) and it is her conclusion, and reasonably so, that they provided the domestic dwellings of Trekboer stock farmers in this area of the Karoo from about 1830 and through to the end of the nineteenth century. The core of the Chapter has

been an examination of the distribution of these structures. The rationale for this has been to assess a developmental sequence implied by the classification of these buildings into Types that assumes a chronological order in which an emphasis on circularity and domed roof forms gave way to increasing rectangularity.

The hypothesized chronology of the corbelled building changing from Type A through B to C appears to be confirmed by the data. However, while this sequence is valid, the data cannot support the idea that these types are chronologically discrete. While Type A structures can be associated with earlier farms, as established through the title deed date, their presence in the northern areas, on farms that were purchased much later in the nineteenth century, and co-mingled with Type C structures, indicates that they continued to be built. What is clear is that the Type C structures fall predominantly within the later nineteenth century title deeds and that they unquestionably were a later nineteenth century innovation and an advance based upon the round base form and domed roof. However, tying the construction of these structures down to a specific date or decade based on the farm title deed date is difficult. While the construction sequence is valid this cannot be formally tied in any specific way to the construction of domestic dwellings that formalised occupation of a farm at the time of its purchase. This raises the issue that while the corbelled structures are part of the way the nineteenth century landscape unfolded and was developed, the occupants of these buildings were not necessarily the people who drove this process in terms of actual ownership of land. I return to this issue below and in the next Chapter.

In summary, the main conclusions drawn from a consideration of the environment are as follows. Topography appears to be an important factor as it obviously affects other environmental features, such as grazing and temperature. The distribution of the corbelled buildings in this region of the Karoo are broadly distributed in a reverse C on the plateau above 800m with no one Type associated with a particular altitude. Other factors that are affected by height include vegetation which will determine the grazing capacity and coupled with temperature could also adversely

affect livestock. Thus topography may be an important consideration in determining where settlement was preferred in order to utilise a variety of suitable grazing areas, and gain access to differing altitudes and environments.

Better grazing capacity is associated with higher altitudes and corbelled buildings are generally situated to take advantage of this. Although not all corbelled buildings are located in the areas of better grazing, the majority of structures are situated where access to more than one grazing zone is possible. Temperature is also linked to the topography, with cooler temperatures associated with higher altitudes. This is important particularly for sheep as high heat can negatively affect animals causing the loss of livestock. While some corbelled structures and the livestock management coordinated from them are placed to take advantage of higher areas and therefore cooler conditions, the majority of structures are found in the increasingly marginal areas of the north and west.

Water is obviously an essential requirement for farmers and their livestock, yet as demonstrated in Figure 4.9 and 4.10 this region does not receive and retain much precipitation. It is only along the high mountains of the escarpment that any meaningful rainfall and its retention occur. This partly explains the location of the Western and Southern groups, but not the corbelled buildings found in the north where there is low rainfall and high evaporation rates. However, the location of the Northern group can be explained by the presence of perennial rivers in this area (Figure 4.13). It is access to a dependable water source that is of main concern. Although some corbelled buildings are not situated near a source of surface water, these structures presumably used ground water as the main rock type of this region is mudstone which is known to hold water.

The location of corbelled buildings as a whole is a compromise between a number of environmental factors. The main factor that influences location is water accessibility, either through rainfall or by rivers. Due to the arid nature of this region this is an important consideration for farmers not only for themselves but also for

their livestock. The other two are linked to topography and a number of these structures are found on the higher ground of the escarpment. A location on higher ground provides better grazing and more manageable temperatures in summer for both animals and people.

The general environment appears to have played a role in the location of the corbelled buildings as ascertained through a comparison with main variables in the region, namely grazing and access to water, be it more rainfall or perennial rivers. While it is difficult to link the distribution of any one Type of structure to environmental and climatic variability, the general distribution of these structures does, in certain areas, indicate that the location of groups of structures, irrespective of time, was based on ranking environmental variables. In the south, for example, structures located in the vicinity of the Roggeveld escarpment could have taken advantage of variable seasonality in grazing along the lines suggested by historic records. But within a strategy of mobility, the corbelled structures as a core domestic focus, do not appear to have been built within prime grazing areas and presumably other factors 'pulled' the location away. The absence of corbelled structures within the U-shaped distribution may indicate that the relative ecological and climatic homogeneity of this area meant that there was little to base settlement compromises on that would have optimised a location.

The issue of compromise is perhaps best expressed in the general distribution of the Northern group of corbelled structures. Here there is a mingling of all three corbelled building Types that seem, in their distribution to have responded, in terms of their location, to roughly the same variables. While there are distinctions between the east, near Loxton and Victoria West and out to the west in the areas south-west of Carnarvon and at the western limits of the corbelled structure distribution around Williston, this group appears to be within the relatively high density of perennial river systems. In what is the most marginal area in the region, this is not surprising. What potentially makes the distribution of this Northern group even more relevant is that immediately to the north, there are areas of higher

ground that supports better grazing conditions, and yet these structures are not located there. I have suggested that in this case the location of these structures was a clear compromise in which the priority was to settle within the relatively high density area of perennial rivers and access the better grazing through transhumance.

This Chapter has engaged with the corbelled structures, their typology, potential chronology and sequence and their distribution on the landscape relative to environmental and climatic factors. Throughout this discussion the issue of an open landscape and the management of livestock through access to different areas has been emphasised. The nature of these corbelled buildings, premised on indigenous architectural forms, are a dwelling that expresses and continues a tradition of livestock and pastoralist management and the discussion has been developed around this. However, the historical context of the nineteenth century within which these corbelled houses appeared and were built and occupied needs to be revisited in the next Chapter. While it is reasonable to state that the occupants were linked to a Trekboer ancestry with a deep entanglement with indigenous forms and that the emphasis in the discussion encourages a view that the nineteenth century Karoo landscape unfolded in a natural way, in which farms were purchased and Trekboers expanded across the Karoo in terms of occupying and engaging with its natural setting, a view of the larger historical forces at work in the Karoo may modify this. In this regard, and among other points, I return to the expansion of the Merino sheep wool industry into the Karoo and assess that the appearance and distribution of these corbelled structures was a specific response to this process and to new economic forces, rather than as a process that unfolded within a natural setting. While this was clearly important in a marginal environment, it needs to be considered that specific historical and economic factors drove this process.

Chapter 5: General discussion

When the British government took control of the Cape Colony at the beginning of the nineteenth century, they instituted changes in the administration and use of the land. This was due to the previous VOC administration failure to retain control over the spread of farms to the interior and the inability of officials to effectively manage the loan farm system, resulting in a degree of administrative chaos. The British reforms to land tenure rights affected how farms were defined on the landscape. These changes included the requirement for farm title deeds to be issued for a specific location and of a designated size, with no consideration for the topography or natural resources on the land. The question that arises from this alteration in the land tenure is how this changed the concept of landscape in the arid Karoo?

The Trekboers entered this environmentally harsh region in the latter half of the eighteenth century and adopted the model of livestock management refined by the indigenous Khoekhoen pastoralists which focused on a seasonal transhumance. This migratory lifestyle, free of administrative accountability, was crucial for survival during this period. Initially there was a mutual use of the semi-arid region by both Europeans and the indigenous Khoesan, but as more colonists moved to this area in search of farm land, conflict arose over rights to the scarce resources of the Karoo. Despite the hostilities that undermined Khoekhoen pastoralism and devastated the hunter-gatherer San, cultural exchange continued. The Trekboer attitude to the land was one of openness and fluidity with a limited emphasis placed on creating permanent residence. This was due to the relatively extensive transhumant movement from the cooler, high lying areas of the Roggeveld escarpment used in the summer to grazing pastures in the warmer low lands to the south and north of this escarpment in winter. This cultural attitude of the Trekboer to land was not fully understood by the government in the Cape.

The land tenure system introduced by the British Governor Caledon in 1807 resulted in title deeds being granted for specifically defined and formally surveyed farms. The chronology of the granting of farm title deeds in the Karoo region under investigation, which is bounded by Roggeveld Mountains in the west and the Nieuweveld Mountains in the south, was examined in Chapter 3. The chronological distribution showed an expected general south to north trend which on initial inspection corresponds to the unfolding of this new legal status. Thus farms purchased in the earlier part of the nineteenth century are located closer to the Cape Colony in the escarpment areas of the Roggeveld and Nieuweveld Mountains, while those further to the north were acquired in the latter part of the century. However, closer analysis of the chronological distribution of those farms purchased earlier in the nineteenth century showed a shallow U-shape curving from Middlepos in the south-east to Vosberg in the north-west.

Interrogating this distribution further with respect to environmental and climatic factors, the key variables associated with this distribution are higher rainfall and more importantly, better grazing in these escarpment areas. When the physiological tolerances of sheep, in particular Merino sheep, are considered, the earlier farm title deeds map onto areas that are better suited to their management and production. Prior to the formalization of land tenure through the acquisition of title deeds, the Trekboer employed transhumant strategies through loan farms and grazing licences. Thus seasonal grazing migration of sheep from the escarpment in summer to lower areas in winter was ensured. With the implementation of land tenure, farmers may have acquired several title deeds to farms strategically located to optimize the use of marginal grazing land. This reasoning applies specifically to the farms with earlier title deeds.

Farms with title deeds obtained later in the nineteenth century are located in marginal areas to the north with lower grazing capacities, higher temperatures, less rainfall and higher evaporation rates. However, the greater density of perennial rivers may have played a role in their acquisition and settlement. The introduction of wind pumps in the 1870's may also have facilitated occupation of this region.

The introduction of Merino sheep to the Karoo region in the 1850's is a turning point in the nineteenth century. Subsistence farming of the mutton-producing fat-tailed sheep for the local market gave way to an export orientated farming strategy based on the overseas wool market utilizing Merino sheep. This change began when the 1820 British settlers moved from the coast inland to farming areas in the east of the Karoo, around Graaff-Reinett. Their progressive ideas and adoption of the Merino sheep for livestock farming was in response to a changing economy where wool production was a profitable farming enterprise. To take advantage of this lucrative export market there was a need to increase production with the acquisition of land in more marginal areas to the west. A subsequent market boom in the 1870's led to further westward expansion which was facilitated by the adoption of the new technologies of fencing and wind pumps. This resulted in a gradual closing off the landscape through the utilization of fencing and a reduction in tracts of free land.

The Trekboer farmers were more reticent in adopting the Merino sheep and a new focus of farming away from their subsistence lifestyle. However, when these sheep were accepted, their transhumant movement across the Karoo landscape was still employed as the physiology of Merino sheep was not conducive to the environmental pressures found in the region. The lack of adequate grazing and high temperatures could be overcome by moving to better suited areas, however, an adequate supply of water was of primary importance. Movement across this region was an essential strategy for survival in this semi-arid environment. This

transhumant lifestyle would leave only ephemeral traces in the archaeological record. Corbelled buildings are such evidence of their presence.

This vernacular architecture is unique to the Karoo region under investigation and provides evidence of a change in the lifestyle of the Trekboer farmer after 1830. Examination of the general distribution of corbelled buildings reveals a reverse C pattern on the plateau above 800m. The positioning of the majority of these structures on higher altitudes is associated access to better grazing zones and more equitable temperatures beneficial for sheep farming. This suggests that corbelled buildings were primarily located straddling different grazing zones with a particular focus on access to water. The Western and Southern groups are evidence that meaningful rainfall and its retention were a key concern. In contrast the location of the Northern group can be explained by the presence of perennial rivers in the area. That access to water is primary factor in the location of corbelled buildings is confirmed on the scale of individual farms.

An interesting observation is the absence of corbelled buildings within the reverse C. This 'hole' may indicate that the homogeneity of the environment found in this area was incompatible with the continuation of a transhumant way of life required for livestock management.

Corbelled buildings can be classified into 3 basic Types (Kramer, 2012) based on base form and roof form which can be then used to identify a developmental sequence. This hypothesized chronological order is that circularity of base and domed roof form gave way to an increasing rectangularity during the nineteenth century. This is based on the premise that the round form is consistent with the beehive-shaped buildings of the indigenous Sotho/Tswana and thus of earlier construction. Later European influences played a role in the development of the square-based forms.

The application of farm title deed dates to confirm this sequence was undertaken. Type A structures with a round base and round roof were associated with farms purchased early in the nineteenth century. However, their presence on later deeded farms where Type C structures of greater rectangularity predominate implies that the association between corbelled building Type, as a chronological marker, is not strongly supported when farm title deed date is used as a point of reference.

Early nineteenth century travellers to this region of the Karoo like Burchell (1824) and Lichtenstein (1928) failed to mention these unique corbelled buildings in their journals, suggesting that prior 1830 they were absent. This indicates that an historic event in the mid 1800's precipitated their construction. The arrival of wealthy 1820 British settlers to the east of this region, around Graaff-Reinett, with Merino sheep was probably the catalyst. Their growing wealth and power resulted in expansion of their farms and flocks displacing the poorer Trekboer farmers (Anderson, 1985). In response to this encroachment and continued uncertainty of land ownership, these latter farmers constructed the rudimentary round-based, round-roofed Type A buildings. This enabled them to continue their transhumant lifestyle without investing or tying themselves to a specific piece of land.

With the boom in the overseas wool market in the 1870's and the prospect of greater profits farmers sought additional land in more marginal farming areas. This was aided by the introduction of wind pumps in 1874 allowing farmers to utilize water stressed areas that were previously not conducive to life stock farming. The construction of Type C corbelled buildings was possibly a physical expression of success in the difficult environment and ownership of the land, much like the British farmer's homesteads to the east.

By the end of the nineteenth century the majority of the Karoo region was occupied by Merino sheep farmers. In the east intensive farming on large tracts of fenced lands lead farmers, particularly the British, to adopt a sedentary lifestyle on their designated title deeded farms. With the increased legal compartmentalization of this region a closed landscape could be envisaged. This contrasts with the region to the west, the area under investigation in this thesis. Here the Trekboer farmers, who could not afford to purchase land under the new land tenure system, retained their deeply engrained extensive transhumant seasonal approach to farming, due in part to the marginal nature of the environment and the physiological constraints of Merino sheep. This together with archaeological evidence left by the migratory farmers in the form of corbelled buildings suggests that the landscape in this part of the Karoo remained open.

Chapter 6: Conclusion

This thesis endeavoured to add to the history of the Karoo by investigating the nature of changes that occurred during the nineteenth century, with a particular emphasis on sheep farming, land tenure and vernacular architecture.

The introduction by the British government in the Cape Colony of new land tenure legislation resulted in farms with fixed boundaries. This changed the nature of the Karoo environment from an open to a more closed landscape. This was facilitated by the introduction of Merino sheep in the mid 1800's which resulted in an alteration in the management system of livestock farming from an extensive to an intensive approach. Encroachment from the east by wealthy wool farmers resulted in the Trekboers being dispossessed of their land and pushed into more marginal environments. However, the Trekboer farmers sought to retain their transhumant way of life adopted from the indigenous groups already present on this landscape. A physical remnant of this lifestyle is the presence of the corbelled building vernacular architecture.

A more in depth examination of this Karoo region was hampered by the limitations the data available. The farm title deed dates were constrained by the cadastral data as only modern farm boundaries were available. It would have been preferable to reconstruct farm boundaries as they were when the first title deeds were issued. However, the relationship between the earlier and later farm purchases would have been lost. Further, the title deed data could not provide information on loan farms prior to 1838 as this was before the institution of the land tenure legislative system. The addition of this information would have provided a better framework in which to contextualize the changes in land tenure and plot the spread of farmers into this region of the Karoo.

The corbelled building data also has some limitations. The base, roof, and projection attributes are not known for all the structures. Mapping the distribution of corbelled buildings on a region scale probably resulted loss of resolution. The two farm case studies examined herein showed that on a local scale more definitive statements could be made.

This study and that of Kramer (2012) provide the basis on which further investigations, particularly on corbelled buildings can be initiated. Archaeological excavations of these structures would enable a better understanding of the social status of the Trekboer farmers and their relationship to these buildings. An examination of other buildings constructed during the same period in the nineteenth century would be instructive in further contextualizing the corbelled buildings in this environment. Biographies of specific farms on which these structures are found would elucidate the relationship between them, farm title deeds and subdivisions.

Appendix A: Farm title deeds

Table 1. List of farms in the Karoo region with dates when title deeds were granted

FARM NAME	DISTRICT	TITLE DEED GRANTED
15	BARKLY-WES/WEST	1893
19	BARKLY-WES/WEST	1892
72	BARKLY-WES/WEST	1874
71	BARKLY-WES/WEST	1882
59	BARKLY-WES/WEST	1910
138	BARKLY-WES/WEST	1881
184	BARKLY-WES/WEST	1880
183	BARKLY-WES/WEST	1894
108	BARKLY-WES/WEST	1838
145	BARKLY-WES/WEST	1887
86	BARKLY-WES/WEST	1881
94	BARKLY-WES/WEST	1889
176	BARKLY-WES/WEST	1881
271	BARKLY-WES/WEST	1862
275	BARKLY-WES/WEST	1892
350	BARKLY-WES/WEST	1891
282	BARKLY-WES/WEST	1890
27	BRITSTOWN	1892
94	BRITSTOWN	1889
145	BRITSTOWN	1887
149	BRITSTOWN	1880
163	BRITSTOWN	1875
282	CALVINIA	1890
411	CALVINIA	1889
412	CALVINIA	1885
430	CALVINIA	1838
469	CALVINIA	1888
430	CALVINIA	1838
524	CALVINIA	1874
581	CALVINIA	1979
526	CALVINIA	1892
ZANDKRAAL 713	CALVINIA	1838
ZANDBULT 723	CALVINIA	1884
BRAKBOSVLAKTE 709	CALVINIA	1918
MATJES FONTEIN 712	CALVINIA	1893
LEEUWENDRIFT 702	CALVINIA	1890
ANNEX KRANSFONTEIN 721	CALVINIA	1838
HAM KRAAL 717	CALVINIA	1889
715	CALVINIA	1884

KAPGAT 724	CALVINIA	1838
KRANSFONTEIN 719	CALVINIA	1893
ANNEX LEEUW FONTEIN 716	CALVINIA	1907
MULDERSVLEI 279	CALVINIA	1875
725	CALVINIA	1948
OSHOEK 718	CALVINIA	1911
RIETFONTEIN 859	CALVINIA	1838
LANGE KUIL 871	CALVINIA	1838
DE HOEKEN 863 863	CALVINIA	1895
KOOKFONTEIN 868	CALVINIA	1948
NIEUWE ELANDS OOG 873	CALVINIA	1892
UITKOMST 857	CALVINIA	1838
HANGNES 861	CALVINIA	1918
WILGEBOOM 864	CALVINIA	1838
BONEKRAAL 875	CALVINIA	1838
ZANDBULT 870	CALVINIA	1893
HARDEHEUWEL 880	CALVINIA	1838
DIE WILGEBOOM 891	CALVINIA	1910
ELANDSFONTEIN 897	CALVINIA	1838
898	CALVINIA	1837
BRAKKEFONTEIN 893	CALVINIA	1838
706	CALVINIA	1896
ANNEX KRUIPIN906	CALVINIA	1911
KLEINE FONTEIN 886	CALVINIA	1838
VET PAD 917	CALVINIA	1880
1008	CALVINIA	1911
KLIP PLAAT ANNEX 905	CALVINIA	1910
902	CALVINIA	1911
KLIP BANK 1007	CALVINIA	1886
901	CALVINIA	1911
GROENFONTEIN 1014	CALVINIA	1838
VRYDBURG 881	CALVINIA	1911
DE HOOP 1015	CALVINIA	1838
BRAND KOP 1013	CALVINIA	1911
MIDDELPOS 887	CALVINIA	1838
LEEUW PAD VLAKTE 1009	CALVINIA	1885
MIDDLEDRIFT 1006	CALVINIA	1891
SCHOOR KRAAL 1003	CALVINIA	1910
AVONTUUR 1017	CALVINIA	1841
ZYPER FONTEIN 1024	CALVINIA	1838
DASSIE BERG 1005	CALVINIA	1890
1023	CALVINIA	1838
1010	CALVINIA	1930

OLYVENBOSCH 1039	CALVINIA	1862
DASSIE VLAKTE 1051	CALVINIA	1893
1033	CALVINIA	1841
1038	CALVINIA	1892
RHEBOKSFONTEIN 1025	CALVINIA	1838
RATELKRAAL 1042	CALVINIA	1887
ZOEKOP 1026	CALVINIA	1838
1031	CALVINIA	1893
YMANSKRAAL 1041	CALVINIA	1892
DE WITTE VLAKTE 1043	CALVINIA	1896
KLEINFONTEIN 1027	CALVINIA	1838
1030	CALVINIA	1881
1028	CALVINIA	1951
1029	CALVINIA	1912
1088	CALVINIA	1905
BOEZAK 1090	CALVINIA	1910
ROODE WERF 1091	CALVINIA	1904
OORLOGS HOEK 77	CARNARVON	1890
KAREEBOSCH FONTYN 78	CARNARVON	1848
BOTER LEEGTE 65	CARNARVON	1874
VISSERS KLOOF 69	CARNARVON	1875
CARELS GRAF 76	CARNARVON	1866
PAARDEVLEI 73	CARNARVON	1872
SCHIET POORT 64	CARNARVON	1880
BLAAUWPOORT 71	CARNARVON	1890
ZEEKOEGAT SOUTH 81	CARNARVON	1881
ZEEKOE GAT 87	CARNARVON	1912
SWART FONTEIN 67	CARNARVON	1871
BRAK PUTS 66	CARNARVON	1873
JAGERSBERG 72	CARNARVON	1892
WONDERHEUVEL 70	CARNARVON	1888
86	CARNARVON	1881
UPPER ZWARTRAND 90	CARNARVON	1924
BIESTJES DAM 88	CARNARVON	1855
JOOSTES WERVEN A 82	CARNARVON	1963
MEYS DAM 68	CARNARVON	1907
SWARTFONTEIN 496	CARNARVON	1899
94	CARNARVON	1889
KARREEKLOOF 490	CARNARVON	1882
81	CARNARVON	1860
106	CARNARVON	1838
BRONKHORSPUT 92	CARNARVON	1859
LOWER ZWARTRAND 91	CARNARVON	1860

WILLEM-MEINTJE-KLOOF 492	CARNARVON	1890
135	CARNARVON	1889
SCHIET KOLK 491	CARNARVON	1882
206	CARNARVON	1888
HONDE BLAF 493	CARNARVON	1878
LOT B PFADDERFONTEIN 495	CARNARVON	1877
LOT A POFADDER FONTEIN 494	CARNARVON	1877
GROUND ADJ CYPHERWATER 89	CARNARVON	1860
KARREE KOLK 489	CARNARVON	1890
163	CARNARVON	1875
145	CARNARVON	1887
CYPHERWATER 488	CARNARVON	1848
HOUDENBEK 482	CARNARVON	1838
584	CARNARVON	1981
174	CARNARVON	1893
206	CARNARVON	1888
202	CARNARVON	1890
165	CARNARVON	1935
487	CARNARVON	1896
483	CARNARVON	1852
264	CARNARVON	1891
WITGRAS 501	CARNARVON	1890
UITSPAN KOLK 499	CARNARVON	1891
WATERVAL 497	CARNARVON	1880
STUURMANS FONTEIN 498	CARNARVON	1891
248	CARNARVON	1883
TKOBOBOOS 500	CARNARVON	1891
483	CARNARVON	1852
KARREE-KLOOF 502	CARNARVON	1892
SWAVELFONTEIN 107	CARNARVON	1920
585	CARNARVON	1982
ROOI VLEI 575	CARNARVON	1875
368	CARNARVON	1890
BRANDFONTEIN 503	CARNARVON	1891
376	CARNARVON	1875
BIESJES LAAGTE 511	CARNARVON	1911
DRAAI KOLK 515	CARNARVON	1892
WITFONTEIN 514	CARNARVON	1891
VLAK WERVEN 513	CARNARVON	1894
SCORPIONS DRIFT 516	CARNARVON	1874
VRYE LAAGTE 529	CARNARVON	1882
KAFFERSKRAAL 536	CARNARVON	1838
KALK GAT 517	CARNARVON	1873

CELERY FONTEIN 523	CARNARVON	1838
528	CARNARVON	1912
BIESJES LAAGTE 521	CARNARVON	1889
LEEUWFONTEIN 520	CARNARVON	1838
525	CARNARVON	1930
522	CARNARVON	1851
KLIP KOLK 518	CARNARVON	1874
KLIP HEUVELS 519	CARNARVON	1889
VRYE LAAGTE 529	CARNARVON	1882
JAKHALSDRAAI 551	CARNARVON	1892
KLIPBANKS FONTEIN 533	CARNARVON	1838
PLAT KUILEN 531	CARNARVON	1880
526	CARNARVON	1892
524	CARNARVON	1874
DRIEKOPPEN 550	CARNARVON	1838
LOT B DE CYFER 537	CARNARVON	1875
SPOOR KOLK 553	CARNARVON	1880
STOF KRALEN 552	CARNARVON	1884
SNEEUWKRANS 532	CARNARVON	1850
VOGELFONTEIN 538	CARNARVON	1838
BIESJES POORT 534	CARNARVON	1880
VLOKS WERVEN 535	CARNARVON	1874
DE CYFER 91	CARNARVON	1875
ROODE DAM 549	CARNARVON	1884
NIEWE UITVLUGT 539	CARNARVON	1838
BRONKHORST REQUEST 92	CARNARVON	1859
541	CARNARVON	1883
TYGER-VLEY 555	CARNARVON	1880
KRUGERS KOLK 548	CARNARVON	1891
GANSVLEY 554	CARNARVON	1848
RIET-FONTEIN 547	CARNARVON	1877
RIETFONTEIN 546	CARNARVON	1838
582	CARNARVON	1979
RONDOM 540	CARNARVON	1865
581	CARNARVON	1979
571	CARNARVON	1865
RIETFONTEIN 572	CARNARVON	1848
BREAKFASTDAM 556	CARNARVON	1890
VANSWEGENS FONTEIN 560	CARNARVON	1843
BOTTEL DAM 558	CARNARVON	1892
VERTOON-KOP 557	CARNARVON	1892
561	CARNARVON	1872
UITSPAN BERG 564	CARNARVON	1883

562	CARNARVON	1844
563	CARNARVON	1872
206	COLESBERG	1888
15	COLESBERG	1893
28	COLESBERG	1893
201	COLESBERG	1880
202	COLESBERG	1890
WINKELHAAK 128	FRASERBURG	1876
VONKS LEEGTE 157	FRASERBURG	1879
DASENBERG 155	FRASERBURG	1876
SPIOENBERG 156	FRASERBURG	1875
MIDDEL WERVEN 154	FRASERBURG	1875
PATRYSFONTEIN 160	FRASERBURG	1944
KLEIN STOEY FONTEIN 167	FRASERBURG	1873
163	FRASERBURG	1875
GANNA POORT 161	FRASERBURG	1887
WINDHOEK 168	FRASERBURG	1838
VYGEBOSCH KRAAL 162	FRASERBURG	1890
ZANDWERVEN 217	FRASERBURG	1890
KRAB FONTEIN 218	FRASERBURG	1838
VERTOON VLAKTE 222	FRASERBURG	1890
DOORTJIES SYFER 166	FRASERBURG	1887
KOOKER`S GRAFS VLAKTE 221	FRASERBURG	1890
BRAK VALLEY 216	FRASERBURG	1838
VISCHGAT 223	FRASERBURG	1838
DE PLAAT 169	FRASERBURG	1891
KLIP DRIFT 203	FRASERBURG	1838
SPRINGFONTEIN 207	FRASERBURG	1880
KLIP GAT 209	FRASERBURG	1875
DE VLEI 208	FRASERBURG	1880
GOUWS VLAKTE 219	FRASERBURG	1890
BAN ZYLS KRAAL 210	FRASERBURG	1838
KOPPIESFONTEIN 214	FRASERBURG	1878
FRIESLAND 200	FRASERBURG	1879
NOBELSFONTEIN 170	FRASERBURG	1874
226	FRASERBURG	1882
KORFSPLAATS 204	FRASERBURG	1838
BLAAUWBOS PUTS 224	FRASERBURG	1872
228	FRASERBURG	1874
KOPJESFONTEIN 199	FRASERBURG	1891
GOUS VLAKTE 215	FRASERBURG	1890
202	FRASERBURG	1890
DE SYFER 229	FRASERBURG	1877

OMKEER KOLK 235	FRASERBURG	1875
KWEEKDEEL 201	FRASERBURG	1891
MARTJES VALLEY 245	FRASERBURG	1838
VOGELSTRUISFONTEIN 253	FRASERBURG	1838
206	FRASERBURG	1888
WELGEVONDEN 231	FRASERBURG	1838
JURYS FONTEIN 233	FRASERBURG	1838
RIETFONTEIN 257	FRASERBURG	1841
PAARDE GRASS VALLEY	FRASERBURG	1838
TABAKS FONTEIN 242	FRASERBURG	1838
BAKENKOP 234	FRASERBURG	1874
RIETPOORT 238	FRASERBURG	1838
VOGELSTRUISFONTEIN 253	FRASERBURG	1838
BAKOVENSKRAAL 244	FRASERBURG	1838
252	FRASERBURG	1891
JACKHALSFONTEIN 247	FRASERBURG	1837
BRANDFONTEIN 325	FRASERBURG	1838
STOFKRAAL 243	FRASERBURG	1838
BLYDEVOORUITZICHT 299	FRASERBURG	1888
256	FRASERBURG	1879
VISSRES KOLK LEEGTE 246	FRASERBURG	1892
248	FRASERBURG	1883
KLIP SPITS 240	FRASERBURG	1838
KLEINFONTEIN 292	FRASERBURG	1879
LEENDERTS FONTEIN 289	FRASERBURG	1838
SPRINGFONTEIN 327	FRASERBURG	1838
VARSCHE VALLEY 284	FRASERBURG	1838
OORLOGSFONTEIN 280	FRASERBURG	1838
MODDERASKOLK 281	FRASERBURG	1892
GROOTWAMAKERSVLEI 304	FRASERBURG	1941
ZAAIFONTEIN 322	FRASERBURG	1872
BORD VOL WATER 313	FRASERBURG	1877
ROOI POORT 287	FRASERBURG	1879
TAFELKOP 285	FRASERBURG	1890
CANGO RAND 292	FRASERBURG	1879
PLOEG FONTEIN 365	FRASERBURG	1838
312	FRASERBURG	1890
GROOTFONTEIN 311	FRASERBURG	1941
ANNEX RIET POORT 326	FRASERBURG	1878
282	FRASERBURG	1890
LUDIGS GRAF 324	FRASERBURG	1837
BOOYS BISSIES 286	FRASERBURG	1879
368	FRASERBURG	1890

319	FRASERBURG	1892
BIESJES LAAGTE 283	FRASERBURG	1884
DE KRUIS VAN BLOEM FONTEIN 323	FRASERBURG	1837
ZANDHEUVEL 378	FRASERBURG	1838
GREAT KRANSE FONTEIN 369	FRASERBURG	1838
WOLGEVAT 288	FRASERBURG	1874
ROODE POORT 328	FRASERBURG	1837
RIET POORT 330	FRASERBURG	1837
GIDEONSFONTEIN 375	FRASERBURG	1963
KRUIS AAR 370	FRASERBURG	1916
GOEDVERWACHTING 305	FRASERBURG	1912
ZEKOEGAT 374	FRASERBURG	1838
ROBERTSKRAAL 331	FRASERBURG	1837
PAARDE FONTEIN 380	FRASERBURG	1880
KRAAIKOP 379	FRASERBURG	1892
RIET POORT 316	FRASERBURG	1901
KOOPMANS GRAFT 329	FRASERBURG	1837
MODDERASKOLK 381	FRASERBURG	1890
LANGE KUILEN 337	FRASERBURG	1837
EENDE KUIL 317	FRASERBURG	1837
PLAT KRAAL 382	FRASERBURG	1838
KALKFONTEIN 332	FRASERBURG	1837
VISSERS KOLK LEEGTE 349	FRASERBURG	1892
377	FRASERBURG	1918
376	FRASERBURG	1875
MOUTONS FONTEIN 363	FRASERBURG	1841
FONK FONTEIN 336	FRASERBURG	1837
DWAALFONTEIN 364	FRASERBURG	1841
DROOG VOETS FONTEIN 356	FRASERBURG	1837
VREEDE KOLK 358	FRASERBURG	1889
BANKS FONTEIN 347	FRASERBURG	1871
KALKFONTEIN 335	FRASERBURG	1937
VERSCHE WATER 385	FRASERBURG	1841
DROOG VOETS FONTEIN 350	FRASERBURG	1891
WATERFALL 398	FRASERBURG	1837
DAMSFONTEIN 396	FRASERBURG	1913
DAMSFONTEIN 397	FRASERBURG	1837
BAMBURGERS HOOGET 355	FRASERBURG	1897
354	FRASERBURG	1912
KLIPHEUVELS 393	FRASERBURG	1838
334	FRASERBURG	1878
GROENBERGS VLAKTE 400	FRASERBURG	1879
GROENBERGS VLAKTE 399	FRASERBURG	1883

RATTELFONTEIN 394	FRASERBURG	1837
DRAAIRIVIER 390	FRASERBURG	1948
HARTEBEESFONTEIN 395	FRASERBURG	1852
SPIOEN BERG 387	FRASERBURG	1843
GROOTFONTEIN 392	FRASERBURG	1838
DE BRAK 391	FRASERBURG	1892
386	FRASERBURG	1893
TWEEFONTEIN 407	FRASERBURG	1837
PORTIONS OF BLOEMFONTEIN 406	FRASERBURG	1893
GROENBERG FONTEIN 403	FRASERBURG	1837
411	FRASERBURG	1889
408	FRASERBURG	1892
350	FRASERBURG	1891
AYESFONTEIN 352	FRASERBURG	1837
RYERS VALLEY 401	FRASERBURG	1838
413	FRASERBURG	1837
ALBERTS GRAF 415	FRASERBURG	1912
DRAAI RIVIER 388	FRASERBURG	1838
GANNAKRAAL 422	FRASERBURG	1838
412	FRASERBURG	1885
STEENKAMPS VLAKTE 416	FRASERBURG	1880
SPIONSBERG PLAAT 423	FRASERBURG	1890
schaap kooi 420	FRASERBURG	1891
409	FRASERBURG	1890
410	FRASERBURG	1893
442	FRASERBURG	1837
LEEUWE KLOOF 402	FRASERBURG	1837
419	FRASERBURG	1891
KLIPFONTEIN 447	FRASERBURG	1837
KOPJES KRAAL 405	FRASERBURG	1882
WELGEVONDEN 441	FRASERBURG	1890
ALBERTS GRAF 417	FRASERBURG	1838
KALK WAL 424	FRASERBURG	1890
SELLERY FONTEIN 426	FRASERBURG	1838
430	FRASERBURG	1838
EZELSFONTEIN 433	FRASERBURG	1838
429	FRASERBURG	1891
DE PUTS 425	FRASERBURG	1889
KLIPFONTEIN 434	FRASERBURG	1838
VOGELFONTEIN 436	FRASERBURG	1838
TEE KLOOF 439	FRASERBURG	1837
WILGERBOSCH KLOOF 449	FRASERBURG	1859
TAFEL BERG 428	FRASERBURG	1890

TYGERHOEK 468	FRASERBURG	1838
OLIVIERS REQUEST 432	FRASERBURG	1889
456	FRASERBURG	1881
DE KRUIS 458	FRASERBURG	1895
427	FRASERBURG	1890
452	FRASERBURG	1838
RIETFONTEIN 470	FRASERBURG	1838
DRIEFONTEIN 464	FRASERBURG	1838
DAGGA FONTEIN 465	FRASERBURG	1838
RIET FONTEIN VLAKTE 472	FRASERBURG	1890
ROODEHEUVEL 473	FRASERBURG	1886
460	FRASERBURG	1881
GOEDE VERWAGTING 462	FRASERBURG	1838
BAK OVENS KRAAL 471	FRASERBURG	1891
SPINNEKOP KRAAL 466	FRASERBURG	1838
DE GOEDE HOOP 463	FRASERBURG	1838
469	FRASERBURG	1888
KOEKEMOER 482	FRASERBURG	1838
DE KOM 474	FRASERBURG	1838
KRUIS RIVIER 483	FRASERBURG	1903
RHENOSTER VALLEY 485	FRASERBURG	1838
562	GORDONIA	1844
561	GORDONIA	1872
WATERVAL 497	GORDONIA	1880
584	GORDONIA	1981
469	GORDONIA	1888
15	HANOVER	1893
19	HANOVER	1892
147	HANOVER	1880
100	HANOVER	1882
524	HAY	1874
256	HAY	1879
522	HAY	1851
264	HAY	1891
252	HAY	1891
563	HAY	1872
562	HAY	1844
271	HAY	1862
561	HAY	1872
427	HAY	1890
430	HAY	1838
201	HAY	1880
202	HAY	1890

35	HAY	1860
419	HAY	1891
275	HAY	1892
282	HAY	1890
7	HAY	1893
411	HAY	1889
408	HAY	1892
584	HAY	1981
312	HAY	1890
386	HAY	1893
377	HAY	1918
368	HAY	1890
3	HERBERT	1911
15	HERBERT	1893
6	HERBERT	1893
35	HERBERT	1860
174	HERBERT	1893
226	HERBERT	1882
98	HOPETOWN	1875
149	HOPETOWN	1880
386	KENHARDT	1893
409	KENHARDT	1890
410	KENHARDT	1893
81	KENHARDT	1860
408	KENHARDT	1892
35	KIMBERLEY	1860
183	KIMBERLEY	1894
105	KIMBERLEY	1838
86	KIMBERLEY	1881
163	KIMBERLEY	1875
706	KURUMAN	1896
376	KURUMAN	1875
206	KURUMAN	1888
7	NAMAKWALAND	1893
6	NAMAKWALAND	1893
3	NAMAKWALAND	1911
571	NAMAKWALAND	1865
105	NAMAKWALAND	1838
264	NAMAKWALAND	1891
456	NAMAKWALAND	1881
419	NAMAKWALAND	1891
174	NAMAKWALAND	1893
429	NAMAKWALAND	1891

528	NAMAKWALAND	1912
184	PHILIPSTOWN	1880
59	PHILIPSTOWN	1910
6	PHILIPSTOWN	1893
94	PHILIPSTOWN	1889
135	PHILIPSTOWN	1889
174	PHILIPSTOWN	1893
252	POSTMASBURG	1891
585	POSTMASBURG	1982
252	POSTMASBURG	1891
256	POSTMASBURG	1879
201	POSTMASBURG	1880
202	POSTMASBURG	1890
248	POSTMASBURG	1883
452	POSTMASBURG	1838
469	POSTMASBURG	1888
483	POSTMASBURG	1852
541	POSTMASBURG	1883
228	POSTMASBURG	1874
15	RICHMOND (CA)	1893
27	RICHMOND (CA)	1892
147	RICHMOND (CA)	1880
86	RICHMOND (CA)	1881
ZANDHEUVEL 1	SUTHERLAND	1838
TITUS FONTEIN 12	SUTHERLAND	1841
6	SUTHERLAND	1893
7	SUTHERLAND	1893
WOLVENHOEK 8	SUTHERLAND	1880
VAN DER WALTS KRAAL 11	SUTHERLAND	1953
WELTEVREDE 2	SUTHERLAND	1902
DONKERFONTEIN 5	SUTHERLAND	1888
LEEUWFONTEIN 13	SUTHERLAND	1838
3	SUTHERLAND	1911
ELANDS EIVIER 14	SUTHERLAND	1843
MULDERSFONTEIN 23	SUTHERLAND	1838
ROODEWAL 21	SUTHERLAND	1838
BRANDDEKRAAL 22	SUTHERLAND	1838
SNYDERS POST 20	SUTHERLAND	1838
19	SUTHERLAND	1892
RIETKUIL 34	SUTHERLAND	1838
BERSEBA 37	SUTHERLAND	1960
THE REQUEST 38	SUTHERLAND	1890
HANGINDIHAK 16	SUTHERLAND	1892

15	SUTHERLAND	1893
BAVIAANS DRIFT 36	SUTHERLAND	1838
GUNSTFONTEIN 29	SUTHERLAND	1838
26	SUTHERLAND	1893
WOLVE DANCE 24	SUTHERLAND	1838
BASTARDS KRAAL 30	SUTHERLAND	1839
28	SUTHERLAND	1893
DE HOOP 39	SUTHERLAND	1838
MATJESFONTEIN 25	SUTHERLAND	1838
27	SUTHERLAND	1892
MEINTJES PLAAS 56	SUTHERLAND	1911
DRUPFONTEIN 31	SUTHERLAND	1838
KLIPFONTEIN 55	SUTHERLAND	1838
59	SUTHERLAND	1910
WILGERBOSCH KRAAL 32	SUTHERLAND	1838
LANGE KLOOF 60	SUTHERLAND	1911
RIETFONTEIN 49	SUTHERLAND	1838
PALMIETFONTEIN 42	SUTHERLAND	1890
RIET KUIL 50	SUTHERLAND	1838
GENEGENHEID 40	SUTHERLAND	1838
EENDE KUIL 41	SUTHERLAND	1840
TAAI BOSCH KLOOF 63	SUTHERLAND	1838
ELANDS FONTEIN 47	SUTHERLAND	1838
MATJESFONTEIN 217	SUTHERLAND	1838
BRANDWACHT 46	SUTHERLAND	1838
WATERVAL 64	SUTHERLAND	1832
VIERFONTEIN 65	SUTHERLAND	1838
DE KUILEN 43	SUTHERLAND	1838
QUAGGAFONTEIN 66	SUTHERLAND	1838
TAFELBERGS PLAAT 87	SUTHERLAND	1890
MEALIEBERG 45	SUTHERLAND	1940
72	SUTHERLAND	1874
EENSAAMHEID 77	SUTHERLAND	1838
VOGELFONTEIN 68	SUTHERLAND	1838
OORLOGS KLOOF 76	SUTHERLAND	1838
71	SUTHERLAND	1882
WELGEVONDEN 79	SUTHERLAND	1838
ELANDSBERG 86	SUTHERLAND	1838
HOUDENBECK 69	SUTHERLAND	1838
UITKYK 67	SUTHERLAND	1838
WITFONTEIN 85	SUTHERLAND	1939
BONTBERG 88	SUTHERLAND	1890
MATJES RIVIER 80	SUTHERLAND	1838

KLIP KRAAL 82	SUTHERLAND	1848
RHEBOCKSFONTEIN 107	SUTHERLAND	1838
EZEL JAGT 78	SUTHERLAND	1838
WIND HOEK 112	SUTHERLAND	1893
MERINE 216	SUTHERLAND	1838
UITVLUGT 90	SUTHERLAND	1838
PAARDE KRAAL 113	SUTHERLAND	1893
108	SUTHERLAND	1838
KEEROM 110	SUTHERLAND	1838
KUILENBURG 96	SUTHERLAND	1838
105	SUTHERLAND	1838
106	SUTHERLAND	1838
OUDE BERG 111	SUTHERLAND	1894
81	SUTHERLAND	1860
PHISANTE RIVIER 92	SUTHERLAND	1838
GEELHOEK 103	SUTHERLAND	1838
DE KUILEN 142	SUTHERLAND	1838
BLAAUWBLOEMETJIES KEEP 85	SUTHERLAND	1838
KANARIEFONTEIN 25	SUTHERLAND	1838
BRAK RIVIER 98	SUTHERLAND	1838
GROOT FONTEIN 120	SUTHERLAND	1893
JAKHALS VALLEY 99	SUTHERLAND	1838
HOTTENTOTFONTEIN 102	SUTHERLAND	1838
PORTUGALS RIVIER 218	SUTHERLAND	1889
MATJESFONTEIN 97	SUTHERLAND	1838
KLIPFONTEIN 126	SUTHERLAND	1841
LANGEKUIL 138	SUTHERLAND	1838
94	SUTHERLAND	1889
ELANDSFONTEIN 120	SUTHERLAND	1838
DE VREEDE 133	SUTHERLAND	1838
KLIP BANKS RIVIER 122	SUTHERLAND	1894
VINKEKUIL 144	SUTHERLAND	1838
ROGGENKLOOF 132	SUTHERLAND	1838
135	SUTHERLAND	1889
OUDE MUUR 160	SUTHERLAND	1893
159	SUTHERLAND	1895
GUNSTFONTEIN 131	SUTHERLAND	1838
VERLATEN KLOOF 130	SUTHERLAND	1940
KLIP KRAAL 158	SUTHERLAND	1886
KLIPBANKS RIVIER 155	SUTHERLAND	1887
NOOITGEDACHT 148	SUTHERLAND	1838
KLIP DRIFT 156	SUTHERLAND	1880
TONTELDOOSFONTEIN 152	SUTHERLAND	1838

GUNSTEFONTEIN 151	SUTHERLAND	1838
KNOOFLOKS HOEK 154	SUTHERLAND	1893
BEERENVALLEY 150	SUTHERLAND	1838
DE KRUIS 163	SUTHERLAND	1893
BOSCHMANS HOEK 177	SUTHERLAND	1893
KRAAI RIVIER 173	SUTHERLAND	1880
VAN WYKS KRAAL 170	SUTHERLAND	1878
SCHIETFONTEIN 179	SUTHERLAND	1838
BRAND HOEK 176	SUTHERLAND	1891
174	SUTHERLAND	1893
WAGEN DRIFT 175	SUTHERLAND	1897
VINKE KUIL 171	SUTHERLAND	1880
184	SUTHERLAND	1880
WOLVEN HOEK 182	SUTHERLAND	1893
DRIE RONDE HEUVELS 180	SUTHERLAND	1838
183	SUTHERLAND	1894
KAREEBOSCH FONTYN 78	VICTORIA-WEST	1848
GOEDE HOOP 10	VICTORIA-WEST	1865
BIESTJES DAM 88	VICTORIA-WEST	1855
35	VICTORIA-WEST	1860
SWAWELFONTEIN 32	VICTORIA-WEST	1952
28	VICTORIA-WEST	1893
UITVLUGT 38	VICTORIA-WEST	1848
UITVLUGT 38	VICTORIA-WEST	1848
BEYERSFONTEIN 39	VICTORIA-WEST	1838
PAMPOEN POORT 86	VICTORIA-WEST	1870
MOUNT PIERE 89	VICTORIA-WEST	1853
PRINSHOF 90	VICTORIA-WEST	1838
KIEWITS VLUGT KRAAL 93	VICTORIA-WEST	1838
SPANJERSFONTYN 95	VICTORIA-WEST	1848
PAMPOEN POORT 86	VICTORIA-WEST	1870
HARTEBEEST-FONTEIN 94	VICTORIA-WEST	1844
KLIPGATS FONTEIN 133	VICTORIA-WEST	1838
SCHIMMELFONTEIN 134	VICTORIA-WEST	1954
BLAAUWSPITS 152	VICTORIA-WEST	1881
BUSHDOVE FOUNTAIN 151	VICTORIA-WEST	1838
165	VICTORIA-WEST	1935
UITSPAN BERG 142	VICTORIA-WEST	1882
DRUP FONTEIN 146	VICTORIA-WEST	1838
138	VICTORIA-WEST	1881
KOOTS REQUEST 148	VICTORIA-WEST	1881
JACKALS DANCE 143	VICTORIA-WEST	1838
147	VICTORIA-WEST	1880

LAKEN VALLEY 145	VICTORIA-WEST	1838
PIET LOUWS CYFER 200	VICTORIA-WEST	1881
201	VICTORIA-WEST	1880
GTROOT FONTEIN 205	VICTORIA-WEST	1838
TAAI BOSCH FONTEIN 204	VICTORIA-WEST	1844
ABRAMS KRAAL 206	VICTORIA-WEST	1837
264	VICTORIA-WEST	1891
100	WARRENTON	1882
7	WARRENTON	1893
35	WARRENTON	1860
JANSES PUTS 39	WILLISTON	1889
IJZERDOORN PUTS 45	WILLISTON	1892
LYNX KOLK 49	WILLISTON	1881
LAP ZYN KOLK 38	WILLISTON	1890
ZWARTBOSCH LEEGTE 41	WILLISTON	1889
ABRAHAMS VLEI 42	WILLISTON	1882
ONREGT 46	WILLISTON	1891
VERDRIET FONTEIN 50	WILLISTON	1892
71	WILLISTON	1882
BOOY ZYN DAM 40	WILLISTON	1881
HAASFONTEIN 53	WILLISTON	1876
KLEIN ABRAHAMS VLEI 54	WILLISTON	1891
72	WILLISTON	1874
VENDUTIE KOLK 52	WILLISTON	1892
TIERKOP 51	WILLISTON	1891
DE RIET 65	WILLISTON	1879
KABOO KOLK 66	WILLISTON	1892
ERFDEEL 57	WILLISTON	1891
KLAAS TITUS KOLK 65	WILLISTON	1879
DE HOEK 70	WILLISTON	1890
WATER KLOOF 69	WILLISTON	1890
BRUL PADDE LEEGTE 67	WILLISTON	1891
LOS BERG 73	WILLISTON	1875
STEMREGT 68	WILLISTON	1891
JAS KLOOF 76	WILLISTON	1880
LEEUWKUILS POORT 64	WILLISTON	1886
HOTTENTOTS KRAAL 78	WILLISTON	1879
ZAND PUTS 77	WILLISTON	1879
ZWAART KOPJES FONTEIN 79	WILLISTON	1891
RIET POORT 75	WILLISTON	1889
GROOT PAARDE KLOOF 74	WILLISTON	1870
PAARDEBERG 63	WILLISTON	1891
KRANTZKOP 80	WILLISTON	1891

GROOT VOGELSTRUIS FONTEIN 61	WILLISTON	1892
KWAAI PUTS 90	WILLISTON	1882
BISSIES EN ANTEEL KOLK 91	WILLISTON	1890
ONDERSTE VOGELSTRUIS FONTEIN 62	WILLISTON	1891
JOBS PUTS 88	WILLISTON	1891
BLAAUW HEUVEL 96	WILLISTON	1890
VAN RENANS PLAATS 92	WILLISTON	1873
KLEIN PAARDE KLOOF 94	WILLISTON	1879
KAREEBOOM 93	WILLISTON	1878
JAKALSTOREN 86	WILLISTON	1891
KLEIN RHENOSTER BERG 87	WILLISTON	1890
ROOI HOOGTE 97	WILLISTON	1891
KLEIN VOGELSTRUIS FONTEIN 85	WILLISTON	1880
KAREEBOOMPUTS 85	WILLISTON	1880
ACHTERSTE VAN ZYLS PLAATS 89	WILLISTON	1887
DASSIE KLOOF 105	WILLISTON	1878
TAMBOER FONTEIN 95	WILLISTON	1876
DASSIE KLOOF 105	WILLISTON	1878
98	WILLISTON	1875
RUITERS FONTEIN 95	WILLISTON	1876
KLIP KLOOF 102	WILLISTON	1892
DE DAM 101	WILLISTON	1890
REEBOKUYDER 103	WILLISTON	1884
POTLOER 104	WILLISTON	1880
BAKOVEN 109	WILLISTON	1890
KARREE KOP 112	WILLISTON	1870
KOEGA 108	WILLISTON	1890
WIELKOLK 111	WILLISTON	1889
100	WILLISTON	1882
ELIAS LEEGTE 113	WILLISTON	1880
TUINSKLOOF 106	WILLISTON	1889
GROOTMEESTERSKLIP 124	WILLISTON	1870
RIETPOORT 110	WILLISTON	1883
SPRINGERSBAY LEEGTE 116	WILLISTON	1889
BLAAUWZYFER 125	WILLISTON	1880
TYGERFONTEIN 126	WILLISTON	1878
DROOGE PUTS 127	WILLISTON	1878
GROOTFONTEIN 122	WILLISTON	1870
BLOEMFONTEIN 119	WILLISTON	1876
BRUINSKOP 114	WILLISTON	1888
SPRINGERSBAY 115	WILLISTON	1883
KLEINMEESTERSKLIP 123	WILLISTON	1892

KARREEDOORN 129	WILLISTON	1875
BENAUDTSFONTEIN 118	WILLISTON	1881
MOORDENAARSGAT 121	WILLISTON	1890
VAALHOEK 120	WILLISTON	1874
ORANGEPUTS 117	WILLISTON	1889
GORRAS 130	WILLISTON	1878
VOORSTE VAN ZYLS PLAATS 138	WILLISTON	1883
BANKSFONTEIN 133	WILLISTON	1890
WITAAR 132	WILLISTON	1881
SCHUINSHOOGTE 131	WILLISTON	1873
KLIP DRIFT 139	WILLISTON	1894
KLEIN KOOKFONTEIN 137	WILLISTON	1874
GROOT KOOKFONTEIN 136	WILLISTON	1876
LEEUW KRANTZ 134	WILLISTON	1870
ONGELUKSFONTEIN 135	WILLISTON	1887
PAARDE KRAAL 141	WILLISTON	1875
ARBEIDERSFONTEIN 150	WILLISTON	1892
ELANDSFONTEIN 151	WILLISTON	1881
RIETBRACK 153	WILLISTON	1876
ZAKFONTEIN 148	WILLISTON	1881
KLIPMUTS 143	WILLISTON	1892
145	WILLISTON	1887
LANG KUILEN 142	WILLISTON	1879
149	WILLISTON	1880
ELIAS ZYFER 144	WILLISTON	1881
BLOUSYFER 183	WILLISTON	1891
VLEI WERF 147	WILLISTON	1879
LEKKERLOG 179	WILLISTON	1879
VLOKS WERVEN 152	WILLISTON	1873
DE KRUIS 174	WILLISTON	1838
RIETFONTEIN 180	WILLISTON	1877
PALMIETFONTEIN 171	WILLISTON	1891
LUNS KLOOF 177	WILLISTON	1881
176	WILLISTON	1881
JAN KLAAS LEEGTE 172	WILLISTON	1890
JAN KLAAS LEEGTE 194	WILLISTON	1895
KLIP CYPHER 184	WILLISTON	1889
RIETVALLEY 173	WILLISTON	1838
SLANG FONTEIN 187	WILLISTON	1878
GOEDVERWACHTING 175	WILLISTON	1881
PIETS GAT 190	WILLISTON	1892
PLAT CYPHER 186	WILLISTON	1892
RONDEGAT 191	WILLISTON	1838

SPUITFONTEIN 192	WILLISTON	1891
ZUURLAND LEEGTE 195	WILLISTON	1890
MATJES FONTEIN 189	WILLISTON	1892
JAN KLAAS LEEGTE 193	WILLISTON	1891
SLANGBERGS PIET POORT 188	WILLISTON	1878
ANNEX MATONS 273	WILLISTON	1892
264	WILLISTON	1891
BERGS DAM 261	WILLISTON	1890
DIEP FONTEIN 266	WILLISTON	1879
ZWARTBOOYS KLOOF 267	WILLISTON	1876
JAAGERSFONTEIN 270	WILLISTON	1875
MULDERSVLEI 279	WILLISTON	1875
JASFONTEIN 259	WILLISTON	1841
275	WILLISTON	1892
271	WILLISTON	1862
ROOI KOP 262	WILLISTON	1891
LEENDERTS RIVIER 272	WILLISTON	1838
VRYEKOLK 290	WILLISTON	1888

Appendix B: Corbelled buildings

Table 2. List of corbelled buildings with GPS location and attributes*[3]

Farm Name	South	East	Base Shape	Roof Shape	Projections
Aasvoelsvlei I	-31.303778	21.91769444	Square	Round	No
Aasvoelsvlei II	-31.3058667	21.9166	Round	Round	No
Arbeidersfontein	-31.2458167	21.25791667	Square	Square	Yes
Banksfontein	-31.1698722	21.21421944	Round	Unknown	Unknown
Beukeskraal	-32.1070861	21.22615278	Unknown	Unknown	Unknown
Biesiesdam	-30.7459639	22.64631944	Unknown	Unknown	Unknown
Biesiespoort	-31.1876417	22.08938333	Round	Round	Yes
Bitterwater I	-31.2691	21.8538	Round	Round	Yes
Bitterwater II	-31.2706833	21.85373333	Round	Round	Yes
Blouhoogte	-32.2635833	21.3958	Square	Round	No
Boplaas I	-31.4399639	21.74894444	Round	Unknown	Unknown
Boplaas II	-31.4398083	21.74790556	Round	Unknown	Unknown
Brakvlei	-31.4837833	21.72566389	Round	Round	No
Brakwater	-31.337325	22.23554722	Square	Unknown	Unknown
Brownslaagte	-31.1704333	21.01968333	Square	Pitched roof	Yes
Daggafontein	-32.2063333	21.45268333	Round	Round	No
Dawidskolk	-31.5396	21.99940833	Round	Round	No
Dawidskolk II	-31.5394556	21.99906389	Round	Round	No
De Brak	-31.9851	21.31263333	Round	Round	No
De Dam	-31.0399861	21.35220278	Round	Unknown	Unknown
De Hoop (Biesiesdam)	-30.7300194	22.60396667	Round	Unknown	Unknown
De Kolke	-32.1912194	21.47780833	Round	Round	No
De Kom	-32.3559056	21.23672222	Square	Unknown	Unknown
De Postjes	-32.2512167	21.46018333	Round	Round	No
De Puts	-31.3637361	21.8689	Round	Unknown	Unknown
De Val	-32.07295	21.34008333	Round	Round	No
De Wilg I	-31.6845278	22.05111667	Round	Round	No
De Wilg II	-31.7011	22.05143333	Round	Pitched roof	No
Driefontein	-32.2344111	21.34367222	Square	Round	No
Driefontein II	-32.2337389	21.34376389	Square	Unknown	Unknown
Driefontein III	-32.2338028	21.34297222	Round	Unknown	Unknown
Driefontein IV	-32.2339639	21.34376389	Square	Unknown	Unknown
Driekoppen	-31.1583806	22.00654444	Unknown	Unknown	Unknown

[3] Data was obtained from Kramer (2012) using on site GPS cataloguing of the location of corbelled buildings

Droogeputs I	-31.1144583	21.64970833	Square	Pitched roof	Yes
Droogeputs III	-31.1139139	21.64766667	Round	Pitched roof	No
Eendefontein I	-31.3868583	21.95181944	Round	Round	Yes
Eendefontein II	-31.3868583	21.95181944	Round	Unknown	Unknown
Eensaamheid I	-32.2721667	20.57595	Round	Round	No
Gansvlei	-31.4132833	22.02311667	Round	Round	No
Goede Hoop	-30.6501972	22.79653889	Round	Unknown	Unknown
Gorras I	-31.1886	21.51818333	Round	Round	Yes
Gorras II	-31.18755	21.51955	Round	Round	Yes
Gorras III	-31.2117333	21.4135	Round	Round	Yes
Gorras IV	-31.18625	21.52163333	Round	Round	No
Grootfontein	-31.1218167	21.1923	Round	Pitched roof	Yes
Gunstfontein	-32.582	20.68223333	Round	Pitched roof	No
Hartbeesfontein	-32.4006833	20.52276944	Round	Unknown	Unknown
Hillandale	-31.9386611	22.75234722	Round	Unknown	Unknown
Hondefontein	-32.2109833	21.37628333	Round	Round	No
Hongerkloof	-31.7326333	21.38746667	Round	Unknown	Unknown
Hottentotsfontein	-32.4647972	20.53663611	Round	Unknown	Unknown
Janklaasleegte I	-31.4832167	21.03251667	Square	Pitched roof	Yes
Janklaasleegte II	-31.4826	21.03193611	Square	Pitched roof	No
Kareekloof	-30.9430833	21.79596667	Round	Pitched roof	Yes
Karelsgraf I	-30.6192222	22.23290833	Round	Pitched roof	No
Karelsgraf II	-30.6177194	22.23259167	Round	Pitched roof	No
Karelsgraf III	-30.6177194	22.23259167	Round	Unknown	Unknown
Kiewietsfontein	-31.5702167	22.2208	Round	Round	Yes
Klipkolk	-31.1006333	21.72655278	Square	Pitched roof	Yes
Knapdaar	-31.3004972	21.90479444	Round	Unknown	Unknown
Knegsbank	-31.8431833	20.01865	Round	Round	No
Konka	-30.9134667	21.90815	Round	Pitched roof	Yes
Koppiesfontein I	-31.5072667	21.68224167	Round	Round	No
Koppiesfontein II	-31.5083	21.68221111	Square	Unknown	Yes
Krabfontein I	-31.4432778	21.86645278	Round	Round	Yes
Krabfontein II	-31.4433472	21.86639722	Round	Round	No
Krabfontein III	-31.4436444	21.86723056	Round	Round	No
Krabfontein IV	-31.4436917	21.86723611	Round	Round	No
Krugerskolk	-31.2045667	21.8186	Round	Round	Yes
Langbaken	-31.3583667	21.23923333	Round	Pitched roof	Yes
Langfontein	-32.2843611	21.61041667	Unknown	Unknown	Unknown
Leendertseplaas	-31.69105	21.01008889	Unknown	Unknown	Unknown
Leeufontein	-31.0723611	21.85588611	Square	Unknown	Unknown
Leeuwkrantz	-31.2439833	21.13001667	Square	Pitched roof	No
Leyfontein I	-31.2636778	22.60779167	Round	Round	Yes
Leyfontein II	-31.2645444	22.60888611	Round	Round	No

Leyfontein III	-31.2645861	22.60864167	Round	Unknown	Unknown
Leyfontein IV	-31.2616833	22.60618333	Square	Pitched	Yes
Louw se Plaas I	-32.26545	21.39601667	Round	Round	No
Louw se Plaas II	-32.2661194	21.39626944	Round	Round	No
Middelpos	-31.9037	20.22926667	Round	Round	No
Modderfontein I	-31.4834667	21.72370278	Round	Round	Yes
Modderfontein II	-31.4844917	21.72339722	Round	Unknown	Yes
Mooskloof I	-30.9704667	21.79048333	Round	Round	Yes
Mooskloof II	-30.9704333	21.7897	Round	Round	Yes
Omkeerkolk	-31.5682833	22.02908333	Round	Round	Yes
Onderplaas I	-31.81005	20.10535	Round	Pitched roof	No
Onderplaas II	-31.8102	20.10875	Round	Pitched roof	No
Onderplaas III	-31.8091	20.10803333	Round	Unknown	Unknown
Ongeluksfontein	-32.5688833	21.43926667	Round	Round	Yes
Osfontein	-31.2396778	22.33708889	Square	Unknown	Unknown
Perdegrasvlei	-31.6290667	21.8572	Round	Round	No
Perdegrasvlei II	-31.6287694	21.86224722	Round	Unknown	Unknown
Request	-31.234525	22.5353	Unknown	Unknown	Unknown
Rietfontein (west)	-32.2281167	21.17251111	Square	Unknown	Unknown
Rietfontein I	-31.2948667	22.13465	Round	Pitched roof	No
Rietfontein II	-31.2948667	22.1338	Round	Round	Yes
Riethuisies	-32.26585	21.83333333	Round	Round	Yes
Rietpoort I	-31.6376583	21.98417778	Round	Unknown	Unknown
Rietpoort II	-31.6377111	21.98421944	Round	Unknown	Unknown
Rietvlei	-31.4357667	21.06811667	Square	Pitched roof	Yes
Rondom	-32.3963667	21.5026	Square	Round	Yes
Schuinshoogte	-31.2528333	21.3598	Round	Round	Yes
Silvery Holme	-31.48765	22.23395	Round	Round	Yes
Skerpioensdrif	-31.0256194	21.54266667	Round	Round	Yes
Slingersfontein	-31.5751167	21.92856111	Round	Unknown	Yes
Spioenberg	-31.3063333	21.67305	Round	Pitched roof	Yes
Spoorkolk	-31.2123333	21.7517	Round	Pitched roof	Yes
Sterling	-31.2713833	21.44351667	Square	Unknown	Unknown
Stuurmansfontein 1	-30.9159167	21.6631	Round	Round	Yes
Stuurmansfontein II	-30.9126667	21.65808333	Round	Round	Yes
Stuurmansfontein III	-30.9159167	21.79596667	Round	Round	Yes
Swaelkrans	-31.4807167	22.6631	Round	Round	Yes
Swartfontein	-30.6838361	21.55840556	Unknown	Unknown	Unknown
T'kokoboos	-30.9572556	21.68148056	Round	Unknown	Unknown
Tiervlei	-31.25195	21.97345	Square	Round	No
Vaalhoek	-31.4715833	22.47531667	Square	Pitched roof	No
Van Aswegensfontein I	-31.4078389	22.19374167	Round	Unknown	Unknown
Van Aswegensfontein	-31.4049306	22.197225	Round	Unknown	Unknown

II					
Van Reenensplaas	-30.9092306	21.24725556	Round	Pitched roof	No
Vastrap	-31.6818833	21.74263333	Round	Unknown	No
Vinkfontein	-32.5294333	21.09251667	Round	Round	No
Vischgat I	-31.4780722	22.04921944	Round	Unknown	Unknown
Vischgat II	-31.4780722	22.04921944	Square	Unknown	Unknown
Vlieefontein	-32.1557722	22.02064167	Round	Unknown	Yes
Vlinkskolk	-31.2697667	22.0956	Round	Round	Yes
Voorstevanzylsplaas	-31.1894667	20.81948333	Square	Pitched roof	No
Vryeleegte	-31.0572333	22.09459722	Unknown	Unknown	Unknown
Waterval	-30.905	21.55929444	Unknown	Unknown	Unknown
Willow Glen	-32.2191222	21.65346111	Round	Unknown	Unknown
Witfontein I	-32.259	21.37223333	Round	Round	No
Witfontein II	-32.2599139	21.37363056	Square	Unknown	No
Witfontein III	-32.2599139	21.37363056	Square	Unknown	Unknown
Ystervarkspoort I	-31.4077417	22.45241944	Square	Unknown	Unknown
Ystervarkspoort II	-31.4080028	22.43427222	Square	Unknown	Unknown

Appendix C: Methods

Outlined below are the methods used to obtain the data and the process undertaken to produce the various maps.

1. Farm title deeds

Across South Africa there are numerous farms that are currently used for agricultural and livestock farming. The National Geo-Spatial Information office has all these farms as a GIS shape file (a format that allows a visual representation of the data in GIS that is spatially referenced). Having received this data the next task was to determine when these farms were first granted their title deeds.

1.1 Title deeds

The dates for the first title deeds granted to the various farms were obtained from the Deeds Office in Cape Town. There are issues with some of the farm title deeds that make it difficult to assign a single date to the farm. This is due to the current modern farm being made up of many different farms, each granted a title deed at a different time. In cases where more than 50% of the farm area was granted a title deed at a certain date, that date was recorded for the whole farm. Where this was not the case the farm title deed date was left blank. This was done to ensure that the title deed dates accurately defined the farm. The date when each farm was granted their title deed was recorded as a Microsoft (MS) Excel file (See Appendix A). This information was then combined with the cadastral layer of the GIS. The farms could then be attributed different colours depending on the date the title deed was granted.

1.2 Construction of farm title deed layers

To construct the farm title deed layer the cadastral layer was first opened in the GIS, ArcView 9.3 (Figure a1.). The table with the dates of when each farm was granted a deed licence was then imported into ArcView 9.3 as an MS Excel file.

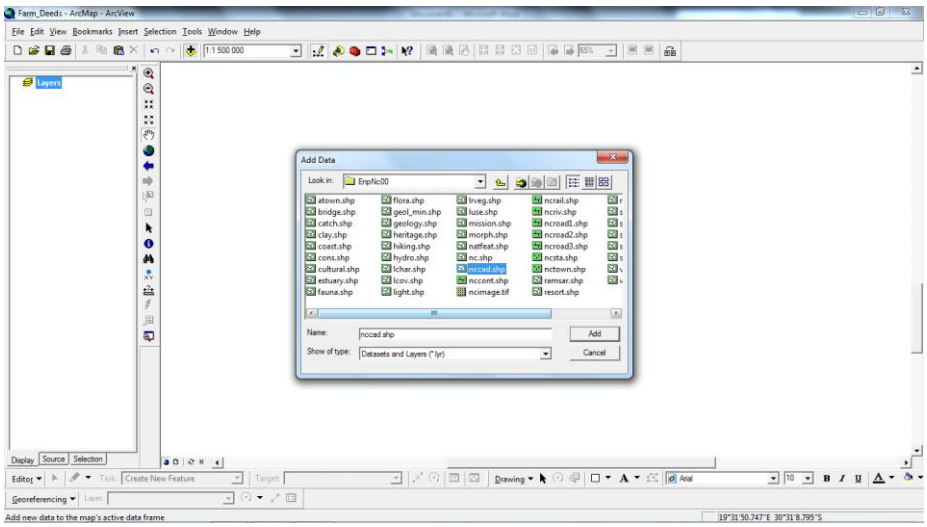

Figure a1: Screen shot of ArcView 9.3 showing the opening of the cadastral layer.

This table was then linked to the cadastral layers attributable by the 'Join' function (Figure a2.).

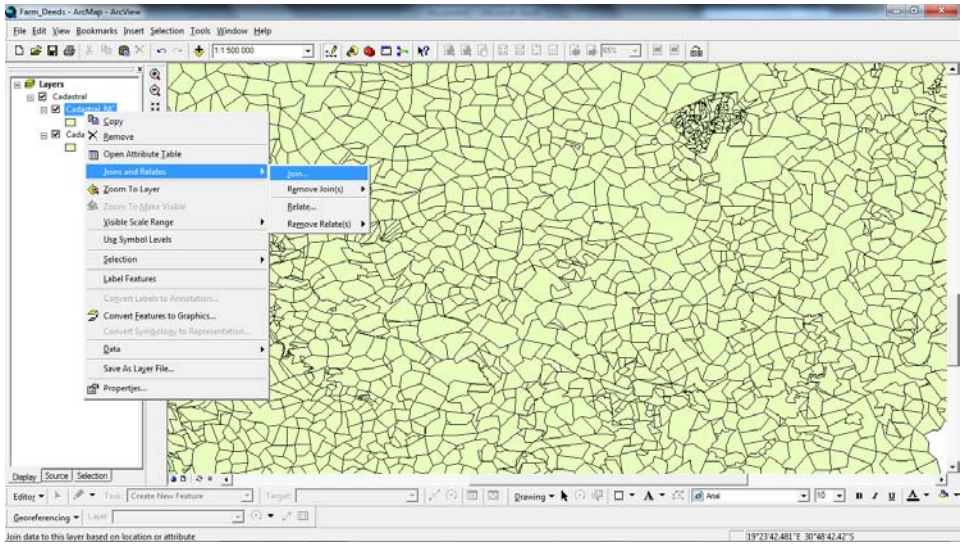

Figure a2: Screen shot of ArcView 9.3 showing the join action to link the farm title deed Excel file to the cadastral layer.

The two tables were then joined by farm name and a new information column was added with the dates of when the farm title deeds were granted (Figure a3).

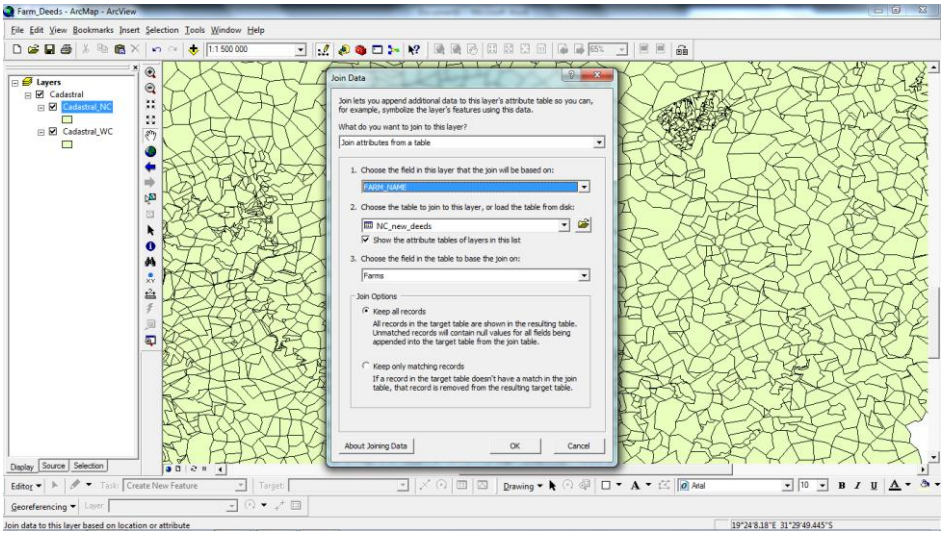

Figure a3: Screen shot of ArcView 9.3 showing how the join between the Excel file and cadastral layer was done.

All the farms with an assigned date were then selected by opening the attribute table (Figure a4) and sorting the data in the second "Farm_Name" column in descending date order (Figure a5).

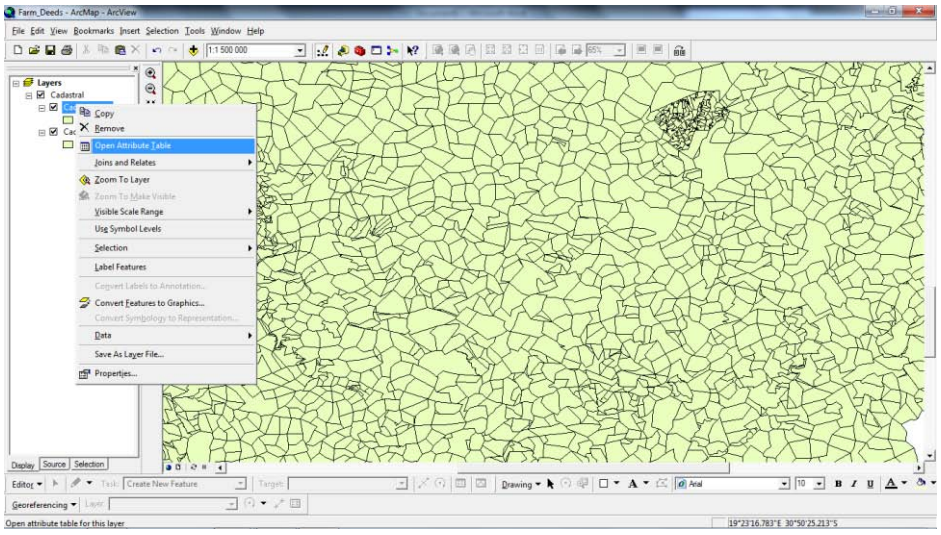

Figure a4: Screen shot of ArcView 9.3 showing the opening of the attribute table.

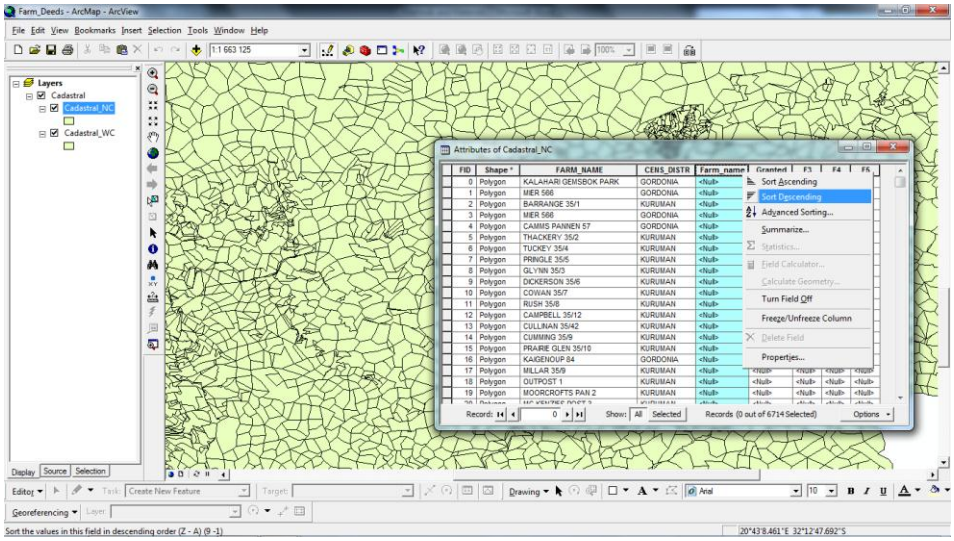

Figure a5: Screen shot of ArcView 9.3 showing the sorting of the 'Granted' column in descending date order.

A selection was made of all the farms, which through the join action had a date in the 'Granted' field (Figure a6).

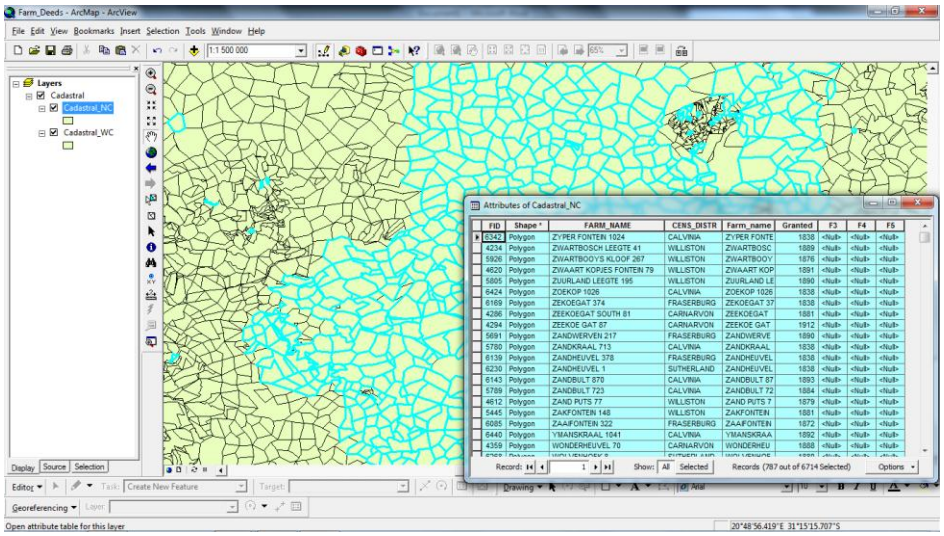

Figure a6: Screen shot of ArcView 9.3 showing the selection of farms by date when title deeds were first granted.

With the selection made, all the highlighted farms were then exported to form a new layer (Figure a7).

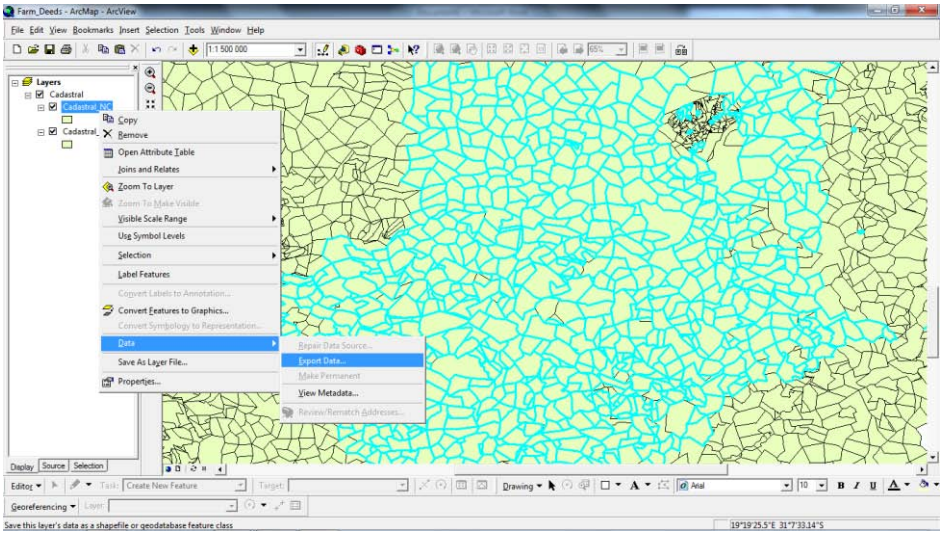

Figure a7: Screen shot of ArcView 9.3 showing the exporting of selected farms

The properties for this “farm deed” layer were then opened and the ‘Symbology’ tab selected (Figure a8).

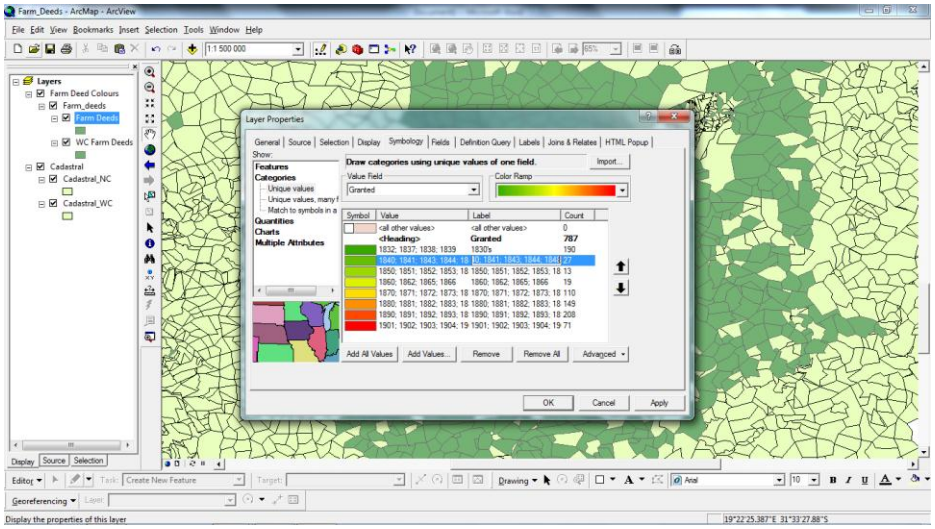

Figure a8: Screen shot of ArcView 9.3 showing the ‘Symbology’ tab in the farm title deed layer properties.

The ‘Add All Values’ button was pressed to display all values in ‘Granted’ value field. By selecting only the ‘Granted’ values with the same date these were then grouped together and labelled with their corresponding decade (Figure a9). The colours were selected in the colour ramp drop down menu. All these changes were then applied and finalised by pressing the ‘Ok’ button. This was done for the Western Cape and Northern Cape cadastral layers as two separate data features.

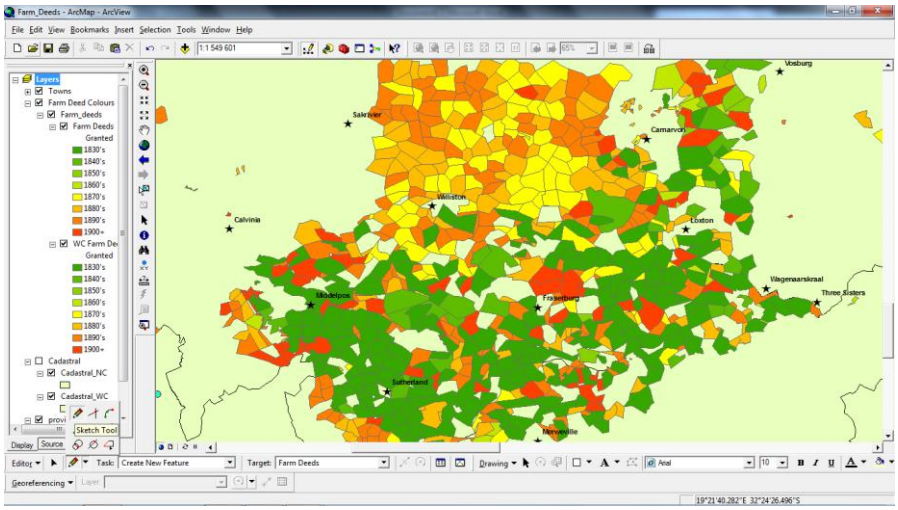

Figure a9: Screen shot of ArcView 9.3 showing the sketch tool after the Editor button was activated

To give a perspective of the Karoo in relation to the rest of South Africa, the ‘Town’s Data’ layer was added from the Mucina and Rutherford vegetation cd (Mucina and Rutherford, 2006). With this displayed, the features were labelled by selecting the ‘Label Features’ button when the layer was right clicked. This map was then shown in the layout view and a scale and north facing directional arrow was added.

To show the division between earlier and later title deeded farms on the various environmental layers a simplified farm title deed layer was drawn. It was done to show just the outlines of the two farm date groupings, thus it was drawn to be hollow in order to allow the layers underneath to be visible. The construction of the

simplified farm title deed layer was done by selecting the 'Editor' button. With 'Edits' on, the outline of the four farm areas was traced using the 'Sketch Tool'. With the outlines drawn, the 'Edits' were saved and the Symbology for these features was altered to black and white by opening the 'Symbology ' tab and clicking on the corresponding symbol to open the 'Symbol Selector' options screen (Figure a10). There the colour and width of the lines was changed.

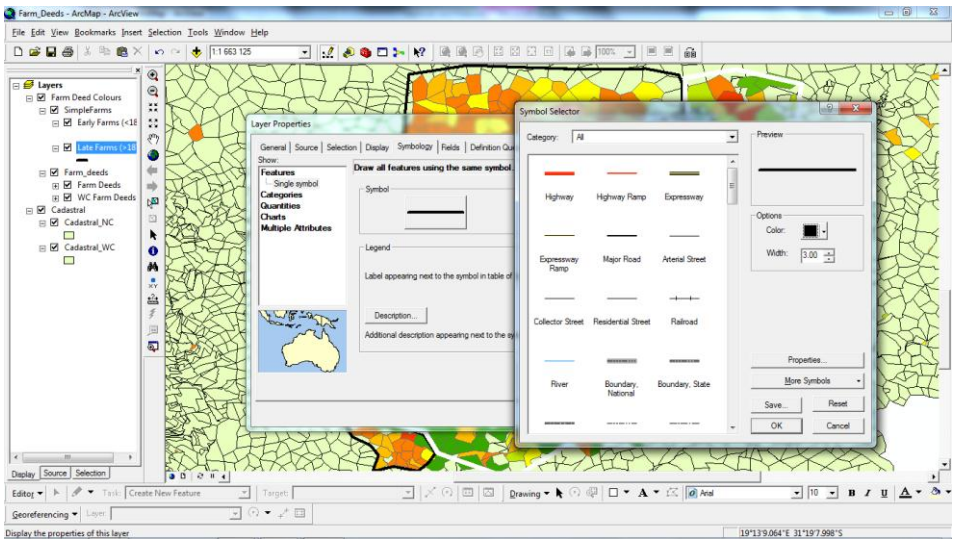

Figure a10: Screen shot of ArcView 9.3 showing how the symbol for the simplified farm title deeds was changed.

With the construction of these two layers additional information could then be superimposed over or below them to help construct a fuller picture of this region and the various aspects that could have affected when these farms were first granted their title deeds.

2. Corbelled buildings

Other features that were added to the GIS were the corbelled buildings. These are displayed as points on the map. To add this feature the location of the corbelled buildings were captured using a Global Positioning Satellite (GPS) in the field. This coordinate data was then entered into MS Excel to make a spread sheet (See Appendix B). Other information about each corbelled building was also entered such as the name of the farm they are associated with, the type of base structure, the roof shape and whether it has projections or not. Due to the nature of the GPS coordinates that were entered into Excel further calculations were needed to transform it from degrees, minutes, seconds into decimal degrees.

With the data entered, the spread sheet was then added to the GIS by using the 'Add Data' button. The spread sheet data was then displayed as points using the 'Display XY data' tool in ArcMap 9.3 (Figure a11).

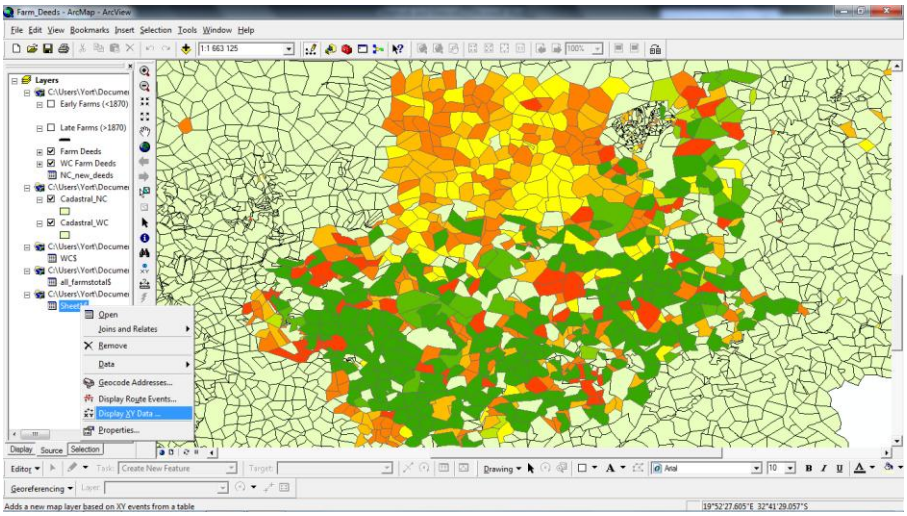

Figure a11: Screen shot of ArcView 9.3 showing the addition of XY data from a MS Excel spread sheet

This tool plots the points on an XY axis in order to position the points correctly. On the X axis the easting of the various corbelled buildings was entered and the southing of these features on the Y axis (Figure a12).

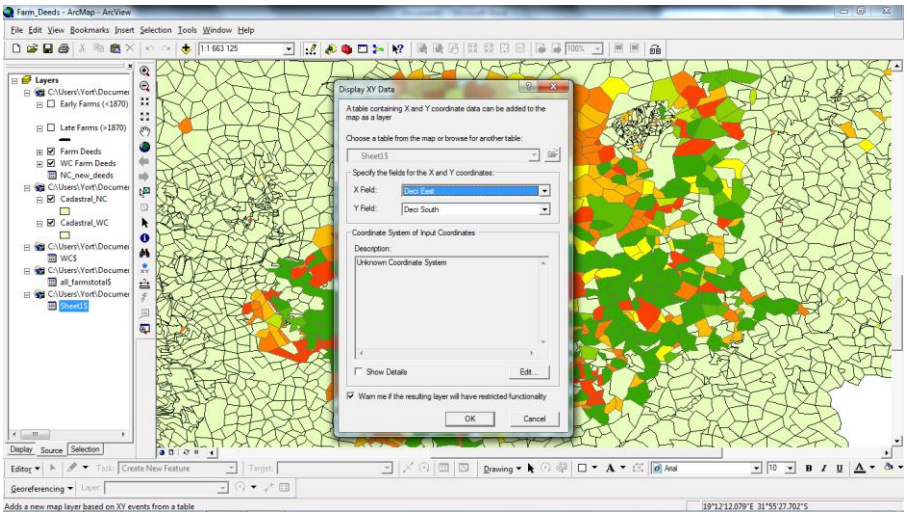

Figure a12: Screen shot of ArcView 9.3 showing how the coordinates for the corbelled building was selected.

Once this was done the points of the location of each corbelled building was displayed in the GIS. In order to manipulate and display the various other attributes such as base type this data had to be exported as a file shape (.shp) type that is designed for GIS programs and that ArcMap 9.3 could manipulate and use (Figure a13).

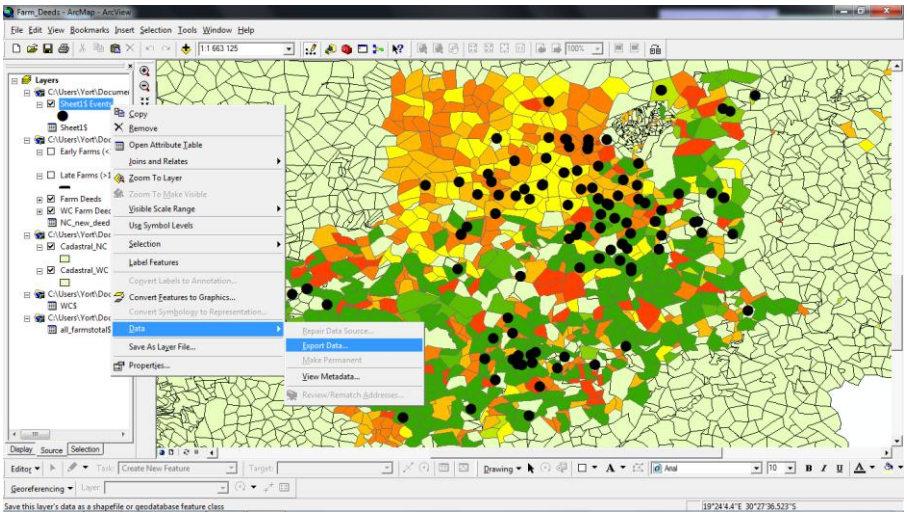

Figure a13: Screen shot of ArcView 9.3 showing the exportation of this XY data to a shape file.

2.1 Changing and showing corbelled building attributes

With the corbelled builds entered as a shape file layer manipulation of this data could begin. To start the 'Layer Properties' window was opened and the 'Symbology' tab selected. With this done the 'Unique Values' in the 'Categories' drop down menu was selected and then the attribute that was required to be displayed was chosen from the 'Value Field' drop down menu (Figure a14). The 'Add All Values' button was then pressed to populate the display. To choose the appropriate symbol to be displayed the dot in the symbol column was clicked to display the 'Symbol Selector' window (Figure a14). The symbol was then changed by selecting the desired shape and then the colour and size altered in the 'Options' area. To apply the changes the 'Ok' button was pressed on all open windows.

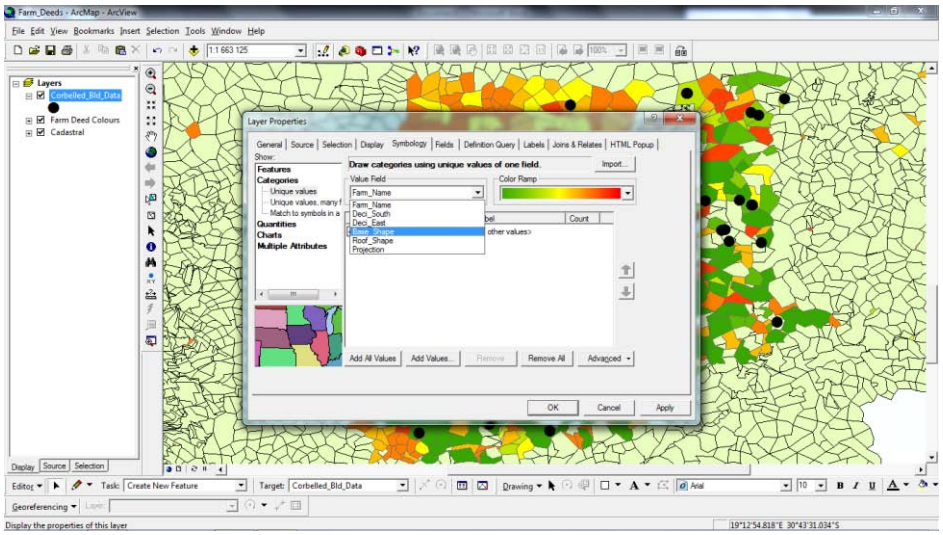

Figure a14: Screen shot of ArcView 9.3 showing how the different attribute types were selected in the 'Symbology' tab in the 'Layer Properties' window

This method was followed for all the single attributes such as base shape, roof shape and projections. First the layer was selected, copied and pasted in the display. With this done changes could be made to construct a new feature layer. The differences between these layers are the attributes selected in the 'Value Field' to be displayed such as base shape or roof shape etc. (Figure a15). Having chosen the

attribute the various values such as round or square base were added and the Symbology changed as outlined above.

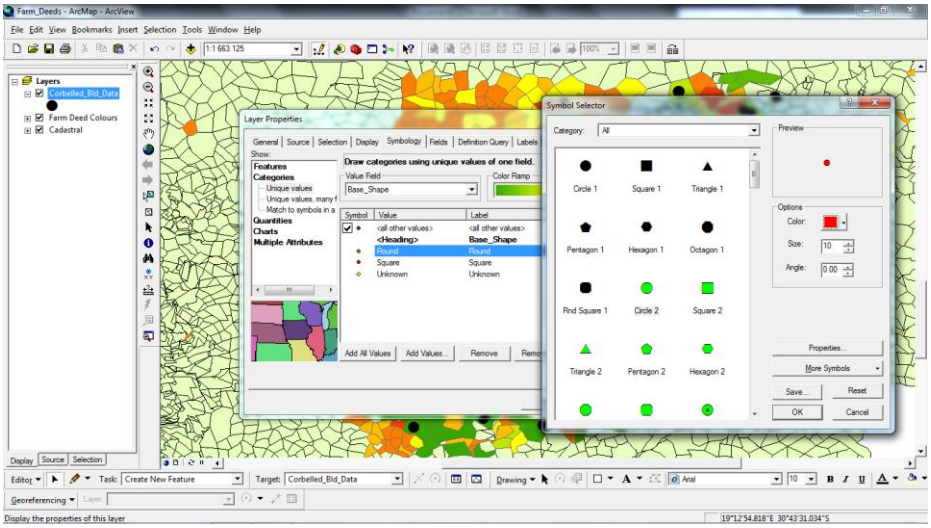

Figure a15: Screen shot of ArcView 9.3 showing the selection of the different symbols for corbelled building base type using the 'Symbol Selector' in the 'Symbology' tab in the 'Layer Properties' window.

The construction of the multi attribute corbelled buildings was done by duplicating the corbelled building layer as described above, but with one major change. Instead of selecting an attribute in the 'Value field' the Symbology was changed to be a 'Single Symbol' in the 'Features' label of the 'Show' box in the 'Symbology' tab. Next the 'Definition Query' tab was selected and the 'Query Builder' button pressed to bring up the 'Query Builder' window (Figure a16). With this done a query was constructed to select only one of each of the values in each attribute i.e. only the round based buildings or pitched roofed structures. The development of this query: 'Base_Shape' LIKE 'Round' AND 'Roof_Shape' LIKE 'Round' AND 'Projection' NOT LIKE 'Yes' is to select only the corbelled buildings that have a round base shape, a round roof and no projections. To select other structures that have different combinations of attributes all that is required is to the change of the attribute elected i.e. from 'Round' to 'Square' for base shape. Each time a group of features

was selected a new layer was copied and pasted in the display so as to have all the different corbelled building grouped types being able to be displayed at once.

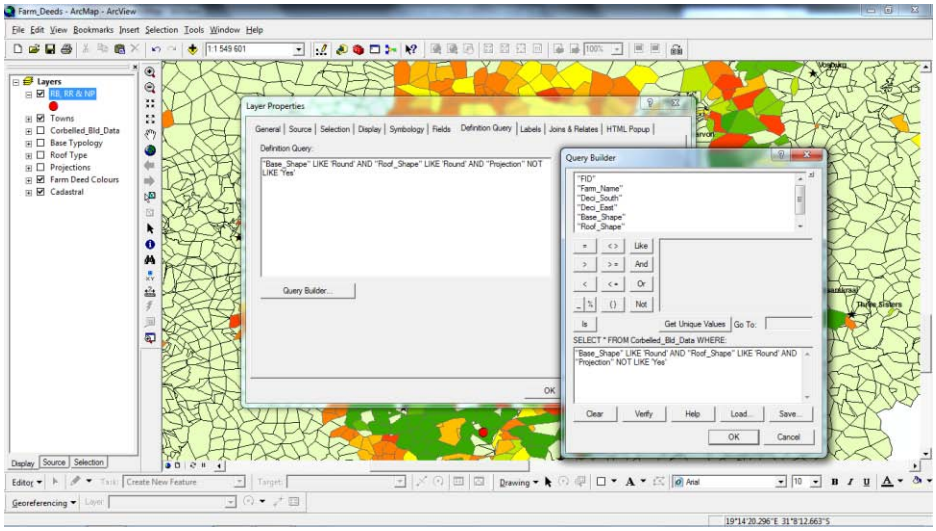

Figure a16: Screen shot of ArcView 9.3 showing how the grouping of attributes was selected using the 'Query Builder' in the 'Layer Properties' window.

It is important to note that some of the corbelled buildings are found within a few meters of each other. These buildings sometimes have different attributes associated with them, but due to their close proximity one building overlaps the other when displayed on the maps. The symbols chosen for each distinct attribute value were selected so as to show the that some buildings overlapped one another. In cases where it is difficult to distinguish the buildings in one area due to overlapping, the description and discussion of the maps will describe the distribution of the buildings.

3. Construction of environmental layers

3.1 Topology

The construction of this layer was done by importing the “contour line” data from the National Geo-Spatial Information office to ArcView 9.3. The colouring of the different contour lines was achieved by opening the properties of this layer and selecting the ‘Graduated Colours’ menu in the ‘Quantities’ list. In the ‘Field’ box the Height was selected from ‘Value’ dropdown menu. The height values were then added to the display. With this done the number of classes to be displayed was changed to 17 in the ‘Classes’ dropdown menu. The ‘Colour Gradient’ was then selected in the ‘Colour Ramp’ dropdown menu to best show the differing typologies of the region, with browns as the lowest heights and dark blue as the highest (Figure a17). Once all the changes had been made the ‘Ok’ button was pressed to apply them. This was done for both the Northern Cape and Western Cape topography layers as both are used in the construction of the maps.

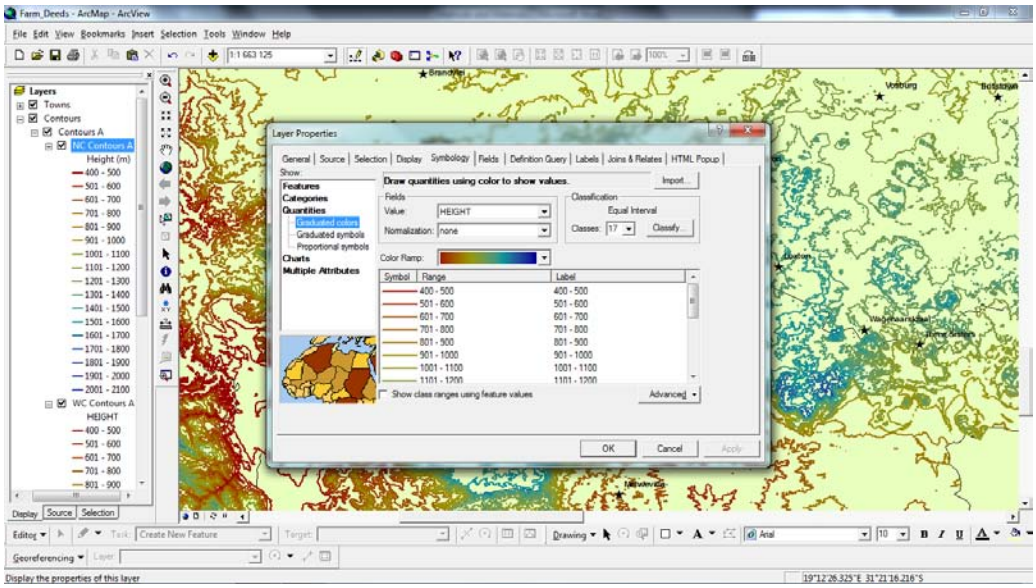

Figure a17: Screen shot of ArcView 9.3 showing how the construction of the topology layer.

3.2 Minimum annual temperature

The mean annual maximum and minimum temperature data was obtained from the Agricultural Geo-Referenced Information Systems (AGIS) website (www.agis.agric.za). With the data downloaded it was then added to the GIS. The attributes were chosen as described above by opening the 'Layers Properties' and selecting the 'Symbology' tab and then 'Unique values' under the 'Categories' heading. The temperature data was then chosen in the 'Value Field' and the 'Add All Values' button was clicked to display the relevant data. Finally the appropriate colour scheme was chosen from the 'Colour Ramp' dropdown menu (Figure a18). For the mean annual maximum temperature the colour gradient was from greens to red, while for the mean annual minimum temperature the colours changed from dark blue to pale pink.

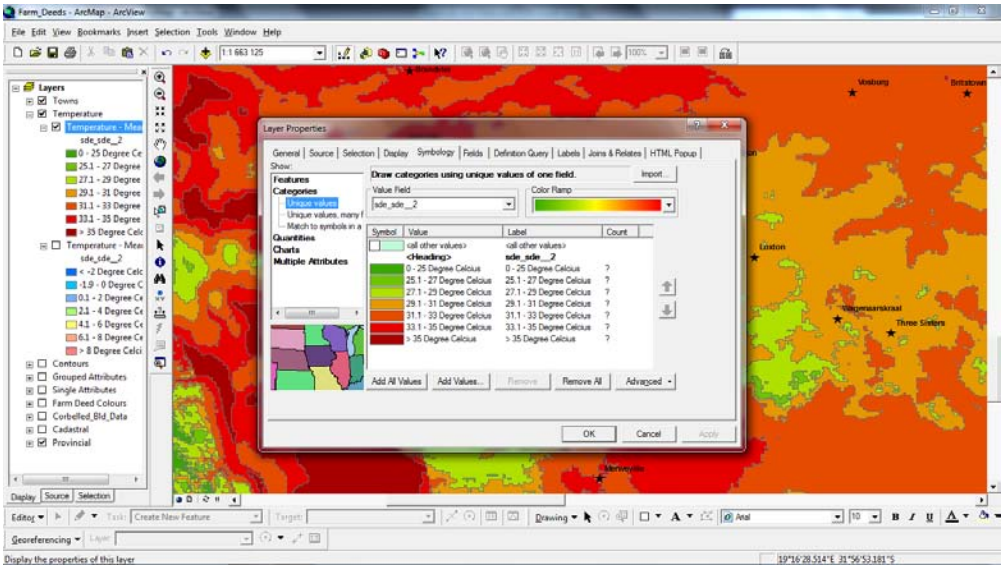

Figure a18: Screen shot of ArcView 9.3 showing the construction of the maximum annual temperature layer.

3.3 Rivers

The construction of the rivers was done using 'Provincial River' layers obtained from the National Geo-Spatial Information office. Having added the data to ArcView 9.3 it was evident that many of the rivers could be discounted as this is a semi-arid zone

and the majority of the rivers shown were non-perennial. This was verified by looking at the attribute table (Figure a19). To select only the perennial rivers the ‘Layer Properties’ window was opened for NC Rivers and the ‘Definition Query’ tab opened. The ‘Query Builder’ button was then pressed opening the ‘Query Builder’ window to allow for a query to be applied. The following query was then entered: ‘DESCR’ LIKE 'PERENNIAL RIVER' (Figure a20). With this done other permanent water features were selected such as dams. Once all the applicable water sources were displayed the Symbology was altered as described above and all the changes accepted (the final display can be seen in Figure a21).

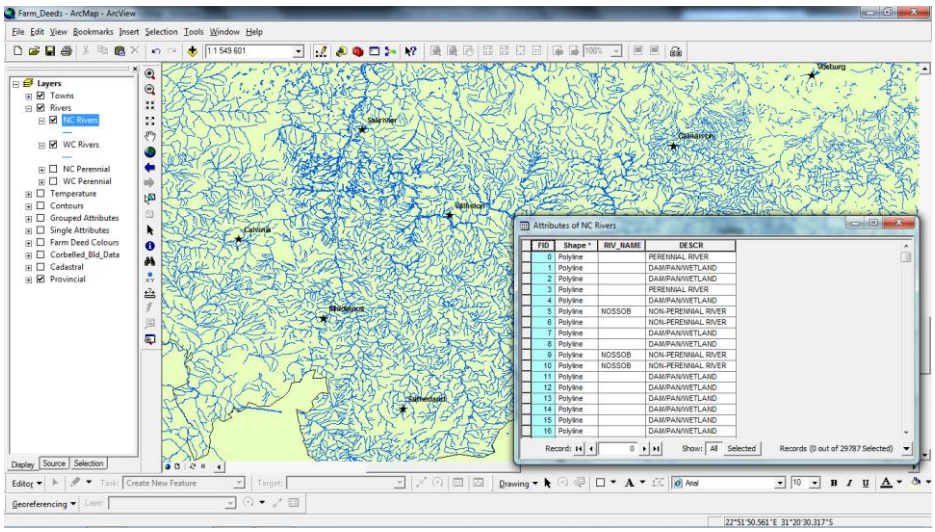

Figure a19: Screen shot of ArcView 9.3 showing the distribution of all the Nothern and Western Cape rivers and the attribute table of the Northern Cape river layer.

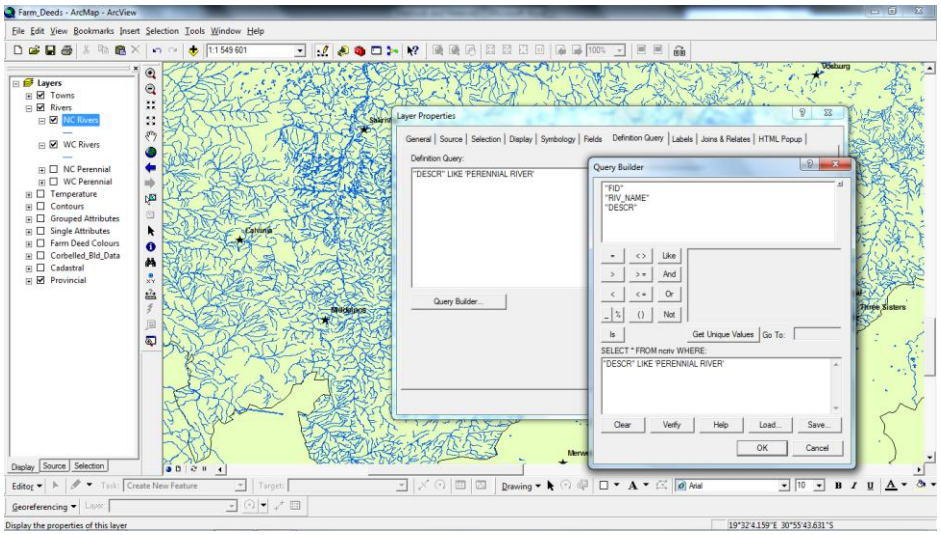

Figure a20: Screen shot of ArcView 9.3 showing the 'Query Builder' and query used to select only the perennial rivers of the Northern Cape river layer.

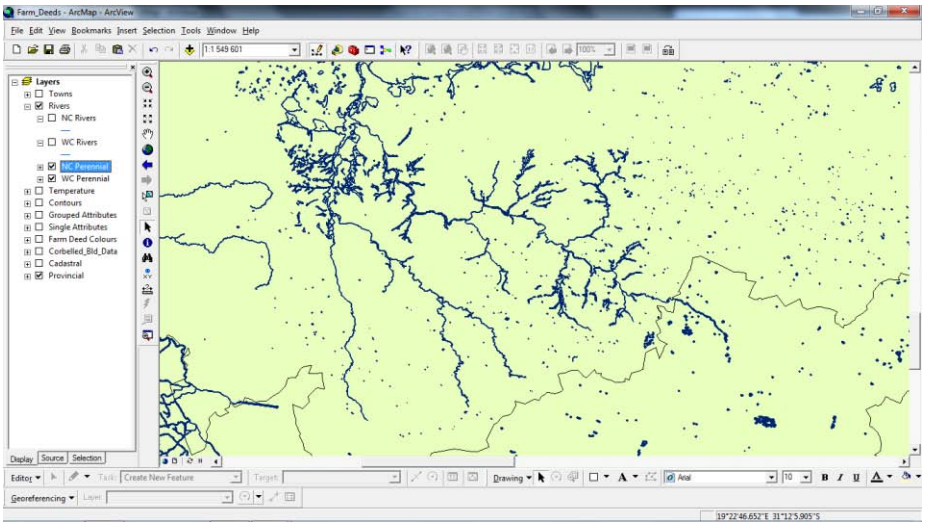

Figure a21: Screen shot of ArcView 9.3 showing the final layout of the perennial rivers and dams of both the Northern and Western Cape.

3.4 Grazing capacity

The grazing capacity data was again obtained from the AGIS website (www.agis.agric.za) and opened in the ArcView 9.3. The same protocol was followed as described above for the changing of the Symbology of this layer. Figure a22 shows the changes made and applied for this layer.

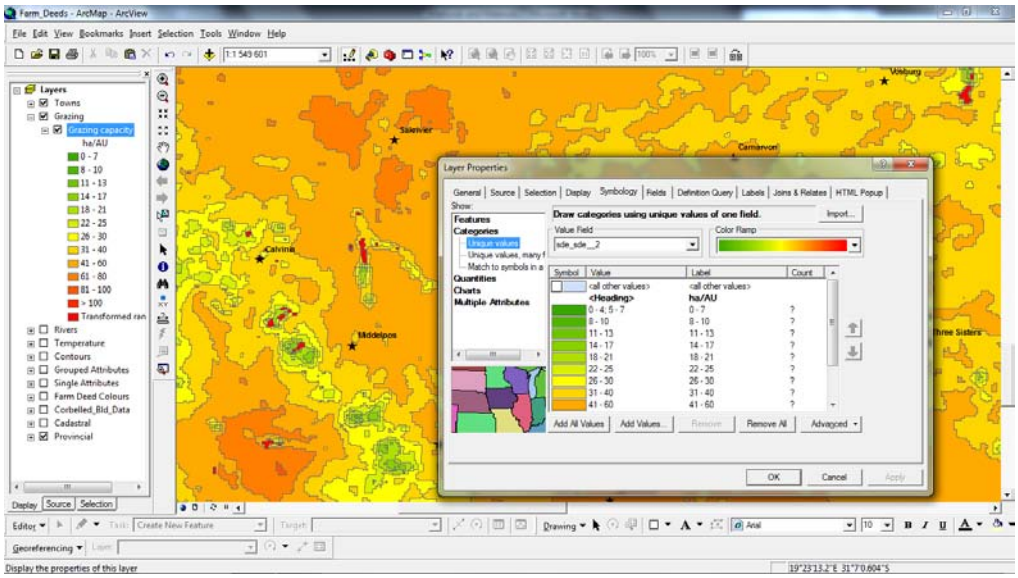

Figure a22: Screen shot of ArcView 9.3 showing the Symbology chosen for the 'Grazing Capacity' layer which was downloaded from www.agis.agric.za.

3.5 Geology

The geology of this region contains a variety of different rock types. This data was collected from the National Geo-Spatial Information office in Mowbray, Cape Town. Both the Northern Cape and Western Cape data was added. Due to the number of rock types (Figure a23) only those applicable to the region under investigation were displayed. To do this a selection of all the geology in the display was selected by choosing the 'Select Features' tool and dragging it across the display screen. With this done the selected attributes were exported to from another layer (Figure a24). This was again done to the Western Cape geological data. With all the relevant geology displayed, the same method of choosing an appropriate way to display the

data using the options available in the ‘Layer Properties’ ‘Symbology’ tab as described above.

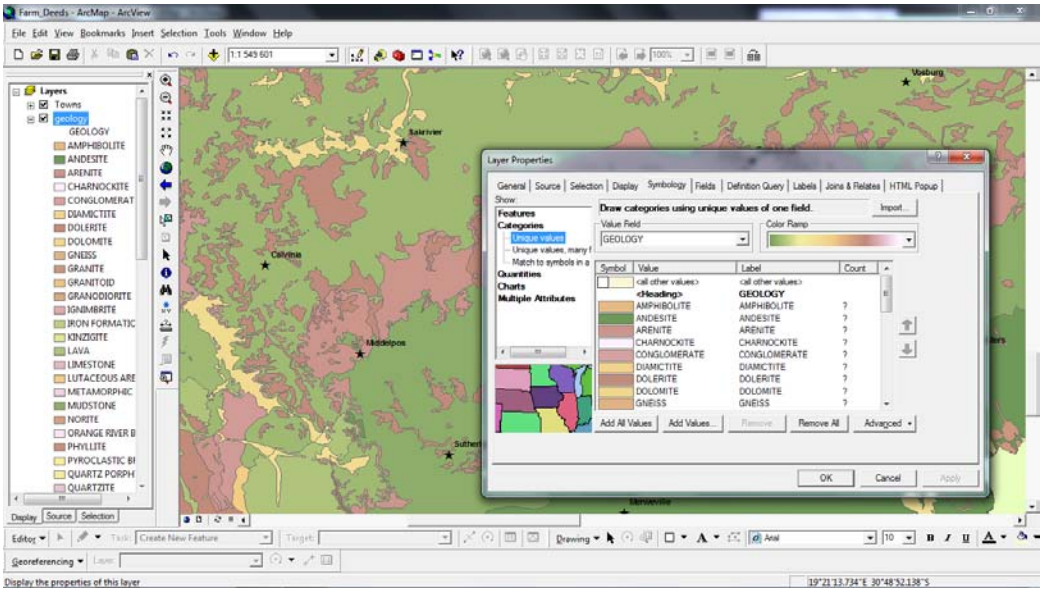

Figure a23: Screen shot of ArcView 9.3 showing the display and properties of the geology in the Karoo region under investigation.

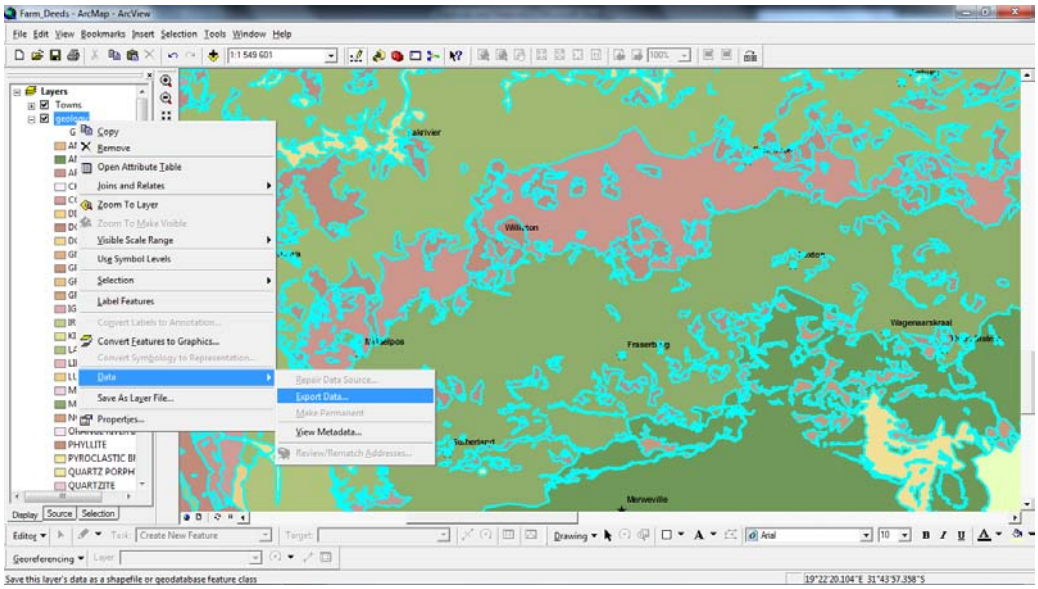

Figure a24: Screen shot of ArcView 9.3 showing the display of selected attributes of the geology layer in the Karoo region under investigation and the ‘Export Data’ action.

3.6 Rainfall

The mean annual rainfall data layer was obtained from the AGIS website (www.agis.agric.za). The data was added to the GIS and the 'Value Field' with the rainfall data is selected. This is followed by choosing an appropriate colour scheme to represent the data (Figure a25).

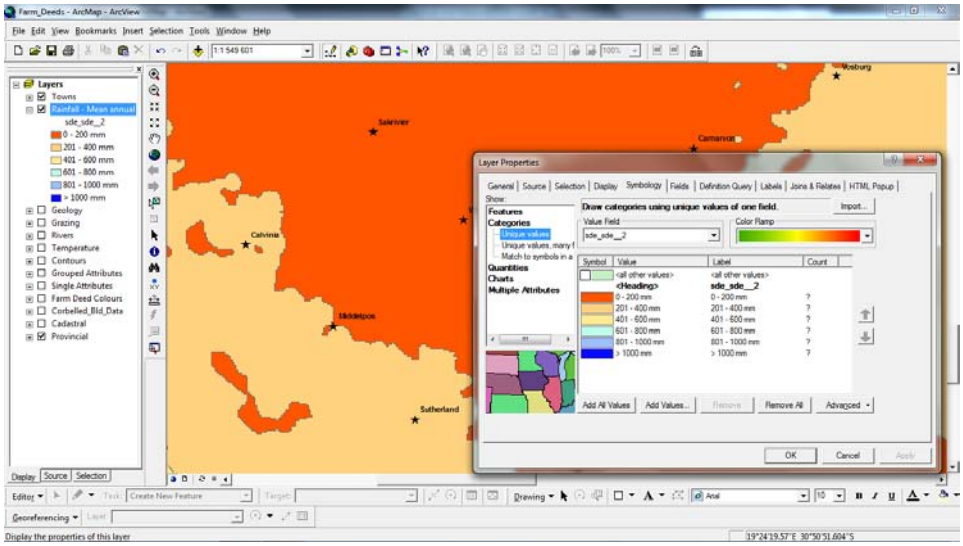

Figure a25: Screen shot of ArcView 9.3 showing the colour scheme chosen for the 'mean annual rainfall' layer for the Karoo region under investigation.

3.7 Evaporation

To construct the evaporation rate the AGIS website (www.agis.agric.za) was used to obtain this environmental data. With this information downloaded it was added to the GIS display. The 'Layer Properties' window was then opened and the correct attribute selected in the 'Value Field' drop down menu. An appropriate colour scheme was then chosen and the resulting changes applied to the display (Figure a26).

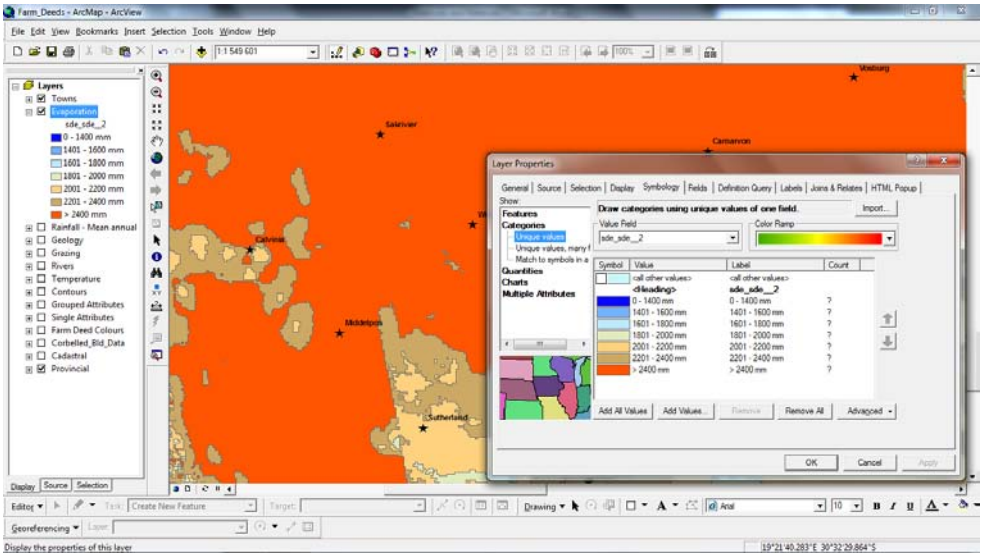

Figure a26: Screen shot of ArcView 9.3 showing the colour scheme chosen for the 'mean annual evaporation rate' layer for this Karoo region under investigation.

3.8 Soil potential

The soil potential data was collected from the National Geo-Spatial Information office in Mowbray, Cape Town. As this data is split by province both the Northern and Western Cape soil potential data was added to the display. Then following the same process described above the 'Layer Properties' window was opened and the correct attribute in the 'Value Field' selected. An appropriate colour scheme was then chosen. This colour scheme was selected again for the Western Cape soil potential data to ensure colours were continuous across this region for each different feature (Figure a27).

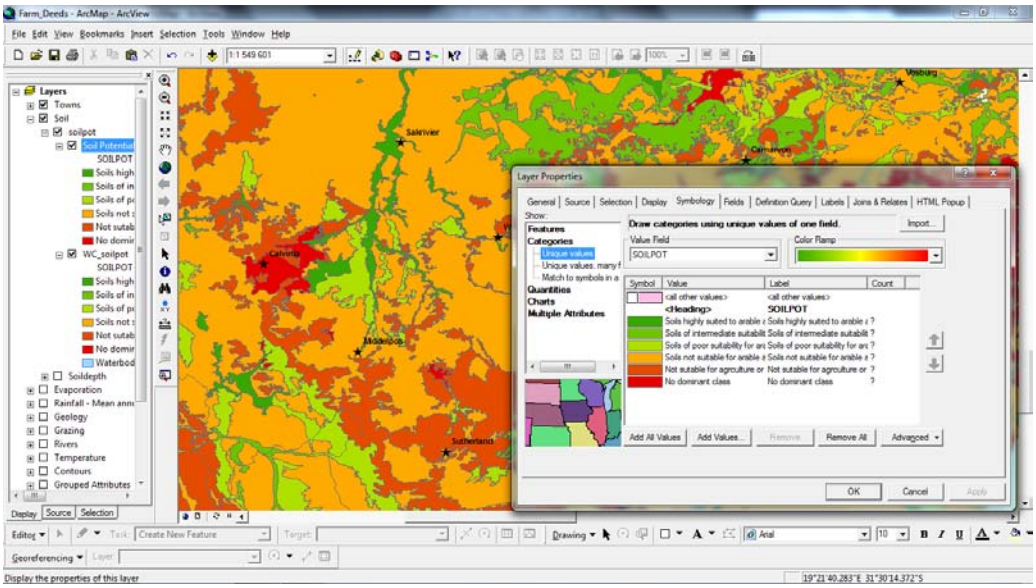

Figure a27: Screen shot of ArcView 9.3 showing the colour scheme chosen for the 'Soil Potential' layer for the Karoo region under investigation.

4. GIS and other sources

With the information entered into the GIS extensive background reading was then done in order to make use of and bring meaning to the data. . This was done to place the data in the context of the Karoo region. Information about the Karoo's natural environment was collected to better understand the geology and vegetation of the area. Information on the history of the Karoo and surrounding areas was important in understanding the fluidity and changes that occurred on this land and how people lived on it. One of the major impacts on the Karoo was the introduction of merino sheep. In order to understand why this animal changed the landscape information on its history was examined. To develop ideas of how the land was used, the legislation of farm title deeds and quitrent farms was investigated. This led to information on the structures built on the farms, such as corbelled buildings and wind pumps, being researched. These all showed the change from an open free ranging landscape to a closed segmented use of land. How this landscape changed

or resisted the change that occurred is why GIS is used. To determine how all these aspects fit together and are viewed, landscape archaeology was also researched. In order to obtain these various sources of information a variety of avenues were explored. The first was the use of books from the University of Cape Town Library, in particular the collection of books from the African Studies library were pertinent to investigate the history and development of the Karoo in the 19th Century. Other older sources were obtained from the Cape Town Archives office. Various online sites like 'JSTOR' were used to collect journal articles on contemporary ideas and research on the information listed above.

All this information was then compiled and interrogated to determine whether the Karoo region containing corbelled buildings was an open or a closed landscape in the light of the land being increasingly occupied and new technologies introduced to isolated areas throughout the Cape Colony during the nineteenth century.

References

Adhikari, M., 2011. *The Anatomy of a South African Genocide: The Extermination of the Cape San People.* Cape Town: University of Cape Town Press.

Anderson, E., 1985. *A history of the Xhosa of the Northern Cape, 1795-1879*. Unpublished Archaeology M.A. thesis: Cape Town: University of Cape Town.

Anderson, P. R., 1992. *The Human Clay: An essay in the spacial history of the Cape Eastern Frontier 1811-35.* Oxford, England. Oxford University (M.Litt. thesis).

Archer, S., 2000. Technology and ecology in the Karoo: A century of windmills, wire and changing farming practice. *Journal of Southern African Studies*, 26(4), pp. 675-696.

Archer, S., 2002. Technology and ecology in the Karoo: A century of windmills, wire and changing farming practice. In: S. Dovers, R. Edgecombe, & B. Guest, eds. *South Africa's environmental history cases & comparisons*,. Cape Town: David Philip. pp. 675-696.

Ashmore, W. & Knapp, A. B., 1999. Archaeological landscapes: Constructed, Conceptualized, Ideational. In: W. Ashmore & A. B. Knapp, eds. *Archaeologies of landscape contemporary perspectives*. Malden, Mass: Blackwell. pp. 1-32.

Beaumont, P. B. & Vogel, J. C., 1989. Patterns in the age and context of rock art in the northern Cape. *The South African Archaeological Bulletin*. 44, pp. 73-81.

Barrow, J., Mavor, W. F., Le Vaillant, F., & Le Vaillant, F., 1807. *Travels in Southern Africa.* London: Minerva-Press for Lane, Newman, and Co.

Barrow, S. J., 1968. *An account of travels into Southern Africa, in the years 1797 and 1798*. New York, USA. Johnson Reprint Corporation.

Beinart, W., 1998. The night of the jackal: sheep, pastures and predators in the Cape. *Past & Present,* 158, pp. 172-206.

Beinart, W., 2008. *The rise of conservation in South Africa: settlers, livestock, and the environment.* Oxford: Oxford University Press, pp. 1770-1950.

Bender, B., Hamilton, S. & Tilley, C., 1997. Leskernick: stone worlds; alternative narratives; nested landscapes. *Prehistoric Society*, 63, pp. 147-178.

Binford, L. R., 1982. Objectivity-explanation-archaeology. In: C. Renfrew *et al*., eds. *Theory and explanation in archaeology*. New York: Academic Press, pp. 125-138.

Botha, C. G., 1919. Early Cape land tenure. *South African Law Journal*, 36, p.149.

Botha, C. G., 1927. *Place names in the Cape Province,* Cape Town: Juta.

Bollong, C. A., Vogel, J. C., Jacobson, L., van der Westhuizen, W. A. & Sampson, C. G., 1993. Direct dating and identity of fibre temper in pre-contact Bushman (Basarwa) pottery. *Journal of Archaeological Science*, 20, pp. 41-55.

Bollong, C. A., Sampson, C. G. & Smith, A. B., 1997. Khoikhoi and Bushman Pottery in the Cape Colony: Ethnohistory and Later Stone Age Ceramics of the South African Interior. *Journal of Anthropological Archaeology,* 16, p.131.

Boucher, M. & Penn, N. G., 1992. *Britain at the Cape, 1795 to 1803*. 9th ed. Houghton, South Africa: Brenthurst Press.

Bradley, R., 1997. *Rock art and the prehistory of Atlantic Europe: signing the land.* London: Routledge.

Brown, D. E., Harrison, P. C., Hinds, F. C., Lewis, J. A. & Wallace, M. H., 1977. Heat stress effects on fetal development during late gestation in the ewe. *Journal of Animal Science*, 44(3), p. 442.

Burchell, W. J., 1824. *Travels in the interior of Southern Africa.* London: Longman, Hurst, Rees, and Orme.

Burrough, P. A., 1990. Principles of Geographical Information Systems for land resources assessment. In: J. Star & J. E. Estes, eds. *Geographic information systems: an introduction*. New Jersey: Prentice Hall Nueva York.

Cape of Good Hope (South Africa), 1859. *Report of the Commissioners appointed for the purpose of determining the unit of land measure*. Cape Town: Government Printer.

Clarke, D. L., 1978. *Analytical archaeology* (2nd ed). New York: Columbia University Press.

Daws, G. T. & Squires, V. R., 1974. Observations on the effects of temperature and distance to water on the behaviour of Merino and Border Leicester sheep. *The Journal of Agricultural Science*, 82(03), pp. 383-390.

Degen, A. A., 1977a. Fat-tailed Awassi and German Mutton Merino sheep under semi-arid conditions: 1. Total body water, its distribution and water turnover. *The Journal of Agricultural Science*, 88(03), pp. 693-698.

Degen, A. A., 1977b. Fat-tailed Awassi and German Mutton Merino sheep under semi-arid conditions: 2. Total body water and water turnover during pregnancy and lactation. *The Journal of Agricultural Science*, 88(03), pp. 699-704.

Degen, A. A. & Young, B.A., 1981. Effect of air temperature and feed intake on live weight and water balance in sheep. *Journal of Agricultural Science (Cambridge)*, 96, pp. 493-496.

Du Toit, D. J., 2008. The indigenous livestock of Southern Africa [Online]. Avaliable: http://www.damarasheep.co.za/files/ParisRoundtable.pdf [accessed 3 September 2011].

Duly, L. C., 1968. *British land policy at the Cape, 1795-1844.* Durham: Duke University.

Dunnell, R. C., 1992. The notion of site. In: J. Rossignol & L. A. Wandsnider, eds. *Space, time, and archaeological landscapes*. New York: Plenum Press, pp. 21-41.

Ebert, D., 2004. Applications of archaeological GIS. *Canadian Journal of Archaeology*, 28(2), pp. 319-341.

Epstein, H., 1960. History and origin of the Ronderib and Namaqua Afrikaner sheep. *Zeitschrift fnr Tierznchtung und Znchtungsbiologie*, 74(14), pp. 267-292.

Esterhuysen, A. & Smith, J., 2007. Stories in stone. In: P. Delius, ed. *Mpumalanga: history and heritage*. Scottsville: University of Kwazulu Natal Press, pp. 41-64.

Feinstein, C. H., 2005. *An economic history of South Africa: Conquest, discrimination and development.* Cambridge: Cambridge University Press.

Flannery, K. V. & Marcus, J., 1996. Cognitive archaeology. In: *Contemporary Archaeology in Theory: A Reader*, ed. RW Preucel, I Hdder pp. 350-363

Fletcher, R. & Winter, R., 2008. Prospects and problems in applying GIS to the study of chalcolithic archaeology in southern Israel. *Bulletin of the American Schools of Oriental Research*, 352, pp. 1-28.

Giliomee, H. B., 1975. *Die Kaap tydens die eerste Britse bewind*, 1795-1803. Kaapstad, Hollandsch Afrikaansche Uitg. Mij.

Giliomee, H. B., 1989. The eastern frontier, 1770-1812. In: R. Elphick, H. B. Giliomee, & J. C. Armstrong, eds. *The shaping of South African society, 1652-1840*. Middletown, Conn: Wesleyan University Press, pp. 291-326.

Godée-Molsbergen, A., 1916. *Reizen in Zuid-Afrika in de Hollandse tijd*. Vol 2. The Hague: Martinus Nijhoff.

Grosskopf, J. F. W. & Carnegie Commission of Investigation on the Poor White Question in South Africa, 1932. *Rural impoverishment and rural exodus.* Stellenbosch: Pro Ecclesia.

Grove, R., 1989. Scottish missionaries, evangelical discourses and the origins of conservation thinking in southern Africa 1820-1900. *Journal of Southern African Studies*, 15(2), pp. 163-187. Available from: ISI:A1989U061600002

Guelke, L. 1988. The Anatomy of a Colonial Settler Population: Cape Colony 1657-1750. *The International Journal of African Historical Studies*, 21(3), pp. 453-473.

Guelke, L. & Shell, R., 1992. Landscape of conquest: frontier water alienation and Khoikhoi strategies of survival, 1652-1780. *Journal of Southern African Studies*, 18(4), pp. 803-824.

Hancock, W. K., 1958. Trek. *The Economic History Review, New Series*, 10(3), pp. 331-339.

Hauser, K., 2007. *Shadow sites: photography, archaeology, and the British landscape, 1927-1955* New York: Oxford University Press, USA.

Hockly, H. E., 1957. *The story of the British Settlers of 1820 in South Africa.* Cape Town: Juta.

Hodgson, F. D. I., 1987. Geohydrology. In: R. M. Cowling *et al*., eds. In*: The Karoo biome a preliminary synthesis. Part 2 - Vegetation and History*, Pretoria, South Africa: Foundation for Research Development, Council for Scientific and Industrial Research, pp. 84-91.

Holtorf, C. J., 1997. Megaliths, monumentality and memory. *Archaeological Review from Cambridge*, 14(2), pp. 45-66.

Howison, J., 1834. *European colonies, in various parts of the world: view in their social, moral and physical condition*, 2nd ed. London: R. Bentley.

Ingold, T., 1993. The temporality of the landscape. *World Archaeology*, 25(2), pp. 152-174. Available from: ISI:A1993MB85100002.

Johnson, M., 1997. Rethinking houses, rethinking transitions: of vernacular architecture, ordinary people and everyday culture. In: Gaimster, D., & Stamper, P., (eds). *The age of transition: the archaeology of English culture 1400 to 1600*. Oxbow Books, Oxford, pp. 145 -155.

Johnson, M., 2007. *Ideas of landscape.* Malden, MA: Blackwell Publishers.

Juvanec, B., 2003. *Vaulting, facing and infilling as components of corbelled construction*. Available: www.pierreseche.com/los_bombos.htm [accessed 20 October 2010].

Kramer, P., 2007. Corbelled buildings: an overview. *Vernacular Architecture Society of South Africa*, 17, pp. 5-6.

Kramer, P., 2012. *The History, form and context of the 19th century corbelled buildings of the Great Karoo*. Unpublished MA Archaeology thesis. Cape Town: University of Cape Town

Lichenstein, H., 1928. *Travels in southern Africa in the years 1803, 1804, 1805 and 1806*, Translated by Plumptre, A. 10-11th ed. Cape Town: The Van Riebeeck Society.

Legassick, M. C., 1969. *The politics of a South African frontier: The Griqua, the Sotho-Tswana and the missionaries, 1780-1840: the politics of the frontier zone*. Ph.D thesis: University of California, Los Angeles, USA.

Legassick, M. C., 2010. *The Politics of a South African Frontier: The Griqua, the Sotho-Tswana and the Missionaries, 1780-1840*. Basel, Switzerland: Basler Afrika Bibliographien.

Lloyd, C., 1970. *Mr. Barrow of the Admiralty- a life of Sir John Barrow, 1764-1848.* London: Collins.

Lucas, G., 2001. *Critical approaches to fieldwork: contemporary and historical archaeological practice.* London: Routledge.

Lynch, J. J., Brown, G. D., May, P. F. & Donnelly, J. B., 1972. The effect of withholding drinking water on wool growth and lamb production of grazing Merino sheep in a temperate climate. *Australian Journal of Agricultural Research*, 23, pp. 659-668.

Macfarlane, W. V., Dolling, C. H. S. & Howard, B., 1966a. Distribution and turnover of water in Merino sheep selected for high wool production. *Australian Journal of Agricultural Res*earch, 17(4), pp. 491-502.

Macfarlane, W. V., Howard, B. & Morris, R. J. H., 1966b. Water metabolism of Merino sheep shorn during summer. *Australian Journal of Agricultural Research*, 17, pp. 219-225.

Maggs, T. M., 1976. *Iron Age communities of the southern Highveld.* Pietermaritzburg, Council of the Natal Museum, Pietermaritzburg, South Africa.

Maguire, J., 2008. Building in stone in the Karoo: possible explanations for the restricted distribution of corbelled houses. *Vernacular Architecture Society of South Africa,* 19, pp. 15-30.

Marais, J. S., 1939. *The Cape coloured people, 1652-1937*. London: Longmans.

McGregor, B. A., 1986. Water intake of grazing Angora wether goats and Merino wether sheep. *Australian Journal of Agricultural Research,* 26, pp. 639-642.

Mentzel, O. F., Marais, G. V., Hoge, J. & Mandelbrote, H. J., 1944. *A geographical and topographical description of the Cape of Good Hope*. Cape Town: The Van Riebeeck Society.

Metadata at http://www.agis.agric.za/agisweb/agis.html [Accessed 12 March 2011]

Moffett, A., 2011. *Schimmelfontein Ceramics: the first description and assessment of late 19th century Karoo assemblage*. Unpublished BA Archaeology honours thesis Cape Town: University of Cape Town.

Moodie, D., 1960. *The record; or, A series of official papers relative to the condition and treatment of native tribes of South Africa*. Cape Town and Amsterdam, A.A. Blakema.

Moodie, J. W. D., 1835. *Ten years in South Africa including a particular description of the wild sports of that country.* London: Bentley.

Morris, D., 1988. Engraved in Place and Time: A Review of Variability in the Rock Art of the Northern Cape and Karoo. *The South African Archaeological Bulletin*, 43 (148), pp. 109-120.

Mucina, L. & Rutherford, M. C., 2006. *The vegetation of South Africa, Lesotho and Swaziland*. Pretoria: The South African National Biodiversity Institute.

Neville, D., Sampson, B. E. & Sampson, C. G., 1994. Frontier Wagon Track System in the Seacow Valley, North Eastern Cape. *The South African Archaeological Bulletin,* 49 (160), pp. 65-72.

Noble, J., 1875. *Descriptive handbook of the Cape Colony its condition and resources.* Cape Town: Juta.

Parer, J. T., 1963. Wool length and radiant heating effects in sheep. *The Journal of Agricultural Science*, 60(01), pp. 141-144.

Penn, N. G., 1986. Pastoralists and pastoralism in the northern Cape frontier zone during the eighteenth century. *Goodwin Series*, 5, pp. 62-68.

Penn, N. G., 1993. Mapping the Cape: John Barrow and the First British occupation of the Colony, 1795-1803. *Pretexts*, 4(2), pp. 20-43.

Penn, N. G., 2005. *The forgotten frontier colonist and Khoisan on the Cape's northern frontier in the eighteenth century.* Athens: Ohio University Press.

Peterman, G. L., 1992. Geographic information systems: Archaeology's latest tool. *The Biblical Archaeologist*, 55(3), pp. 162-167.

Plug, I. & Sampson C. G., 1996. European and Bushman Impacts on Karoo Fauna in the Nineteenth Century: An Archaeological Perspective. *The South African Archaeological Bulletin,* 51(163), 26-31.

Pourlis, A. F., 2011. A review of morphological characteristics relating to the production and reproduction of fat-tailed sheep breeds. *Tropical Animal Health and Production,* 43(7) pp. 1267-1287.

Pringle, T., 1834. *African sketches.* London: Edward Moxon.

Ridings, R. & Sampson, C. G., 1990. There's no percentage in it: intersite spatial analysis of Bushman (San) pottery decorations. *American Antiquity*, 55(4), pp. 766-780.

Roberts, B., 1976. *Kimberley: turbulent city.* Cape Town: David Philip Publishers.

Robin, C. & Rothschild, N. A., 2002. Archaeological ethnographies. *Journal of Social Archaeology*, 2(2), pp. 159-172.

Rolls, E. C., 1984. *A million wild acres.* Ringwood, Victoria: Penguin.

Ross, R., 1975. The 'White' population of South Africa in the eighteenth century. *Population Studies,* 2(2), pp.217-230.

Ross, R., 2008. *A concise history of South Africa.* Cambridge: Cambridge University Press.

Ross, R., 2010. Khoesan and Immigrants: The emergence of colonial society in the Cape, 1500-1800. In: C. Hamilton, B. K. Mbenga, & R. Ross, eds. *The Cambridge history of South Africa: from the early times to 1885 volume 1*. Cambridge: Cambridge University Press, pp. 168-210.

Rubidge, R., 1979. *The Merino on Wellwood: Four Generations.* Graaff-Reinet: Unpublished.

Sadr, K. & Sampson, C. G., 1999. Khoekhoe ceramics of the upper Seacow River Valley. *South African Archaeological Bulletin*, 55(169), pp. 3-15.

Sampson, C. G., 1984. Site clusters in the Smithfield settlement pattern. *The South African Archaeological Bulletin*, 39(139), pp. 5-23.

Sampson, C. G., 1996. Spatial organisation of Later Stone Age herders in the upper Karoo. In Pwiti, G., and Soper, R. (eds.), *Aspects of African Archaeology*: *Papers from the 10th Congress of the Pan-African Association for Prehistory and Related Studies*, University of Zimbabwe Press, Harare, pp. 317-326.

Sampson, C. G. & Vogel, J. C., 1996. Fibre temper in Later Stone Age ceramics from the upper Karoo. *The South African Archaeological Bulletin*, 51(164), pp. 99-105.

Sampson, C. G., Sampson, B. E. & Neville, D., 1994. An early Dutch settlement pattern on the north east frontier of the Cape Colony. *Southern African Field Archaeology*, 3, pp. 74-81.

Sampson, C. G., 2010. Chronology and dynamics of Later Stone Age herders in the upper Seacow River Valley. *Journal of Arid Environments*, 74(7), pp. 842-848.

Savage, S. H., 1990. GIS in archaeological research. In: K. M. Allen & S. W. Green, eds. In*: Interpreting space GIS and archaeology*. London: Taylor & Francis, pp. 22-31.

Schoenian, S., 2010. Heat stress in sheep and goats. 9-7-2010. Available from: http://www.sheepandgoat.com/articles/heatstress.html. [accessed 2 July 2011]

Slater, H., 1975. Land, labour and capital in Natal: The Natal land and colonisation. *Journal of African History*, 16(2), pp. 257-283.

Smit, G. N., 2009. Calculation of grazing capacity and browse capacity for game species. Available from http://www.wildliferanching.com/content/grazing-capacity-game [accessed 6 October 2011]

Smith, B. W., Ouzman, S., Chippindale, C., Dowson, T. A., Mitchell, P., Morris, D., Wallis, R. J., Wilmsen, E., Smith, B. & Ouzman, S., 2004. Taking Stock. *Current Anthropology,* 45(4), pp. 499-526.

Sparrman, A., 1977. *A voyage to the Cape of Good Hope towards the Antarctic Polar Circle, round the world and to the country of the Hottentots and the Caffres, from the year 1772-1776*, 6th ed. Forbes, V.S., Cape Town: The Van Riebeeck Society.

Star, J. & Estes, J. E., 1990. *Geographic information systems: an introduction*. New Jersey: Prentice Hall.

Tewari, D. D., 2009. A detailed analysis of evolution of water rights in South Africa: An account of three and a half centuries from 1652 AD to present. *Water SA (Online)*, 3(5), pp. 693-710.

Theal, G. M., 1897. *Records of the Cape Colony copied for the Cape Government, from the manuscript documents in the Public Record Office, London.* London: William Clowes & Sons printer.

Turner, S., 2006. Historic landscape characterisation: a landscape archaeology for research, management and planning. *Landscape Research*, 31(4), pp. 385-398.

van der Merwe, H. D., 1990. *The social context of the rock art during the contact period in the north-western Cape and the Seacow River valley*. Unpublished M.A. thesis: Cape Town: University of Stellenbosch.

van der Merwe, P. J., 1937. *Die noordwaartse beweging van die Boere voor die Groot Trek (1770-1842.)* Den Haag: W.P. van Stockum.

van der Merwe, P. J., 1945. *Trek studies oor die mobiliteit van die pioniersbevolking aan die Kaap.* Kaapstad: Nasionale Pers.

van der Merwe, P. J. & Beck, R. B., 1995. *The migrant farmer in the history of the Cape Colony, 1657-1842.* Athens: Ohio University Press.

van Sittert, L., 2002. Holding the line: The rural enclosure movement in the Cape Colony, c. 1865-1910. *Journal of African History*, 43(1), pp. 95-118. Available from ISI:000174954900005

Walt A. I. H., 1928. *Die Ausdehnung der Kolonie am Kap der Guten Hoffnung (1700-1779)*. Berlin: E. Ebering.

Walton, J., 1951. Corbelled stone huts in Southern Africa. *Man*, 51, pp. 45-48.

Walton, J., 1960. Corbelled building of the Karee Berge. Report of survey carried out in May 1960.

Walton, J., 1989. *Old Cape Farmsteads*. Cape Town: Human & Rousseau

Walton, J. & Pretorius, A., 1998. *Wind pumps in South Africa*. Cape Town: Human & Rousseau.

Wellington, J. H., 1955. *Southern Africa: a geographical study*. Cambridge: Cambridge University Press.

Wilmont, A., 1869. *History of the colony of the Cape of Good Hope: from its discovery to the year 1819*. Cape Town: J.C. Juta.

Westbury, W. & Sampson C. G., 1993. To Strike the necessary Fire: Acquisition of Guns by the Seacow Valley Bushmen. *The South African Archaeological Bulletin*, 48(157), pp. 26-31.

Wheatley, D. & Gillings, M., 2002. *Spatial technology and archaeology: The archaeological applications of GIS*. Taylor and Francis, London.

Zachario, N., 2011. *The archaeological record of the Xhosa in the Northern Cape frontier zone: a case study from the Pramberg*. Unpublished BA Archaeology honours thesis. Cape Town: University of Cape Town.