

ISBN 978-82-575-1027-5  
ISSN 1503-1667



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PHILOSOPHIAE DOCTOR (PHD) THESIS 2011:64

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# KNOWING THE LANDSCAPE: SCIENCE, PEOPLE AND POWER RELATIONS IN NAMAQUALAND, SOUTH AFRICA

Å KJENNE LANDSKAPET: VITENSKAP, FOLK OG MAKTRELASJONER I NAMAQUALAND,  
SØR-AFRIKA

EIRIN HONGSLO

# Knowing the landscape: Science, people and power relations in Namaqualand, South Africa

*Om å kjenne landskapet: Vitenskap, folk og maktrelasjoner i Namaqualand, Sør-Afrika*

Philosophiae Doctor (PhD) Thesis

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Ås 2011



Thesis number 2011:64  
ISSN 1503-1667  
ISBN 978-82-575-1027-5



# Part I

Introduction



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## Summary

In this thesis I explore the links and co-production between science and politics in Namaqualand through answering three research questions: 1. To what extent have landscapes in Namaqualand changed during the last 66 years (1939-2005), and how have different land uses contributed to the state of present landscapes? 2. How have science and policy influenced each other in the formation of local planning initiatives during the land reform process in Namaqualand? 3. In what ways do politics and land tenure models influence ecological science concerning communal land management in southern African dryland areas?

Land degradation has been a recurrent theme in environmental research. Widespread erosion, overgrazing and desertification presumably caused by African smallholders have been a key concern by policymakers and development agencies for more than a century. This degradation orthodoxy is partly based on equilibrium models in ecological science and partly on modernization theories of land tenure and commercialization of agriculture. Both the equilibrium model and the focus on private land tenure have met considerable critique in Southern Africa and in Africa in general. Critics argue that dryland areas are ecologically unstable and unpredictable and therefore do not fit the equilibrium model. Further, they argue that privatization of land and limitations of grazing animals will marginalize the poorer farmers and lead to more poverty in rural areas, without contributing to more sustainable grazing areas. Still however, equilibrium-based thinking continues to influence African land and environmental policies.

This project was carried out in Namaqualand, South Africa where, like in the rest of South Africa, apartheid policy brought about segregation between colored and white farmers, creating a dual agricultural system. The colored population was enclosed in small reserves, while white farmers gradually formed large farms that were later fenced. This unequal distribution of land and resources has continued until today and forms the background for the land reform process that started in 1994.

The thesis is a case study of the development of knowledge about environmental change in Namaqualand. It discusses the politicized production and application of science and in doing so the thesis combines the approaches of Political Ecology and Science and Technology Studies. This thesis contributes to the existing body of literature in the following ways: The first paper combines data on land cover changes in Concordia (a communal area in Namaqualand), in a neighboring private farm and in a neighboring nature reserve, with data on the history of land use in the area. The article combines repeat photography covering a period of 66 years with interviews with local farmers on land use history and the authors find that vegetation has changed negligibly in the communal area studied over the 66-year period. While cultivation in the communal areas probably changed the landscape considerably, this change happened prior to the time period studied. In the neighboring private farm, as well as in the nature reserve,



vegetation cover and species composition have recovered considerably since 1939. Thus rather than a degradation process in the communal area, we uncover a regeneration in the private farm and the nature reserve, following destocking subsidies and subsequent conservation.

The second paper documents how the notion of carrying capacity was employed in a management plan developed as part of the land reform policy process in Concordia. Initially, the notion of carrying capacity was used by communal farmers to challenge the current distribution of land and the dominating idea that communal farming inherently led to degradation. Eventually, however, the concept contributed to depoliticize rangeland policy by rendering the relationship between land and livestock a question of numbers and not a question of how much land communal farmers have access to.

The third paper discusses the use of photography in fenceline contrast studies within ecological science. Fence-line contrast study is a methodology used in ecology to compare two areas (divided by a fence). This way one may assume that other conditions are equal and that difference in management practice can explain visible differences found. Based on two cases from Namibia and Southern Africa, the article substantiates that fenceline contrast photographs are more than an objective representation of landscape difference. Rather, they function as models that relate ecological dynamics to presumptions of land tenure and management. The message implied in using such photographs is that communal tenure inherently leads to overgrazing and, hence, to the degradation of pastures, while private tenure results in healthy rangelands. This is a message that echoes the degradation orthodoxy, and the fenceline contrast photographs thus contribute to the current pressure on communal land tenure, even though the data as such do not support such a pessimistic view.

The overall argument of this thesis is that science and politics are intrinsically linked and co-produced, both in political processes and in the production of scientific knowledge. While the findings of the first article question general assumptions of the validity of the degradation orthodoxy in Namaqualand, the second and the third articles show how degradation orthodoxy still influences both policy processes and science production. Thus, in order to open up for other influences and new and more fitting ecological models in policy and science, change must happen at different levels of the process of knowledge production and policy formation.

## Sammendrag

I denne avhandlingen undersøker jeg forbindelsen og samproduksjonen mellom politikk og vitenskap i Namaqualand i Sør Afrika. Avhandlingen tar utgangspunkt i tre forskningsspørsmål: 1) I hvilken grad har landskapet i Namaqualand endret seg fra 1939 til 2005, og hvordan har ulik bruk av påvirket landskapet? 2) Hvordan påvirker vitenskap og politikk hverandre når lokale plandokumenter for beiteallmenninger skal utformes i forbindelse med jordreformprosessen i Namaqualand? 3) På hvilke måter påvirker politiske modeller for organisering av eiendom den økologiske forskningen i beiteallmenninger i det sørlige Afrika?

Jordforringelse har vært et tilbakevendende tema i miljøforskningen i Afrika. Politikere, byråkrater, forskere og utviklingsorganisasjoner har trukket en sammenheng mellom fattige bønders praksis og det de har tolket som utbredt erosjon, overbeite og forørkning. I Sør-Afrika er denne oppfatningen delvis basert på likevektsmodeller innen økologien og delvis på moderniseringsteorier innen samfunnsvitenskapene. Både likevektsmodellene og fokuset på privat eierskap har møtt betydelig motstand blant forskere de siste tiårene. Kritikerne hevder at tørrelandsområder har en ustabil og uforutsigbar økologisk dynamikk, og at likevektsmodellene ikke gjenspeiler det som skjer på bakken. Følgelig mener forskere at privatisering og begrensninger i dyretall marginaliserer fattige bønder og fører til mer fattigdom på landsbygda, uten at man vet om det vil føre til en mer bærekraftig utnyttelse av beiteområdene. På tross av disse advarslene dominerer likevektstankegangen afrikansk miljø- og landbrukspolitikk.

Avhandlingen bygger på et feltarbeid i Namaqualand i Sør Afrika. Dette området er i likhet med resten av Sør-Afrika merket av kolonitiden og senere av apartheidtiden. Skillet mellom fargede og hvite har ført til en todeling i landbruket. Gjennom 1800 og 1900-tallet tok settlerbøndene kontroll over mer og mer av jorda til lokale gjeter og beitefolk. De fargede bøndene ble henvist til små reservater, mens hvite settlerbønder gradvis dannet større farmer som seinere ble gjerdet inn. Denne ujevne fordelingen av jord og ressurser har fortsatt fram til i dag, og er bakgrunnen for jordreformprosessen som startet i 1994.

Denne avhandlingen er en case-studie av samproduksjonen mellom politikk og økologisk vitenskap i Namaqualand. Avhandlingen diskuterer den politiserte bruken og produksjonen av vitenskap og kombinerer dermed innsikter fra politisk økologi med vitenskaps- og teknologistudier. Avhandlingen er et bidrag til den eksisterende litteraturen på følgende måter: Den første artikkelen tar utgangspunkt i data om endringer i vegetasjonsdekket i allmenningen Concordia, på en tilgrensende privat farm og på et naturreservat. Disse dataene sammenliknes med data på tidligere bruk av området. I artikkelen bruker vi gamle og nye landskapsfotografier fra en periode på 66 år. De vi finner i fotografiene analyserer vi sammen med intervjuer med lokale allmenningsbønder og farmere om den historiske bruken av området. I studien fant vi en tendens som er helt motsatt av den myndighetene har advart mot. Myndighetene har fryktet at hard bruk av allmenningen vil føre til uopprettelige skader. Men på den tilgrensende farmen og i naturreservatet viser det seg at vegetasjonen er fortettet og at artssammensetningen er gjenvunnet i løpet av disse 66 årene. Dette har skjedd som følge av apartheidstatens subsidier for å kutte dyretall på farmen på 1970-tallet og det påfølgende vernet av naturreservatet. Dermed kan ikke forskjellen i vegetasjonsdekket i beiteallmenningen på den ene siden og den private farmen og

naturreservatet på den andre tilskrives forringelse i allmenningen, men en regenerering og fortetting av vegetasjonen på farmen og i naturreservatet. Dette viser for det første at en slik regenerering er mulig, og for det andre at vegetasjonen i allmenningen holder seg stabil.

Den andre artikkelen dokumenterer hvordan begrepet 'bæreevne' ble brukt i en planleggingsprosess i Concordia som var en del av jordreformprosessen i Sør-Afrika. Til å begynne med ble begrepet bæreevne brukt av organisasjonen som organiserte jordreformen i Namaqualand (Surplus People Project) til å vise myndighetene at den skeive fordelingen av jord hverken var økologisk eller økonomisk bærekraftig. Begrepet ble innarbeidet i forvaltningsplanene og i beiteforskriftene, og etter at omfordelingen av jorda var avsluttet fikk bæreevnebegrepet en ny funksjon. Nå bidro 'bæreevne'-begrepet til å avpolitisere beitepolitikken ved at god forvaltning ble redusert til et spørsmål om hvor mange dyr man har på beitet og at diskusjonen om hvor mye land de fattige bøndene burde ha tilgang til ble dysset ned.

Den tredje artikkelen diskuterer bruken av fotografier i gjerdekontrast-studier i økologiske akademiske tidsskrifter. Gjerdekontrast-studier er en metode brukt i økologi for å sammenlikne to områder (delt med et gjerde). Basert på to caser, en studie fra Namibia og en fra Sør-Afrika, hevder jeg at gjerdekontrast-fotografier er mer enn en objektiv representasjon av forskjeller i landskap. Like viktig er at de fungerer som modeller som relaterer økologisk dynamikk til forestillinger om at privat eierskap er det mest fordelaktige for enkeltbønders økonomi og for miljøet. Disse modellene er ikke uttalt i artiklene som er studert, men budskapet som bildene uttrykker er at felleseie av beiter i seg selv fører til overbeite og dermed til beiteforringelse, mens privat eierskap medfører en mer bærekraftig bruk. Dette er et budskap som har klangbunn i de store fortellingene om degradering og allmenning som myndighetene i Sør-Afrika og Namibia har forfektet i over hundre år. Dermed bidrar bildebruken og fortolkningen av bildene til et politisk press på allmenningen som organisasjonsform, selv om dataene i artiklene ikke tegner et så dystert bilde.

Det overordnede argumentet i denne avhandlingen er at vitenskap og politikk er nøye sammenvevd, både i politiske prosesser og i produksjon av vitenskap. Funnene i den første artikkelen stiller spørsmål ved den generelle oppfatningen av forringelse av beitelandet i Namaqualand. Den andre artikkelen viser at den gamle forestillingen om degradering av allmenningsområdene fortsatt påvirker politikk og vitenskap. Den tredje artikkelen viser at oppfatningene om at allmenningsbeite er skadelig lever videre gjennom bruk og fortolkning av gjerdekontrastfotografier. For å åpne opp for økologiske ikke-likevektsmodeller i politikk, og for nye tanker om hva som er bærekraftig organisering av eiendom, må dermed forandringer skje på forskjellige nivåer i politikkutforming og vitenskapsproduksjon.

## **Acknowledgements**

This thesis would not have been possible without the guidance, help and support from numerous others. First I would like to thank the Norwegian University of Life Sciences for funding my project, and Nansenfondet and Nordic Africa Institute for funding my fieldwork in South Africa.

Noragric, Norwegian University of Life Sciences (UMB), has been a wonderful working place for seven years. I am indebted to my two supervisors, Tor Arve Benjaminsen and Randi Kaarhus, for all the inspiring conversations we have had, and for their guidance through this long process. I would also like to thank the administrative staff at Noragric for finding solutions to all kinds of bureaucratic challenges, and for being positive and supportive throughout. Ever helpful Liv Ellingsen and Ingeborg Brandtzæg in the library: thanks for finding every thinkable source and for making me feel like I am the only user in Noragric. Various colleagues have read manuscripts at different stages, and shared academic enthusiasms and frustrations with me. I would particularly like to thank Poul Wisborg and Frode Sundnes for their constructive comments. And a special thanks to Synne Movik, for reading various manuscript and being a friend. The wonderful mix of academic and private talks we have shared has been a source of constant comfort and inspiration.

Numerous people assisted me in South Africa. Thanks to Professor Timm Hoffman for providing me with office space in University of Cape Town and for inspiring discussions on dryland ecology. Thanks to Rick Rohde for the work and time we shared in Namaqualand and for help and support and patience in writing up paper I. Special thoughts go to Tomm Kristiansen who provided a second base for us in Cape Town. Memories of the dinners at your house still warm our hearts. Also thanks to Wiggo Andersen and the staff at Underberg Guest House for going out of their way to assist me with practicalities when I first arrived in South Africa.

Fieldwork in Namaqualand would have been much more difficult and much less inspiring, were it not for all my contacts in Springbok and Concordia. Special thanks to Janie Saal, who taught me Afrikaans, and guided me in the world of stock farming and the social life in Concordia, and for just being my friend, and to Nuchey van Neel for opening up her home and sharing love, time and valuable contacts with me. And thanks also to all the people who shared generously of their

time to contribute to this project. Farmers in Namaqualand (particularly Pete and Drika Cloete, Bennie Saal, Poulthje Saal, Willem van Wyk, and David Cloete) shared their knowledge and experience with me. So did the people in the extension office and in NamaKhoi municipality. Special thanks to Jan Johannes and Abe Koobman. I would also like to thank the commercial farmers around Concordia.

Thanks also to Anne Hege Simonsen and Carsten Ohlmann in Oslo and Akershus University College and to Nina Lager Westberg, Norwegian University of Technology and Science for guiding me in photographic theory and reading early versions of paper III.

A very special hug goes to my friend and PhD colleague (now doctor) Guro Aandahl. I always knew you were there for advice, help and support. Our daily talks through working days, sick leaves, maternity leaves and more working days have made life durable and enjoyable, even at its darkest. Thank you.

And thanks to my good friend, Karin Rasmussen, for always believing in me.

I am further indebted to my parents for their untiring love and support, and for visiting us in Namaqualand and Cape Town. Their interest in my life and work means everything. My mother has been a wonderful help during the last months and so has her husband, Kjell Ove. My father, Jan; my parents-in-law, Nina and Karsten; my brother and sister-in-law, Gard and Åse and my sister-in-law Maria and brother-in-law Sigmund have all been of great help and support.

And a special thanks to my husband and best friend Jørgen Alnæs, for sharing the time in South Africa with me, and for being understanding, flexible and extremely hard working throughout, and in addition to all that, being truly involved in my work and progress. And to my children Mariken and Bjørn who share their love unconditionally and have put up with my absences and self indulgence for months: thank you.

# 1. Introduction and research objective

Landscapes in South Africa are extraordinarily orderly, and Namaqualand is no exception. Driving through Namaqualand on the national road N7, one sees vast empty-looking landscapes, fenced into paddocks. Indeed, the fences are perhaps the most striking feature of the landscape. Occasionally one drives through a village or passes a filling station, but seldom are people seen. With the exception of the fences and filling stations, these large, barren-looking landscapes were what met the first European travelers to Namaqualand in the 17<sup>th</sup> century. They were soon to discover that the areas were by no means empty; people lived and herded their animals here, making use of the sparse grazing offered by such dry areas.

Namaqualand is a dryland area, where livestock has played an important part in people's livelihood for more than 4000 years (Hoffman and Rohde 2007). During the last two centuries, until the end of the apartheid era in the early 1990s, settler land policies led to the displacement of indigenous herders. Apartheid policies established a system of segregation between colored and white farmers and created a dual agricultural system. What the apartheid government categorized as the 'colored population' consisted of a mixture between indigenous people (such as the Khoikhoi and the Nama) and people of mixed descent of indigenous and European origin. Communities of 'colored people' were confined to small reserves in rural areas and townships in urban areas. White farmers, on the other hand, were allowed to settle on land formerly controlled by indigenous people, and gradually established large farms. This unequal distribution of land and resources has continued until today, and prompted the land reform process that started in 1994 at the end of the apartheid era.

Knowledge about landscapes is a central tenet in environmental science, and informs debate and policy formation. In Namaqualand, people's knowledge of landscapes takes a diversity of forms. While herders know and appreciate the land for the resources it offers, conservationists and ecologists emphasize the large amounts of endemic species in various areas. Miners explore and

exploit copper and diamond deposits, and tourists come here for the flower spectacle that follows rainy season.

Warnings of degradation in African communally-managed rangeland areas have been common over the last century. In Africa, colonial governments warned against degradation in pastoralist communities in the early 19<sup>th</sup> century (Beinart 1996), warnings which were restated through development interventions in the 20<sup>th</sup> century (Homewood and Rodgers 1987, Homewood 2004, Rohde et al. 2006). Such warnings were also heard in South Africa. Early reports on rangeland degradation appeared there during the 18<sup>th</sup> century and the Drought Commission Report of 1922-23 presented extensive data to consolidate the impression of South Africa as a future desert, threatened by drought, denudation and overstocking (Beinart 1996). The Desert Encroachment Committee of 1951 reiterated the conclusion of the Drought Commission Report (Beinart 1996). These warnings were translated into policy when ‘betterment plans’ introduced principles of rotational grazing and stock limitations in the black and colored reserves from the 1930s onwards (de Wet 1995). What can be termed ‘degradation orthodoxy’ had become established in science and policy.

Degradation orthodoxy is based partly on equilibrium models in science and partly on modernization theories of tenure and privatization (Benjaminsen et al. 2006, Rohde et al. 2006). In short, the equilibrium model assumes that nature follows a pattern of succession towards a climax. Disturbances such as grazing can be balanced with succession to create points of equilibrium where farmers can harvest sustainable yields of livestock products. Modernization theories favor privatization before communal land, as well as commercialization of private areas. Consequently, private farmers received subsidies to destock on their farms, and to fence their farms into paddocks to encourage more predictable and stable livestock production. Both the degradation orthodoxy and management models based on the modernization of agriculture have continued to inform South African land policies (Benjaminsen et al. 2006, Rohde et al. 2006).

However, the degradation orthodoxy has been challenged from various different points of view. Ecologists have argued that the equilibrium model does not represent the vegetation dynamics in dryland areas accurately. They hold that rangelands do not develop gradually from colonizer to

climax-community, but rather change discontinuously, and sometimes irreversibly and inconsistently. Consequently, climatic conditions may be just as important for vegetation change as stocking rates (Ellis and Swift 1988, Westoby et al. 1989, Friedel 1991, Laycock 1991, Sullivan and Rohde 2002). Most likely, the reality is patchy, and a variety of dynamics occurs at different geographical levels (Wiens 1984, Sullivan and Rohde 2002). Along the same line, scholars have argued that the degradation orthodoxy blames pastoralists unduly for rangeland degradation (Homewood and Rodgers 1987, Vetter 2005, Benjaminsen et al. 2006). Further, the degradation orthodoxy allows for tighter state control of pastoral communities and privatization of communal areas which is politically rather than scientifically motivated (Sullivan 2000, Wisborg 2006). Following these points of view, I argue that non-equilibrium theories open up new ways for understanding vegetation dynamics and emphasize the need to understand the specific location, as well as local understandings of environmental change.

The debate about ecological models has, to some extent, been paralleled by scientific research undertaken in Namaqualand. A number of studies support the orthodox view that grazing permanently affects rangelands (Allsopp 1999, Todd and Hoffman 1999, Hoffman and Ashwell 2001, Anderson and Hoffman 2007). However, the application of degradation orthodoxy to Namaqualand pastures has also been contested. It has been suggested that vegetation changes are event-driven rather than the result of grazing pressure (Jürgens et al. 1999), and that rangeland dynamics are better understood in terms of complex dynamics, rather than the equilibrium model (Richardson et al. 2005, Hongslo et al. 2009, Richardson et al. 2010). Benjaminsen et al. (2006) contest the idea of permanently degraded pastures on the basis of long-term stock numbers. They argue that stock densities are closely correlated with variations in rainfall over the last hundred years, and that no significant decline in livestock productivity can be detected.

A study on Namaqualand environmental history indicates that grazing and cultivation has affected communal areas unevenly: while rivers and rocky areas were not particularly affected by agricultural activities, the sandy bottomlands were affected (Hoffman and Rohde 2007). Similarly, several studies have discussed the influence of modernization ideals on Namaqualand land policies. Lebert and Rohde (2007) demonstrate how the link between tenure and degradation has been utilized by the powerful elite to gain exclusive access to the new commons,



acquired after land reform. In a similar vein, Benjaminsen et al (2006) criticize the institution of carrying capacity in new land reform policies as it prioritizes commercial production systems at the expense of communal systems, and consequently privileges a minority of emergent farmers over the poor majority. Rohde et al (2006) make a similar point, claiming that the degradation orthodoxy is still influential in Namaqualand and more generally in southern Africa. They claim that policies based on the degradation orthodoxy have exacerbated the problems they were designed to solve. For example, Benjaminsen and Sjaastad (2008) demonstrate how the seemingly innocent process of demarcating sowing plots in Concordia to secure farmers' tenure rights, led to privatization of the commons.

## **1.1 Research objectives**

The main objective of this study is to explore the connections between models of vegetation dynamics, knowledge and power in a dryland area in Namaqualand, South Africa. The study takes the form of an exploration of landscape change and stability in Namaqualand, and possible causes of these changes and stable states. Further, I explore the co-production of science and politics in dryland areas, and analyze the representation of difference between communal and private grazing areas in scientific literature.

In order to address these objectives I ask three research questions:

1. To what extent have landscapes in Namaqualand changed during the last 60 years, and how have different land uses contributed to the state of present landscapes?
2. How have science and policy influenced each other in the formation of local planning initiatives during the land reform process in Namaqualand?
3. In what ways do politics and land tenure models influence ecological science concerning communal land management in southern African dryland areas?

While research on ecological dynamics and the relationship between knowledge and policy in Namaqualand is extensive, each of the papers in this thesis contributes to the existing literature in different ways. In the first paper, my co-authors and I investigate the extent to which the

orthodox view on degradation holds in Namaqualand and challenge assumptions that communal areas are in the process of degradation. Claims of degradation in communal areas are often based on the difference in vegetation cover and composition between communal and private areas (Todd and Hoffman 1999, Anderson and Hoffman 2007). It is assumed that the communal areas represent the result of a degradation process that the private areas have not been subjected to due to better farming practices. However, these studies do not provide historical photographic evidence to support their argument.

In order to contribute to filling this research gap, our first paper combines a comparison between different broad land use categories (communal farms, private farms, and conservation areas) with an analysis of change over time. By incorporating temporality in the analysis, we obtain a better picture of how different areas have changed, and simultaneously a better understanding of what caused these changes. We also interviewed land users about their use of specific areas, which deepened our understanding of the connections between land use and landscape change. As it turns out, this combination of methodologies also questions the assumption that communal areas are permanently degraded because of cultivation and high stocking rates. We conclude that the difference between communal and other areas can be attributed to landscape changes in private and conservation areas following destocking, rather than a degradation process in the communal areas over the last 65 years.

During this study, I also investigated the production and application of knowledge and the extent to which these are influenced by political preferences of tenure and management. Like other researchers have pointed out before me, carrying capacity is a central concept in the local implementation of land reform. In the second paper I discuss why carrying capacity became important. Scholars have argued that development initiatives tend to render the relationship between humans and their resources technical and consequently non-political (Ferguson 1994, Scott 1998, Li 2007). I demonstrate that the numerical nature of carrying capacity enabled the NGO tasked with facilitating the implementation in Namaqualand (Surplus People's Project) to map the state of affairs in 20 communal rangelands. This mapping rendered the rangelands technical, but not non-political. Rather, by arguing in jargon and logic that was accepted among government officials, the facilitators used the discrepancy between the amount of land in the

communal areas, the amount of animals and the carrying capacity to argue for more land through the land reform process. The communal areas received more land, although not as much as they had asked for. Concurrently, the formation of management plans and grazing regulations continued, including the application of carrying capacity. The result was that measures to control the amount of animals on the land dominated the management plans and grazing regulations. The second paper thus details the causes and effects of the influence of the degradation orthodoxy on the planning process.

In the third paper I analyze representations of difference between communal and private farms in southern Africa, in scientific papers on ecology. As mentioned above, the point of departure in many studies of land degradation in communal areas are is the difference in vegetation cover between communal grazing areas and other areas. This paper analyzes two fence-line contrast studies and shows that the basis for many such comparisons is not only differences in land management systems – the normative connotations of the differences are just as important. The communal landscapes are interpreted as being degraded and in the process of continuous further degradation, while the private area and the experimental farm are assumed to be managed in a sustainable way. The respective unsustainable and sustainable management systems are linked to different practices (e.g. stocking rates, use of rotational grazing and rest) as well as to difference in tenure. The fence-line contrast photographs function as scientific models and link landscape aesthetics, management systems, and tenure, thus co-producing ecological knowledge with political assumptions linked to the modernization of agriculture. To my knowledge, no other studies analyzing fence-line photographs exist.

The scope of my objective – to explore the connections between models of vegetation dynamics, knowledge and power in a dryland area in South Africa – is challenging in many respects. It required investigation of a wide array of sources and also spans a wide range of themes, from ecological dynamics on the one hand, to theories about photography and visual representation on the other. While I was sometimes forced to have each foot in a different ‘camp’, and time for deep immersion in one particular area of the literature was limited, this broad scope was no accident. I intentionally wanted to include studies of both landscape change and of representation of landscapes. Why? By questioning the assumptions underlying landscape change and the

causes thereof, and the representation of landscape change, I wholeheartedly enter into the debate about these changes. My broad contribution demonstrates that there are indeed alternative perspectives of landscape change, within the language and extended methodology of ecology. At the same time my thesis discusses how environmental orthodoxies still have a stronghold, both in policy formation and in knowledge production, thus emphasizing the need for opening up the whole process of producing and applying knowledge. My approach draws on critical political ecology, as it interrogates both the application of science in politics and the politicized production of science itself (Forsyth 2003). The study contributes to both the political ecology literature and the science and technology literature, adding to the trend of combining the two perspectives (Forsyth 2003, Goldman et al. 2011).

## **1.2 Organization of the thesis**

This introduction is organized in five sections. Section 2 discusses ontological and epistemological aspects of studying nature and introduces critical political ecology, which forms the backdrop of my study. Section 3 discusses the research design and methodology, and provides some reflections on fieldwork in Namaqualand. Section 4 introduces the study area and its history – Namaqualand, and land reform processes in Namaqualand and South Africa. The three research papers follow after the introduction. The first paper: ‘Landscape change and ecological processes in relation to land use in Namaqualand, South Africa, 1939 to 2005’ is co-authored with Rick Rohde and Timm Hoffman and was published in the South African Geographical Journal in 2009. The second paper: ‘Why is the notion of ‘carrying capacity’ so persistent in rangeland management? A study of a planning process in South Africa’, was sole authored and submitted to Geoforum. The third paper: ‘The politics of focus: fence-line contrast photographs as scientific models in ecology’ is also sole authored, and has not yet been submitted to a journal.

## 2. Knowing nature: Social constructivism and political ecology

This thesis is based on the notion that knowledge and policy are co-produced in all forms of governance. Facts are influenced by values and values are influenced by facts. The ideal proposed by positivist scientists that science should be value-free, and that science is applied in policy may therefore be of little use in analysis of science and policy. Nevertheless, this divide has been influential in western science since it was first introduced during modernism. In this chapter I discuss the philosophical basis for a separation between nature and culture, and between knowledge and policy. I consider what nature is thought to be and how different philosophical movements conceive of human beings' ability to access nature through knowledge. Moreover, I explore how different philosophical movements have tried to bridge the constructed gap the separation between nature and culture, and between knowledge and policy. Further, I present some theoretical assumptions in my thesis and discuss political ecology and critical ecology in some depth. I also consider the implications of social constructivism and non-equilibrium theory for the possibilities they offer in terms of policy change .

### 2.1 Some epistemological and ontological considerations

'Nature' is a commonly used word with a variety of meanings. A range of dichotomies are implied in the term 'nature', which gives us a sense of the variety of uses, for example: nature/society (humanity), nature/culture, natural/artificial, natural/human, nature (wilderness)/civilization. 'Nature', as used in contrasting ways in these various concepts, illustrates quite different senses of the word. Nature as opposed to artefact (natural/artificial) implies a very different meaning than nature as opposed to society, which in turn has different implications for the use and understanding of the concept. We thus see that "nature is a terribly

imprecise concept” (Carolan 2005: 399). Discussions of issues related to nature thus call for a definition of what referent we mean when we talk about ‘nature’. In this chapter I discuss different conceptions of nature, and to what degree they are ‘socially constructed’. Here different views represent different perspectives, both on how we can obtain or construct facts or truth, and the extent to which these truths exist independently of our knowledge about them. I then discuss different philosophical schools of thought that have influenced my work.

The question of what nature is constitutes an important philosophical divide within the social sciences, as well as between natural and social sciences. And it is no wonder that this question is contentious, as it is a question of what we consider to be real, and what we think we can access or understand as human beings. Different philosophical currents relate to this question differently and there is a crucial divide between philosophers who believe that a physical reality exists and that we have access to it (positivists, realists, critical realists and others), and those who believe that access to reality always happens through language, and that there might be a reality beyond which we cannot access (strong social constructivists) (Hacking 1999, Demeritt 2002).

### **2.1.1 Social constructivism**

‘Social constructivism’ is an overall term, and labels theorists who believe that nature is not solely physical, but also to some degree socially constructed. The term ‘social construction’ has been widely used in the social sciences during recent decades, and like ‘nature’ has a variety of referents. When researchers claim that something is socially constructed, they do so for a variety of reasons, and in order to perceive what they mean, we must understand these reasons (Hacking 1999). Hacking (1999) argues that the labeling of a phenomenon or concept as socially constructed often grows out of a notion that things are portrayed as natural and inevitable, yet the researcher thinks they are neither. Often the critique stems from a notion that the situation (a particular perception of nature) is quite undesirable as it is, and that it would be better to get rid of the perception, idea or concept, or at least transform it radically. However the terrain is muddled. Both the concept ‘social construction’ and the referent ‘nature’ are in fact contentious, even among self-styled constructivists (Hacking 1999, Demeritt 2002).

Hacking (1999) distinguishes between two different forms of social constructivism: Social constructivism-as-refutation, and social constructivism-as-critique. I discuss both forms in the following sections.

### **2.1.1.1 Constructivism-as-refutation (critical realism)**

Critical realism is often considered to be ‘soft constructivism’ (cf. Demeritt 2002). Critical realism emerged as a critique of ‘orthodox science’ (Forsyth 2003). ‘Orthodox science’ bases knowledge production on the generation of scientific laws. Laws may come in many forms such as the laws of gravity and Einstein’s  $E=mc^2$ , or broad generalizations about relationships in nature. An example of such a generalization would be ‘deforestation leads to erosion’ or in the case of Namaqualand ‘high stocking rates lead to land degradation’. Traditional science assumes that such generalizations can be drawn on the basis of analyzing large data sets. Generalizations or causal relationships between objects in nature or society were viewed as universal and truthful, until they were thoroughly challenged and eventually replaced by new generalizations (Forsyth 2003). Orthodox science tends to hold that “the entities, states and processes described by correct science really do exist” (Hacking 1983: 21). Positivists assume a clear division between nature and culture. In this ideal view, science is conducted with no influence of culture or politics.

Critical realists share the ontological realism of ‘orthodox science’. They hold that ideas are social concepts that have an ontological basis (i.e. that nature, as such, exists) (Proctor 1998, Demeritt 2002, Bhaskar 2009). Critical realists generally argue that the ontological basis of concepts like nature is understood “through a particular, socially predisposed framework” and therefore all knowledge must in some sense be a social construction (Proctor 1998: 361). Thus no explanation is more than a partial truth (Proctor 1998). Critical realists seek “to understand ‘real’ structures of society and the world, while acknowledging that any model or understanding of such structures will reflect only partial experience of them, and social and political framings within the research process” (Forsyth 2003: 16). But although we can only gain partial glimpses

of the 'real thing' the existence of 'an independent material reality' is not trivial, but necessary for any knowledge production to make sense. In Carolan's words:

[A]lthough we may never be able to know reality as it is, we can say that because reality is real, some approximations of it can be better than others...For without the ability to speak of and point to such things as, for instance, the gas-ravaged bodies, the dead livestock, the soil and water in and around the plant that were contaminated by organochlorines and heavy metals, the birth defects, and the reproductive disorders – which represent convincing evidence that the [Bhopal] accident really did occur – issues of validity become reduced effectively to who has the biggest and loudest bullhorn. (2005: 411)

Although many critical realists are self-proclaimed social constructivists, Demeritt (2002) questions the usefulness of this classification. For critical realists, according to Demeritt (2002), constructivism is a means to refute what they believe are myths, or mistaken ideas about nature. These myths are constructed through the influence of hegemonic power. Critical realists therefore subscribe to the idea that we do have access to nature through science, and that hegemonic ideas should be refuted. Thus, constructivism-as-refutation contains no philosophical critique of orthodox scientific practices, or the extent to which we access an ontological nature.

Although critical realism does not represent a philosophical critique of positivist science, the position enables a critique of inherent political claims in science, and scientific claims in politics. Such a critique presupposes a certain epistemological space; a notion that our knowledge of nature is historically and socially contingent (Hacking 1999). In this notion lies the possibility of a change in knowledge, and possibly of power relationships. Facts are considered facts in relation to a wider discourse. If interpretations of scientific facts are embedded in a particular view of life, then other discourses would call on other facts and produce other knowledge, which again would support a different set of political views.



### **2.1.1.2 Construction-as-critique (discursive constructivism and Actor-Network Theory)**

The proponents of constructivism-as-philosophical-critique insist that critical realists are overly optimistic about our ability to obtain knowledge about nature (Proctor 1998). Constructivists argue, to various, degrees that nature is also socially constructed. Constructivists question the conceptual distinction between nature and culture, and particularly a purely physical ‘nature’ as perceived by modernists (Callon 1986, Latour 2000, Demeritt 2002, Latour 2003). In the following section I give an account of different views of the relationship between nature and society, and also how different philosophical trends relate to reality (ontology) and to our ability to grasp that reality (epistemology).

Cronon (1996) illustrates a classical philosophical critique in his essay ‘The trouble with wilderness; or, getting back to the wrong nature’. Here he discusses wilderness, and claims that wilderness does not exist:

Far from being the one place on earth that stands apart from humanity, [wilderness] is quite profoundly a human creation – indeed, the creation of very particular human cultures at very particular moments in human history....Wilderness hides in unnaturalness behind a mask that is all the more beguiling because it seems so natural.  
(Cronon 1996: 69)

The most radical constructivists are criticized by proponents of conservation for questioning the existence of nature as such. However, that is generally not typical of their approach. Proctor (1998) considers that the difference in perspective between Cronon and the proponents of conservation are at an epistemological, rather than an ontological level. We must consider, he writes, whether we believe that our ideas speak more of the ‘object of knowledge’, or the ‘knowing subject’. The former is the world of reality and existence, or in other words: the world ‘out there’, and the latter is the world of ideas, concepts and values. Do we discuss ‘nature’, or the cultural predispositions that accompany our concepts of nature?

Demeritt (2002) places what he calls ‘discursive constructivism’ within this category of construction-as-philosophical-critique. Discursive constructivists tend to hold that concepts of

nature are socially constructed, that material manifestations of nature are constructed, and that language plays a crucial role in the construction of social reality (Escobar 1996). Discursive constructivists are generally skeptical of an absolute distinction between representation and reality, and between nature and society. Their position is based on Foucauldian ideas “by which the ‘inert objectness’ of nature is constructed” (Demeritt 2002: 773). The advocates of discursive constructivism have diverse opinions, but they share a concern with power and its effect, and “tend to see themselves as engaged in political critique: not just standing back and describing the way nature is socially constructed [...] but also seeking to diagnose the effects of those constructions and thereby also change them”(Demeritt 2002: 773).

Demeritt (2002: 774) warns that many self-styled discursive constructivists intend their critique of orthodox science as a refutation of scientific findings, rather than as philosophical critique. In such cases, he says, it would perhaps be more useful and less confusing to “simply call a particular perception of nature wrong than muddying the waters by invoking the notion of discursive construction”.

Another position that poses a critique of traditional epistemologies is Actor-Network Theory (ANT) which is often associated with Science and Technology Studies (STS). This theory is built on Latour’s (2003) critique of the divide between nature and culture. Latour argues that this divide has been the main organizer of knowledge since modernism, and further that it is contra-productive in the analysis of society:

So long as Nature was remote and under control, it still vaguely resembled the constitutional pole of tradition, and science could still be seen as a mere intermediary to uncover it. Nature seemed to be held in reserve, transcendent, inexhaustible, distant enough. But where are we to classify the ozone hole story, or global warming or deforestation? Are they human? Human because they are our work. Are they natural? Natural because they are not our doing. Are they local or global? Both. (Latour 2003:50)

Consequently, argues Latour (2003), the analytical distinction between nature and culture must be deconstructed. Latour introduces the concept of ‘hybrids’ which in the words of Forsyth (2003: 87) denotes “commonplace objects or ‘things’ that appear to be unitary, real, and

uncontroversial, but in practice reflect a variety of historic framings and experience specific to certain actors or societies in the past”. For the same purpose, Haraway (1991) introduces the concept of ‘cyborgs’ and Forsyth (2003) that of ‘environmental orthodoxies’.

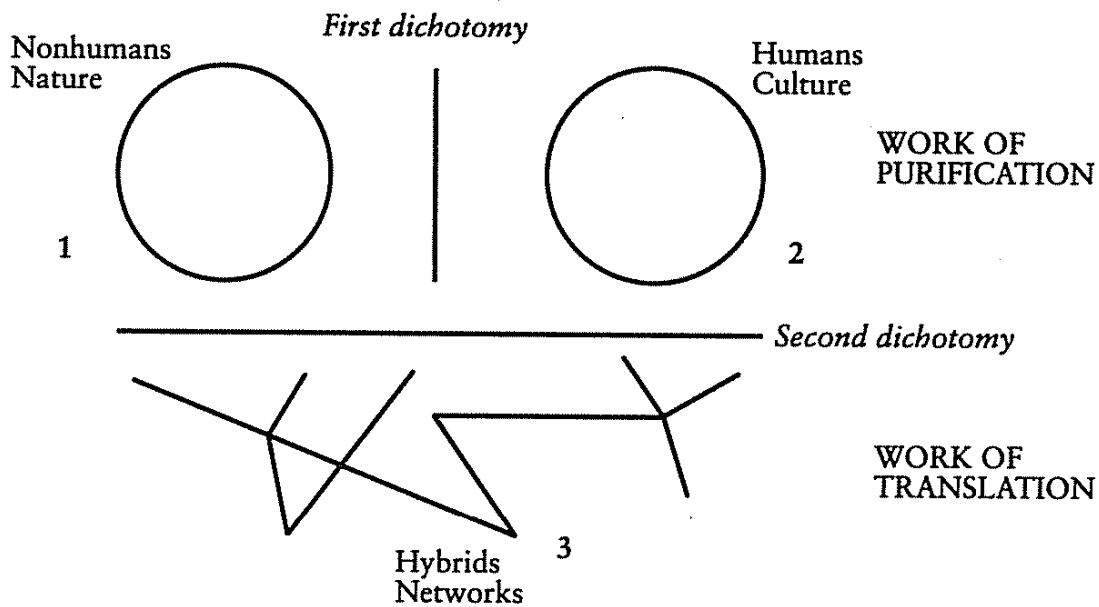


Figure 1: Purification and translation (Latour 2003: 11)

Figure 1 is an illustration of how the ideas of separation of nature and culture on the one hand, and hybrids on the other relate to the objects they represent. Latour claims that the boundary between nature and humanity is maintained through a process he calls *purification* and he writes: “‘purification’ creates two entirely distinct ontological zones: that of human beings on the one hand; that of nonhumans on the other” (Latour 2003:10). *Purification* establishes “a partition between a natural world that has always been there, a society with predictable and stable interests and stakes, and a discourse that is independent of both reference and society”(Latour 2003: 11). In reality, he argues, the world consists of actors, none of them purely natural or purely cultural, who form networks. This process of *translation* “creates mixtures between entirely new types of beings, hybrids of nature and culture” (Latour 2003:10).

Callon (1986) provides an example of such a network in an article on the process of domesticating scallops for production in France, where he shows that the scallops have their own

agenda which influences the other actors in what may be considered a network between scientists, policymakers, fishermen and scallops. Returning to Latour (2003), he attempts to transcend the divide between nature and humanity (society) that has formed the basis of modern philosophy. Following Latour (2003), a process of *translation* allows for thinking about natural phenomena like the hole in the ozone layer, as existing in the same ‘reality’ as that which worries of heads of state, industrial strategies and so on.

## **2.2 Political ecology**

Political ecology is a fairly recent, and still rather an open field of knowledge. As Robbins (2004: xvii) puts it: “It would be impossible to survey the field of political ecology in its entirety. The contributors are too many, the breadth of topics too vast, and the regional diversity too great”. And Robbins has a point. The definitions of political ecology in text books, anthologies and scientific articles are numerous, and so are their scopes, inclusions and exclusions.

Notwithstanding the diversity of meaning, it is possible to define some common research interests and perspectives in the political ecology literature. Scholarly works within political ecology attempt to link an understanding of ecological processes with an appreciation of the politics that influence human-environment relations. The contribution of political ecology then

... resides in its efforts to integrate human and physical approaches to land degradation, through an explicitly theoretical approach to the ecological crisis capable of addressing diverse circumstances (soil erosion in Nepal, water pollution in Delhi) and capable of accommodating both detailed local study and general principles. (Peet and Watts 2004: 7)

Early work in the field of political ecology tended to favor case-study research, rather than the development of coherent theories (Peet and Watts 1993, Bryant and Bailey 1997). An emphasis on on-the-ground field research is still prevalent (Robbins 2004, Goldman et al. 2011), but more recent developments have contributed to building more coherent theory within the realm of political ecology (See for instance Forsyth 2003, Robbins 2004).

Political ecology made headway from the mid 1980s with the work of Blaikie (1985), Blaikie and Brookfield (1987), and Watts (1983), among others. Early political ecologists were incited

by three broad academic trends. First, studies like those by Ehrlich (1968) and Meadows (1972) warned that overpopulation would cause environmental catastrophe if serious action was not taken. Hardin's (1968) article 'The Tragedy of the Commons', linked overgrazing and degradation to common property regimes. This neo-malthusian critique was based on a notion of balance in nature, and assumed nature to be in equilibrium rather than constantly changing. The political solution to overpopulation and overexploitation was "an authoritarian global state" (Bryant and Bailey 1997: 10). Many political ecologists felt uneasy with these representations of environmental problems which blamed the poor for environmental degradation and deleted distribution of wealth from the equation (Bryant and Bailey 1997, Peet and Watts 2004). The critique of these doomsayers triggered an interest among political ecologists in studying the political processes of environmental change (Bryant and Bailey 1997).

A second inspiration for early political ecology was cultural ecology. Cultural ecology focused on explaining the links between cultural practices and environmental management. Such work incorporated studies of biophysical change with studies of cultural practices of production. However, cultural ecologists were also inspired by balance of nature theories, and often portrayed human adaptations to the environment as part of a balanced relationship. Thus, they tended to ignore the wider political economic structures which influence human actions (Bryant and Bailey 1997, Walker 2005).

A third school of thought that influenced early political ecology was the hazard school (Burton et al. 1978). This approach emphasized the perceptual nature of environmental hazards, as well as societies' abilities to adjust and manage hazards (Walker 2005). In order to explain the wider socio-economic influences on the relationship between humans and their environments, many political ecologists learnt from another academic trend: neo-Marxism, which "offered a means to link local social oppression and environmental degradation to wider political and economic concerns relating to production questions" (Bryant and Bailey 1997: 13).

The inspiration from all these trends is evident in Blaikie and Brookfield (1987), which is often considered to be a foundation work in political ecology. They defined their work as *regional* political ecology, a field which:

... combines the concerns of ecology and a broadly defined political economy. Together this encompasses the constantly shifting dialectic between society and land-based resources, and also within classes and groups within society itself. (Blaikie and Brookfield 1987: 17)

Blaikie and Brookfield (1987) argued that degradation, meaning 'reduction to a lower rank', is necessarily perceptual and should be treated as such:

Land degradation should by definition be a social problem. Purely environmental processes such as leaching and erosion occur with or without human interference, but for these to be described as 'degradation' implies social criteria which relate land to its actual or possible uses. (Blaikie and Brookfield 1987: 4)

Thus, in order to determine whether degradation occurs, and subsequently any possible social and economic consequences of degradation (and the benefit of conservation), the local users' perceptions must be taken into account. Blaikie and Brookfield's focus on environmental injustice, and their recognition that people (in developing countries) do not degrade natural resources because they are irrational, but because they are forced into such practices by political circumstances, was a useful contribution which has also influenced later scholars on environmental change (Stott and Sullivan 2000).

Blaikie and Brookfield (1987) critique previous representations of degradation as being due to inappropriate technology, poor management and overpopulation, and instead pinpoint the social origin and definition of degradation (Blaikie and Brookfield 1987, Peet and Watts 2004). This perspective includes consideration of scale in any explanation of degradation, since what is perceived as degradation on one geographical scale may be considered an improvement on another scale. In this focus on scale, the political perspective is also incorporated, emphasizing the importance of understanding political influences on environmental change at different levels (Blaikie and Brookfield 1987).

One could imagine that an emphasis on land degradation as being perceptual, and highlighting the importance of the input of local land users, could incite an interrogation of the scientific findings that support official claims of degradation. Blaikie and Brookfield (1987: 25) do point

out an epistemological divide between “the [camp] which measures, creates its own data and uses others’ in model building, and the other [camp] which calls itself ‘radical’ and eschews analysis of this sort as positivist, and the data as ideologically tainted and reductionist”. They place themselves in between, and acknowledge that data are ‘constructed’ and at the same time ask for better technical measurements which are ‘more ideologically aware’ of distributions of costs and benefits. Still, Blaikie and Brookfield themselves do not pry into knowledge production (Stott and Sullivan 2000).

Later studies in political ecology have taken up the challenge by Blaikie and Brookfield (1987) in the discussion of the importance of spatial scale, and the integration of regional and local explanations of environmental change (cf. Scoones 1997, Turner 1999b, Turner 2003). Also, writers in the political ecology literature have continued their commitment to social justice (Goldman et al. 2011). This normative approach constitutes what Robbins (2004) considers to be the *political* in political ecology. As opposed to earlier approaches like ‘ecoscarcity’ and ‘modernization’, works in political ecology share a “normative understanding that there are very likely better, less coercive, less exploitative, and more sustainable ways of doing things” (Robbins 2004: 12).

While scholars of political ecology tend to agree that the field is about combining an understanding of ecology and of politics in the study of the environment, the weighting of ecology and politics differs in the field. In the first phase of the development of political ecology, most studies included in-depth investigations of biophysical changes (Walker 2005). Blaikie and Brookfield (1987), Hecht (1985) and Watts (1983) all applied natural scientific methodology in their studies. This tradition has continued until today and scholars like Turner (1993, 1999a, 1999b), Benjaminsen (1997, 2001), Benjaminsen, Maganga and Abdallah Dahlberg (2000a, b), Fairhead and Leach (1996), and Zimmerer and Bassett (2003) all combine studies of biophysical changes with studies of socio-economic and political forces of change.

As the field of political ecology grows, so too do its undercurrents (Walker 2005). Ten years after Blaikie and Brookfield (1987), Bryant and Bailey (1997) urged political ecologists to focus more on the politics aspect:

It is true that political ecologists ought not to ignore advances in the understanding of ecological processes derived from “new ecology”, since, in doing so, they might miss an important part of the explanation of human-environment interaction... Yet greater attention by political ecologists to ecological processes does not alter the need for a basic focus on politics as part of the attempt to understand Third World environmental problems. (Bryant and Bailey 1997: 6)

Thus although Bryant and Bailey (1997) acknowledge the need for combining the two perspectives, they slant towards emphasizing politics over ecology. More recently, a particular current of political ecology uses ‘ecology’ more as a backdrop for political struggles than as an object of study. (Walker 2005) moves away from direct engagement in ecology and concentrates on the power dimensions of resource conflicts. In their insistence on political ecology’s potential in “rais[ing] the emancipatory potential of environmental ideas and to engage directly with the larger landscape of debates over modernity, its institutions, and its knowledge”, Peet and Watts (1996: 37) also exhibit this undercurrent. Other proponents of this current are Scott (1985, 1998) and Escobar (1996, 1998, 1999).

The perception of power in the field of political ecology reflects similar developments in other social sciences. Bryant and Bailey (1997) comment that during the early stages of political ecology, scholars like Blaikie (1985), Blaikie and Brookfield (1987) and Watts (1983) employed neo-Marxist structural explanations for environmental problems. Bryant and Bailey’s (1997) commentary goes on to describe how later political ecologists found these explanations too focused on structure, thus leaving little room for weak actors to influence their own lives. Consequently, political ecologists focused on more complex understandings of power which included the power of grassroots actors, and on everyday resistance (cf. Scott 1985). Towards the mid 1990s political ecologists increasingly adopted post-structuralist approaches like ‘discourse theory’ (Escobar 1995) to explore how knowledge and power interrelate and form relationships between humans and nature (Fortmann 1995, Fairhead and Leach 1996, Stott and Sullivan 2000).

Works within the domain of political ecology have discussed the interrelation between knowledge and politics within environmental studies for a long time (cf. Fairhead and Leach



1996, Escobar 1998, Stott and Sullivan 2000). However, one publication stands out in its attempt to establish a coherent approach to political ecological studies of knowledge production and politics, namely Forsyth's 'Critical Political Ecology' (2003).

### **2.2.1 Critical political ecology**

Critical political ecology, according to Forsyth (2003: 4) represents an attempt to "establish the political forces behind different accounts of 'ecology' as a representation of biophysical reality. In this sense, a 'critical' political ecology may be seen to be the politics of ecology as a scientific legitimization of environmental policy". Forsyth holds that a critical political ecology must avoid taking environmental science and explanation for granted, and seek to avoid the "separation of environmental explanation and politics in the analysis of environmental politics" (*ibid.*).

Thus, critical political ecology is inspired by scholars within the field of Science, Technology and Society (STS). The interrelation between science and society within STS has been portrayed as being mutually constitutive:

Scientific knowledge, once recognized as an objective reflection of reality (nature), is exposed in STS work as the outcome of messy and situated practices: practices that are shaped by particular historical, socioeconomic, political and cultural contexts. (Goldman et al. 2011: 11)

These ideas have developed within STS for several decades (Latour 1987, Lynch 1988, Haraway 1991, Latour 2003) and have inspired many political ecology studies. Numerous works have engaged in a debate about the co-production of knowledge and power, not only in terms of the application of knowledge, but also in knowledge production, for a long time (cf. Homewood and Rodgers 1987, Fairhead and Leach 1996, Leach and Mearns 1996, Scoones 1996, Stott and Sullivan 2000, Forsyth 2003, Goldman et al. 2011).

Jasanoff develops the idea of co-production of knowledge and politics in her book 'States of Knowledge' (2004: 2): "in broad areas of both present and past human activity, we gain

explanatory power by thinking of natural and social orders as being produced together”. She argues that in order to understand a historical period, we must appreciate this co-production:

Briefly stated, co-production is shorthand for the proposition that the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it. Knowledge and its material embodiments are at once products of social work and constitutive of forms of social life; society cannot function without knowledge any more than knowledge can exist without appropriate social support. (Jasanoff 2004: 2-3)

Jasanoff further asserts that “ a theoretical enterprise that seeks to explain why the world is ordered in certain ways has to promise more than the line from the popular children’s song: “Everything hangs together because it’s all one piece”” (2004: 17). Co-productionist analysis must go further than “simply to ask what *is*: they seek to understand how particular states of knowledge are arrived at and held in place, or abandoned” (Jasanoff 2004: 19).

As mentioned in the section on epistemology, STS and Actor Network Theory are closely related. Authors like Latour (2003) and Haraway (1991) have promoted a deconstruction of the separation between nature and society (as illustrated in the previous section). They have introduced concepts like *hybrids* (Latour) and *cyborgs* (Haraway), that are thought to illustrate how present concepts of things and relations carry historical conceptions and power relations (Forsyth 2003). While concepts may be natural, they are thus inherently cultural. This deconstruction has been inspiring for many political ecologists, but they have also criticized the concept of power that implicitly lies in such a deconstruction, for “portraying simplistic and overly vertical relations of ‘power-over’, ignoring the multiple and complex forms that power relations take”, and ignoring relationships like ‘power-with’ and ‘power in-spite-of’ (Goldman et al. 2011: 12).

The critical political ecology critique of science involves a critique of ‘environmental orthodoxies’ (Fairhead and Leach 1996, Forsyth 2011); ‘myths’ (Thomas and Middleton 1994, Stott and Sullivan 2000) or ‘narratives’ (Roe 1991, 1994); and ‘story lines’ (Hajer 1995). Neither ‘myths’, ‘narratives’, ‘story lines’ nor ‘orthodoxies’ necessarily imply that claims to knowledge

are ‘false’ or incorrect. Rather, critical political ecologists find environmental orthodoxies vague and contend that simplistic models based on ‘orthodox science’ or ‘laws’ often fail to acknowledge environmental complexities and abilities of local people to adapt to environmental change (Forsyth 2003).

There is a fundamental epistemological challenge implicit in Forsyth’s critique of ‘orthodox science’. At a philosophical level, critical political ecology draws on insights from STS and disputes the perception by positivist scientists of science as a ‘mirror’ of reality. Forsyth (2003) refers to positivist science as ‘orthodox science’. As opposed to ‘orthodox’ science, and in support of a social constructivist position on epistemology (he claims to support both a critical realist position, while drawing on discursive realism), Forsyth (2003) holds that all knowledge is historically and culturally contingent. which applies particularly to concepts like ‘accuracy’ and ‘explanation’. Following on from this critique, Forsyth (2003) challenges the separation between science and politics which both positivist scientists and earlier political ecologists had affirmed.

The separation of science and politics may have two major consequences, argues Forsyth:

... first, many environmental policies will not address the underlying biophysical causes of environmental problems; second, many environmental policies will impose unnecessary and unfair restrictions on livelihoods of marginalized people. (Forsyth 2003: 11)

In terms of the critique of knowledge, it is important to recognize that knowledge matters. In their study of knowledge and policy on deforestation in Guinea, Fairhead and Leach (1996) demonstrate the different ways in which people are affected by the deforestation discourse. The effects are many and grave. In the Guinea study (Fairhead and Leach 1996), local people were affected through taxes, criminalization of their everyday activities, depreciation of their knowledge and livelihoods, as well as a representation of forest people as backward or unwilling to learn and change. The effects of the ‘rangeland degradation orthodoxy’ on people in other parts of Africa are similar, and continue to affect policies and everyday lives of people, as I demonstrate in paper 2 in this volume. The acknowledgement of the importance of co-production implies a commitment to social justice (Goldman et al. 2011) and recognition that “critical

political ecology seeks to indicate how far explanations of environmental problems reflect – or fail to reflect – the perspectives of different social groups” (Forsyth 2003: 85).

I share many of Forsyth’s and Goldman’s perspectives. Paper 2 aims to explain why and how carrying capacity retained its place in local planning policies. Paper 3 seeks to explain how fence-line photographs function as a model for broader political values.

### **2.3 The interconnections between social constructivism, non-equilibrium theory and conservation**

New ways of thinking about ecology and environmental change encourage new perspectives on the relationship between society and nature, which has epistemological and ontological repercussions. Political ecology has increasingly questioned the social science perspective that took claims of land degradation and environmental change (and their underlying theories of homeostasis and stability) at face value (Scoones 1999). As discussed earlier, Blaikie and Brookfield’s (1987) thesis that land degradation is a perceptual term has challenged orthodox views on nature. The environmental historian Cronon (1996) challenged the idea of a pristine and original nature, and demonstrated that there never was such a thing in the pre-colonial USA. Rather, there were large rangelands that were used by the Indians for grazing and other purposes. The very idea of pristine nature was constructed for political purposes. Similarly Neumann (1998) showed that colonial powers constructed the idea of pristine landscapes in order to take control of large land areas.

Other scholars have questioned orthodox views on deforestation, erosion and rangeland degradation (Scoones et al. 1993, Turner 1993, Leach and Mearns 1996, Scoones 1996, Sullivan 1996, Scoones 1997, Sullivan 1999, Stott and Sullivan 2000, Sullivan 2000, Sullivan and Rohde 2002). These studies share the common notion of a dynamic and non-equilibrium perspective on nature, different from the rather static and holistic view that the ‘balance of nature’ (equilibrium) view represents. This shift is more than simply a change in the way researchers think about ecological dynamics. It also represents:

... a shift away from a view of environmental change in terms of either the ‘destruction’ of nature or its social ‘construction’ and towards a view of the production of nature by human and non-human actors, with varying (and often serious) normative implications. (Robbins 2004: xviii)

The view of nature as being stable has also provided conservation proponents with a baseline for the distinction between ‘good’ and ‘poor’ management. Conservation was (and arguably still is) based on metaphors and ideas associated with equilibrium ecology. Following this line of thinking, ‘climax communities’ were claimed to be more valuable than other manifestations of nature and thus deserved to be conserved. Thus, non-equilibrium theory came to challenge the very foundation for the conservation movement:

The new ideas about natural disturbance, succession and the relatively ephemeral composition of contemporary ecosystems deprive environmentalists of the scientific grounds to construct (sic.) hard and fast distinction between human and natural disturbance on the landscape and thus between natural and disturbed landscapes and geographies. Without these distinctions it is impossible to argue that old growth forests are somehow more natural than cutover forests and thus best preserved from logging and other human disturbances which, by definition, are unnatural. (Demeritt 1994a: 26)

Proponents of non-equilibrium ecology have been criticized for being relativists about nature as they question the existence of a pristine nature (Demeritt 1994a, 2002, Walker 2005), and for using non-equilibrium ecology as a justification for human destruction of natural environments (Soulé and Lease 1995). It has also been argued that many social scientists do not recognize that even areas that respond according to non-equilibrium dynamics are vulnerable to change. Rather than mutually excluding each other, non-equilibrium and equilibrium models are both seen as being important in the description of ecological dynamics (Sullivan and Rohde 2002, Briske et al. 2003, Walker 2005).

Constructionists have responded to the critique by conservationists that they a relativist epistemology is a threat to conservation. Bird (1987) argues that we do not need a foundation in an ‘ontological’ nature in order to conserve it. We only need to acknowledge that conservation is

a question of preference. If we can agree that we want a certain amount of our landscapes to be preserved as ‘old’ woods with large biodiversity, then that is sufficient as an argument for conservation. This does not mean that we have no use for scientific knowledge. We are still dependent on knowledge about causal relationships in nature in order to make decisions that correspond with our goals.

I would argue that even if we acknowledge that both ‘old’ and ‘new’ ecological models can co-exist, the expansion of the scope of ecological dynamics beyond that represented by equilibrium models has, to an extent, ‘relativized’ ecology. But rather than constituting a threat to natural science, it may amount to an opening and democratization of the co-production of knowledge and politics to new perspectives, and in the end to new policies.

## **2.4 Concluding remarks**

In my research I discuss a very particular relationship in nature (between rangelands, grazing animals and the owners of the animals), and how this relationship may involve land degradation. The representation of communal areas as degraded presupposes that an ideal relationship between grazing animals and land is best captured through a static measure of the amount of animals an area can sustain through a year (carrying capacity). New policies were subsequently built on this notion of carrying capacity. Representing nature as socially constructed to some degree, and implicitly not inevitable, may have a liberating function, since something that is perceived as socially constructed may also implicitly be socially transformed. Hence, social constructivism can broaden our thinking about knowledge production and application. It can “help us acknowledge the power of humans to shape nature both through our concepts and through the material practices that lead to and follow from those ways of constru(ct)ing nature” (Demeritt 2002: 786).

However, as the feminist theoretician Moi (1999) reminds us: the fact that something is socially constructed rather than natural does not mean that it is easily transformed to something better. Sometimes, she writes, it is easier to physically transform a peninsula into an island than to change people’s perceptions about the world around them. Still, I find that social constructivist

approaches and perspectives from the theories of co-production of knowledge and policy may change our perspectives on what nature is, and how we know it, and that this may consequently broaden policy. If we acknowledge that nature is vulnerable, but at the same time not predetermined to be in one particular way, it may be easier to acknowledge that voices that question orthodox conservation policy are not just a threat to conservation itself, but a contribution into a negotiation of the kind of nature we want.

Through the three papers in this thesis I address issues around the production and application of scientific knowledge through different perspectives. First, I contribute to the debate on vegetation dynamics and question the aptness of orthodox assumptions that informs current land policies. Second, I demonstrate how knowledge and politics can be co-produced through a land planning process. Third, I discuss the co-production of knowledge and politics through the use of fence-line contrast photographs in studies from South Africa and Namibia. Together, these three papers contribute to the literature on vegetation dynamics and landscape change in dryland areas, as well as to the political ecology debate that addresses the interrelations between knowledge and politics. Through my ambition to contribute to a better understanding of vegetation dynamics in dryland areas, this thesis can be considered as a contribution to the traditional line of argument in political ecology (as discussed in this chapter). I engage in a serious discussion of biophysical change which may be appreciated among natural as well as social scientists. At the same time, I contribute to a political ecological tradition that questions the very nature of scientific production and the division of knowledge and policy.

## 3. Methodology

Each of the individual papers discusses their own specific methodologies in detail. In this methodology chapter, I highlight the links and communalities between the three papers.

### 3.1 Case study as a research strategy

The three papers cover common ground, both thematically and methodologically. Although the studies are different in nature, all of them follow a case-study design. Rather than being one case study, it is a collection of three case studies that elucidates an overarching research objective: to explore the connections between vegetation dynamics, knowledge and power in a dryland area in South Africa. In the first study the case is landscape change in Namaqualand and the sub-cases are the Concordia commons, a neighboring commercial farm, and a neighboring nature reserve. In the second study, the case is the planning process that led to the prominent position of carrying capacity and rangeland succession theory. In the third study, the case is fence-line contrast studies and their use of photography. But what are case studies?

Bryman (2008) points out the important distinction between research design and methodology. A case study is a broad research design, which means that it “represents a structure that guides the execution of a research method and the analysis of the subsequent data” (Bryman 2008: 30). As such, case studies are contrasted to experimental design, cross-sectional design, and comparative design. Once a design is chosen, the method for addressing the research question(s) must be decided. Research design and methodology are often related, but this does not mean that a choice of research design decides the methodology. A case study may encompass different methods for data collection and analysis (Bryman 2008).

A case defines what is being studied. Cases are often associated with locations, like a community or an organization (Bryman 2008), but although all events or situations studied happen



*somewhere*, this does not mean that the location is necessarily the case. More often, the location constitutes the backdrop of the case being studied. If a case study is chosen as a research design, then what topics can be studied by means of this design? Stake (2003) provides a rather narrow definition of a case in claiming that a case can be a thing, a person or a place. He excludes processes from his case definition, as he argues that processes lack the boundedness and specificity to be called a case. Ragin (1992), however, does not limit his definition of cases in the same manner. He states that all social science studies are, or can be conceived as, case studies, often from various perspectives. “A case may be theoretical or empirical or both; it may be a relatively bounded object or a process; and it may be generic and universal or specific at the same time” (Ragin 1992: 3). The same author suggests that attempts to define the inherent nature of cases are counterproductive, and urges researchers to concentrate on what their study is a case of, rather than what a case is. I follow Ragin in arguing that relating the case to theory, that is, answering what your case is a case of, is more productive than defining what the case may be. However, the two are not easily separated. In answering what something is a case of, one simultaneously answers what the case is.

In this thesis the community of Concordia in Namaqualand forms the backdrop of the studies. The three case studies are connected to Namaqualand and Concordia, and they all highlight issues that concern Concordia as a grazing commonage, or dryland grazing areas more broadly as an object of knowledge. But what are the three cases cases of?

As Mitchell (2000: 170) points out, a case is “a detailed examination of an event (or series of related events) which the analyst believes exhibits (or exhibit) the operation of some identified general theoretical principle”. He thus emphasizes that cases must be related to a wider theoretical context. In other words, they must be a case of something. Walton (1992) argues that all case studies inherently do relate to theory. As a matter of fact, they are ‘made’ by inducing theory “whether implicitly or explicitly, for justification or illumination, in advance of the research process or as its result” (Walton 1992: 121). Cases, writes Walton, are “wrapped in theory” and “the logic of the case study is to demonstrate a causal argument about how general social forces take place and produce results in specific settings” (Walton 1992: 122).

In practical research studies, cases are chosen for a variety of reasons. Some are chosen for convenience and familiarity, whereas others are chosen for fascination and strategy. But at some point in any research process, the choice of case(s) must be justified (Walton 1992). Stake (2003) makes a distinction between *intrinsic* and *instrumental* case studies. *Intrinsic case* studies are undertaken to achieve a better understanding of the particular case. Whether the specific case is representative of a larger body of cases is not important. Nor is the case's ability to illustrate a problem in an adequate way, or whether it is an important step towards theory building. The *instrumental case* study, on the other hand, is chosen primarily to provide insight into an issue in order to draw generalizations. The case is investigated in depth, its context is scrutinized and ordinary actions are described in detail, as with the intrinsic case. But the aim of this type of case study is to 'pursue the external interest' – i.e. to determine whether the case is typical of that interest or not.

Aandahl (2010: 127) argues that an important trait of case study research is "the purposive sampling, or rather *selection*, where cases are selected according to predefined criteria". The purposeful selection constitutes a strength of case studies, according to Flyvbjerg (2006). Unlike statistical analysis, case studies need not be representative of a larger universe or population. Carefully chosen cases are often more likely to provide rich and interesting information than investigations of larger samples where the questions are often predetermined. However, this does not mean that case studies are independent of this universe. According to Walton (1992), a case's ability to build theory lies in its relation to theory and to other cases. All cases bear claims about theory in one way or another, argues Walton, and researchers invariably relate cases to a larger body of cases in order to justify studying them. According to the same author, an initial criterion for studying a case may be because it is similar to other cases or confirms theory. This corresponds with Bryman's (2008) *exemplifying case* and Yin's (2003) *representative* or *typical case*. Here, cases have interpretive issues in common with previous cases and add evidence to substantiate or, even better, expand earlier understandings (Walton 1992). Walton's second criterion for justification is that the case may be extreme or unique. According to this criterion cases are selected and studied because they are exceptional in one way or another, and then the aim is to understand why and how the case is exceptional. Theorists have argued that case

studies are biased towards verification, and as such are less apt for theory building than other designs with larger samples (Flyvbjerg 2006). Flyvbjerg questions this assumption and holds that case studies are ideal for falsifications and for building theories through interrogating them.

My three cases are all *instrumental* cases, purposively chosen to shed light on different sets of theories. However, all the papers draw on different sets of theories themselves. A case study can thus challenge some parts of a theory and support others. The first case study questions theories of grazing induced degradation in communal areas and can be considered an *exceptional* case in the Namaqualand context. But the critique of equilibrium theory and degradation orthodoxy in dryland areas has gained prominence and a body of literature questioning equilibrium models already exists. Thus, this case is also a *typical* case of dryland areas that do not degrade due to large stock densities, or of areas that are patchy and where different models are relevant within the same geographical area.

In the second paper the planning process is used to investigate claims in the strand of development literature that argues that governmental development initiatives render relationships between people, or between people and their environment technical and, consequently, non-political (Ferguson 1994, Scott 1998, Li 2007). Through my analysis, I found that the first part of this planning process shows that on the contrary, rendering technical can also render political in some cases. At the outset, the case was chosen as an *exemplifying* case, but the analysis revealed that it did not only confirm the theory. The outcome thus illustrates Flyvbjerg's (2006) argument that cases are ideal for falsification. Thus, this case is actually both an *exemplifying* and a *unique* case. The third case is *exceptional* in several ways. It relates to a body of theory that states that like text, photographs constitute arguments, and can exemplify different points of view. But most importantly the two photographs and their interpretations exemplify theories of co-production of research and politics in science (Forsyth 2003, Jasanoff 2004).

As I show, all my cases are ambiguous. They can be understood as examples or as being unique to different sets of theories. Yin (2003) expresses the concern that the ambiguity of cases makes them vulnerable to misinterpretation, and advises that any case should be carefully investigated in advance, in order to avoid misrepresentation. Implicitly questioning this assumption, Ragin

(1992) holds that initiating a research project with a confident notion of what the study is a case of, may be counterproductive. Often, Ragin contends, researchers will only know the answer to that when the project is completed and the writing comes to an end.

Re-reading Ragin (1992) at the end of writing up this thesis was a great comfort. While writing the three papers, one of the main analytical problems was to determine what they were cases of. The reason why it is so difficult to answer this question is, of course, that *'it depends'* (Ragin 1992: 6). Consequently, the process of finding out what a study is a case of, is and should be, an ongoing process. Thus, ambiguity is intrinsic to case study research (Platt 1992, Ragin 1992, Walton 1992). Any case can be considered a case of many different things (Platt 1992). Often the investigator has an initial idea, it often changes through the course of the research. This is healthy, claims Ragin (1992). Walton (1992) makes a similar point from his own research on resistance to a dam project in the United States in the 1920s and 1930s. Starting out, he hypothesized that the protest was a case that could illuminate causes of rebellion. After months of intense study and frustrating hunts for theories that could illuminate his case, he found that his case was a case of something very different, namely of how collective action changed through time in response to a changing configuration of the state. Thus it became a case of “the changing role of agency in history” (Walton 1992: 133). Walton continues that there exists no ideal answer to the question of what a case should be a case of, and concludes that:

The question of cases, their designation and reformulation, therefore is a theoretical matter. The processes of coming to grips with a particular empirical instance, or reflecting on what it is a case of, and contrasting it with other case models, are all practical steps toward constructing theoretical interpretations. And it is for this reason, paradoxically, that case studies are likely to produce the best theory. (Walton 1992: 127)

Implicit in this process oriented view of a case is that cases are not bounded entities that can be *found* in society, but rather are constructed on the basis of research findings. Thus, the point is not to determine the boundaries of the case, but to pinpoint and demonstrate their theoretical contribution and significance (Ragin 1992). This corresponds to my experience with case studies. Cases are not bounded entities to be found clearly demarcated – and further, any case may

contribute to and be significant to several theoretical debates. When writing and analyzing research findings, the challenge then is to determine to which debate the particular findings make the most significant contribution, either by questioning it or by typifying it. Having said that, I would argue that even when the case study is written and published, it will invariably contribute to more than one scientific debate, and consequently be a case of different theoretical interpretations (compare the above discussion of the second paper of this volume).

### **3.2 Researching Namaqualand**

When embarking on my studies in 2004, my main research interest was landscape change, land reform and knowledge production. Namaqualand is a dryland area, where the debates around rangelands and ecological dynamics are lively, and where transfer of land and the establishment of new management systems following land reform were in progress. Issues regarding land reform and tenure security were being hotly debated. Opinions were varied and conflicting, both among farmers in Namaqualand and among extension officers, municipal officials, and members of land reform committees. Furthermore, the land reform process was well underway in Namaqualand, as opposed to other areas in South Africa, where land claims were yet to be settled.

Thus, in Namaqualand it was possible to study a process that was almost completed, but still alive. Since my time in the case study area was limited, and my research interest was fairly broad, I decided to concentrate on one village area. The reason for choosing Concordia was twofold. First, relatively little research had been conducted in Concordia compared to other communal areas in Namaqualand, such as Leliefontein and Richtersveld, so I assumed that people were not experiencing research fatigue, and would still be interested in contributing to my project. At the same time, working in Concordia, situated some 20 km from Springbok, the municipal centre, meant that I would be flexible to schedule meetings with people in local government departments without spending too much of my time on travelling long distances.

During my seven and a half months in South Africa, I commuted between Concordia and Cape Town, spending about four and a half months in Concordia, and the rest in Cape Town. So my

work was separated into intense weeks in Concordia and Springbok, where the days were filled with interviewing, taking notes, preparing for new interviews, and attending meetings. These periods were succeeded by periods in Cape Town, gathering other source materials and spending time on reflection.

Spending time in ‘the field’ has several advantages. For my study, the several longer periods I spent in Concordia gave me the time and opportunity build relationships with people in the community. I had opportunities to talk with people colloquially about farming and rangeland management, and other issues of importance to the community, which meant that I learned to know the village and the grazing areas quite well. Moreover, I had the opportunity to interview several of my respondents more than once. I also went on several day or half-day trips with farmers, and one with an extension officer. In addition, the management committee allowed me to attend their monthly meetings, and to read the minutes from earlier management committee meetings from the local archive, which gave me a good insight into what issues were (or were not) discussed. Few of these encounters with people or trips into the field are cited directly in the three research papers. But direct experience with the people and their rangelands gave me a deeper insight into the concerns of the everyday lives of farmers and officials than I would otherwise have had.

Two key informants in Concordia were particularly important. The first was a woman in her thirties, with whom Noragric has had a working relationship for years. She had played a role in the land reform process in Concordia, had worked in several environmental organizations in the region, and thus proved to be a useful entry point to people in the local government and various organizations. My second contact was my neighbor. She was a first grade teacher, and taught me Afrikaans. She proved to be an invaluable contact in introducing me to farming life. She was from a farming family, and had taken up farming when she was widowed twenty years earlier. She was passionate about farming life. She took me to her ‘farm’ and taught me details of farming practice. She also introduced me to several of the farmers that I interviewed later, gave me advice about good contacts and discretely kept me updated on village gossip.

### **3.3 Interviewing and language**

Most of my interviews were conducted on a one-to-one basis, and all of them were semi-structured. The interviews were conducted in the homes or offices of the respondents, or when possible and relevant, in the field. Qualitative interviewing is normally flexible, but often structured to some extent. Flexibility enables the researcher to adjust to the situation she is in during the research process (Bryman 2008). The flexible nature of these interviews afforded me the freedom to change the questions as I discovered new and pressing concerns that I was not aware of in the beginning, while retaining most of the initial questions so as to be able to triangulate some of the data collected.

While many people in Concordia speak English, few are fluent and some speak no English at all. At the beginning of my stay, I used a temporarily unemployed young neighbor as my interpreter, but for practical reasons that did not work out, so I decided to learn Afrikaans to conduct the interviews by myself. As the learning process took a while, I initially had to choose my respondents according to their English skills. Gradually my Afrikaans improved and I conducted interviews in a mix of Afrikaans and English, and towards the end of my stay, the conversations flowed more naturally. Despite the difficulties, it was an advantage to conduct the interviews myself. Still, I relied on my recorder to some extent.

On a few occasions people asked me to turn the recorder off, so as to tell me things they considered to be contentious, and I might have obtained slightly different answers if I had not used a recorder. However, these drawbacks were compensated for by the advantages of learning the language. Although I hesitate to exaggerate the importance of learning the vernacular, I had the feeling that the respondents spoke more freely to me than they would have if I had understood English only, or worked with an interpreter. In addition, it saved me a lot of time, and the conversations between me and the respondents flowed more naturally. Moreover, gaining a command of the Afrikaans language afforded me opportunities to read policy papers and scientific literature in Afrikaans, and enabled me to analyze the planning process report in the second article in this study.

### **3.4 Written sources**

I collected a range of written sources in Namaqualand and Cape Town. From Professor Timm Hoffman's large collection of material on Namaqualand, I read and copied articles on rangeland health, ecology and management in Namaqualand and other parts of South Africa. The library of the University of Cape Town keeps copies of all national legislation, government reports on the grazing situation in Namaqualand, and reports from the land reform process. The Surplus People's Project has published considerably about the land situation in Namaqualand and South Africa. In the Concordia service office, I read minutes from management committee meetings from five years prior to my field research. In bookshops in Cape Town and Springbok, I found information on Namaqualand and South African history, Namaqualand ecology, farmers and farming practices, as well as on land reform in Namaqualand and South Africa.

### **3.5 Sources used as data and representations**

In the previous chapter I discuss the philosophical challenge for social constructivists who research various representations of environmental change. They criticize 'orthodox science' (cf. Forsyth 2003), and yet they use data resulting from 'orthodox science' in their research. While interrogating science for its inherent political influence opens up a space for analysis that can be liberating, it also implicitly undermines the authority often granted to scientific knowledge production. If scientific knowledge is inherently political and value-laden (Forsyth 2003, Jasanoff 2004cf. , Goldman et al. 2011), what happens to scientists knowledge claims? Can we still depend on them to give us useful information about the environment? From which vantage point can we criticize representations that we find to be inaccurate or misrepresentational? The use of the same (or similar) sources as data and representation leaves the researcher with "no 'neutral language' to describe 'real events'; for considering how the landscape 'actually responds to use'" (Fairhead and Leach (1996: 16). Moore and Vaughan also address this dilemma:

We have to acknowledge that we simultaneously use accounts of all kinds, whether from the past or the present, both as representations and as data. There is no escape from the unease that this dualism produces. All accounts, including our own, are constructed



accounts, but they are also accounts of something. [We do not suggest] that at bottom and in the final analysis facts are facts. It is rather part of a more general plea for a recognition of the fact that in a constituted world, we must recognize the limits of a position that would suggest that we or anybody else had “invented” the lives and histories that form the substance of this book. (Moore and Vaughan 1994: xxiv)

In a similar vein, Demeritt (1994b) holds that combining a skeptical stand on orthodox research is compatible with using such an approach. While he considers ecology to be a “discourse with its own particular rules and disciplinary structures that produce representations of nature” and that “these representations involve exercise of power and should be treated as such” (1994b: 33), this

... does not rule out appropriations from ecological science or other fields of knowledge where they prove useful and convincing. Science can still provide an important way to make our relationships with the world visible to us. These knowledges are necessarily perspectival, situated ones (Demeritt 1994b: 33)

This fact, writes Demeritt, makes scientific measurements of, for instance, atmospheric carbon dioxide, no less important in helping us understand the dynamics of global warming. Hence, Demeritt (1994b) implicitly opens up both possibilities – direct analysis of data as sources, and analysis as representations – and finds both to be crucial elements in studies on environmental change. This is also my approach throughout this thesis. Applied with due skepticism, scientific knowledge is useful and necessary in a fruitful engagement with the environment, as well as with other environmental researchers. For example, we need intimate knowledge about ecological dynamics, the decline in species richness, and the possible damaging effects of toxic waste. But we similarly need to pry apart such knowledge, question the genealogies of such knowledge, and possible stakes for researchers who may be representing the world in a particular way (Sullivan 2000). The aim of such prying is not to discern myths and facts, or as Forsyth (2003) would say, ‘facts’ from ‘norms’, but to make wise judgments based on the facts presented.

While I concur with Demeritt (1994b), Moore and Vaughan (1994), and Fairhead and Leach (1996) that the application of sources as both representations and as data is defensible, I also

concur with Fairhead and Leach (*ibid.*) that it puts the researcher in a vulnerable position. In this study I respond to this challenge by combining diverse methodologies and sources in addressing the research questions. The sources include policy documents; archive sources from Namaqualand; interviews with farmers, municipal officers, officers in Department of Agriculture and Department of Land Affairs; aerial photographs; historical landscape photographs; fence-line photographs; scientific work in ecology, botany, soil science and agricultural sciences; maps; and vegetation surveys. I have sometimes interrogated these sources for what they reveal about Namaqualand landscapes, and sometimes for the representations they provide of the same landscapes and the ecological dynamics of the landscapes. The result is a study which engages both in 'actual' landscape change and in a critical conversation about application and production of knowledge about landscape change.

## 4. Namaqualand and Concordia: Background

### 4.1 Namaqualand geography

Namaqualand is the name of a former managerial district in the Northern Cape Province in South Africa. After post-apartheid municipal reform, Namaqualand was subdivided into four municipalities (Nama-Khoi, Kamiesberg, Richtersveld and Khâi-ma). All four municipalities come under the Namaqua District Municipality which has its base in the town of Springbok (Wisborg 2006, May and Lahiff 2007). When I write about Namaqualand I refer to the area covered by these four municipalities.

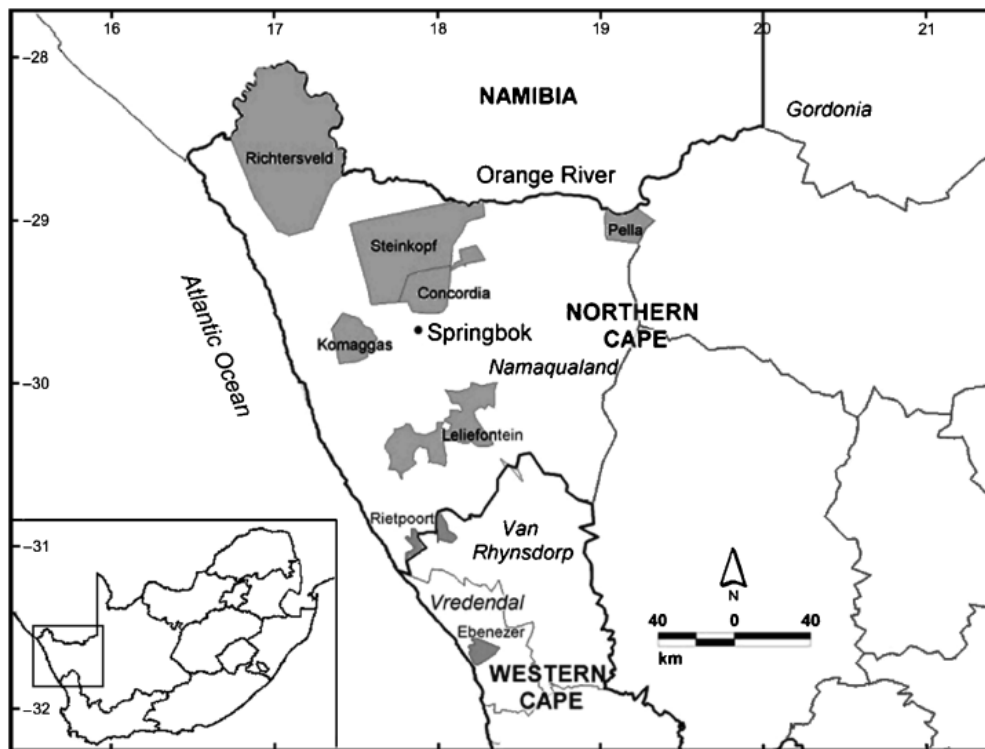


Figure 2: Map of Namaqualand and Northern Cape Province. Source: Timm Hoffman. Graphics: Simon Todd

Namaqualand lies in the far north-west of South Africa and covers an area of 52 600 km<sup>2</sup>. The area stretches from the Kamiesberg mountains in the south, to where the Orange River marks the border with Namibia in the north. To the west the area is bounded by the Atlantic ocean, while the eastern boundary stretches from the plains of Bushmanland to the Kamiesberg mountains. The geography in Namaqualand is varied. Average rainfall varies from 50 mm in the arid Sandveld by the coast, to 400 mm in the Kamiesberg. The central mountain area to the east of the Sandveld receives predictable winter rainfall of between 100 and 350 mm between May and September. The central mountain area is part of the Succulent Karoo biome that exhibits high biodiversity with 3500 species of which 25% are endemic. The Richtersveld to the north is varied in topography as well as local rainfall. Bushmanland lies to the east of the central mountain area. This is desert shrub land, which receives summer rainfall of between 100 and 200 mm. Unlike the central mountain area, the rainfall in Bushmanland is patchy and unpredictable (Benjaminsen et al. 2006).

Namaqualand is sparsely populated, with only 66 000 inhabitants. Of these, about 30 000 live in six communal areas, which were called 'Coloured Rural Reserves' or 'Act 9 areas' under apartheid (Wisborg 2006, Hongslo et al. 2009). People in the communal areas are of mixed Nama descent. Afrikaans is their mother tongue, as it is for white people on the farms and in the towns. Land use in Namaqualand is divided between five major types. Private farm land is the major land use, comprising 52% of the total area. Mining companies own 7% of the land, the state land owns about 8% (mainly farm land), while conservation areas take up 5% of the land (Rohde et al. 2002). Together these private land uses share 72% of the total land area. Through land reform initiatives in recent years, the six communal areas have increased their size from 22% to 28% of the land (Wisborg 2006).

Namaqualand's economy reflects the land use to some extent. Mining contributed to 70% of total wages in 1998. This figure is likely to be lower now, as many mine workers have since been retrenched. Other important sources of income in 1998 were trade (12%), government employment (8%), transport (4%), and finance (2%). These figures do not reflect the number of people in Namaqualand who are dependent on agriculture. A 2003 report found that 26% of the

population in the Northern Cape Province has their main form of employment in agriculture (Stats SA 2003). This amounts to three times as many as were employed in the mining sector.

## 4.2 Namaqualand history

Human activities have marked the Namaqualand landscapes for at least 4000 years. Grazing by domestic livestock in Namaqualand has been dated back to 2000 BC, which is one of the longest grazing histories in Southern Africa (Hoffman and Rohde 2007: 827). In the 18<sup>th</sup> century, Namaqualand was inhabited by indigenous herders (Khoikhoi<sup>1</sup>) known to have rich holdings of sheep, goats and cattle (Boonzaier et al. 1996). Most of the herders stayed in the Kamiesberg area, but they followed a transhumance pattern, and European travelers met them as far north as the Orange River. Though rich, the indigenous herders were not many in number, and Namaqualand was reported as being sparsely populated (Webley 2007).

The advent of European travelers and later settlers affected the indigenous herders (Khoikhoi and San) dramatically. The region became a part of the Cape Colony in 1847. By that time, a war of rebellion and land dispossession had decimated the indigenous herder and hunter populations (Hoffman and Ashwell 2001). Local livestock populations had also decreased dramatically, and the indigenous herders subsequently lost both economic and political influence (Boonzaier et al. 1996, Webley 2007). The settlers were stronger in terms of military might and gradually took control over most of the land in Namaqualand for mining and farming, often through violent conflict. The original population was confined to small communal reserves and many were forced into slavery and serfdom (Hoffman et al. 1999, Hoffman and Rohde 2007). Eventually the herders were forced to apply to the church to establish mission stations in their areas as protection against further loss of land and power. By 1900 several mission stations had been established in Namaqualand (Webley 2007). The mission stations assisted the farmers in keeping control of land surrounding the mission stations, and gradually developed into local authorities (Boonzaier et al. 1996). The government issued what they called ‘tickets of occupation’ to the

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<sup>1</sup> Khoikhoi was a derogative term in Namaqualand, but after independence the indigenous movement has taken up the word again (Boonzaier et al. 1996).

mission stations. Although the tickets of occupation served as provisional protection for the reserve farmers, this was simultaneously a form of dispossession, as the government did not recognize the indigenous herders' claims for permanent control of the land (May and Lahiff 2007).

While the mission stations gained control in Namaqualand, important developments changed the political order at the Cape. The English and the Boers, who had fought each other for control of the Cape since the arrival of the English in the early 19<sup>th</sup> century united to form the Union of South Africa in 1910. Three years later the new union issued the 1913 Land Act. By then, the racial division had deep historical roots, which were formalized by The Land Act (Sparks 1997, Beinart 2001). The broader aim of the Act was to create a surplus work force for the mines and the white agricultural sector, as well as to fight back a growing independent black peasantry (Bundy 1988). About 75% of the land in South Africa was reserved for private ownership by white farmers or companies, while only 8% was designated for African occupation<sup>2</sup> (Beinart 2001). The Land Act further prohibited freehold ownership of land for colored and black farmers (Hoffman and Ashwell 2001). In the aftermath of the Act over a million people were removed from their homes and into 'homelands' or 'bantustans' (Sparks 1997). Later the 1936 Native Trust and Land Act increased the areas reserved for Africans to the figure of 13%, which is often referred to (Beinart 2001).

Many of the segregating and discriminating measures taken by the Union of South Africa were justified on the basis of land conservation, against the background of a growing concern among South African agricultural officials about degradation in South African rangelands (de Wet 1994). Following several serious droughts in the Cape, a number of drought investigations were instigated, and as early as 1904, a connection between paddocking and veld conservation was well established. This was followed by the Fencing Act in 1912 which provided loans and facilitated joint measures by neighbors on private farms to fence their land (Van Sittert 2002).

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<sup>2</sup> This does not include land managed communally through mission stations and other institutions, which represented a little more than 8% (Beinart 2001).

The 1923 Drought Commission concluded that there was indeed widespread degradation on commercial farmland in South Africa, and that it could be combatted by fencing of paddocks, development of more water points, and state interventions to combat degradation (Hoffman and Ashwell 2001, Beinart 2003). However, these suggested measures were never implemented (Hoffman and Ashwell 2001).

Later, the Soil Conservation Act of 1946 legislated measures to combat degradation in commercial farm areas. These initiatives were directed towards white-owned farm land only, but the 1936 Native Trust and Land Act enabled a range of measures to combat degradation in tribal and communal areas, which went under the name 'Betterment plans'. These schemes included the demarcation of rangelands, sowing land, and villages, as well as destocking schemes (de Wet 1995). In some areas, rangeland was fenced into paddocks, and measures to improve stock quality and to combat soil erosion were implemented (Hoffman and Ashwell 2001, Beinart 2003).

In the first half of the 19<sup>th</sup> century, the indigenous herders in Namaqualand lost control of their land and opportunities for local production decreased. Labor outside the reserve became more important for people's livelihoods (Carstens 1966, Hoffman et al. 1999). People from the mission stations worked in the mines, on white-owned farms, and some in the local fish industry (Boonzaier et al. 1996). However, work in the mines was unstable, and people soon began to realize that it could not be trusted as their only source of income (Boonzaier et al. 1996). Many Namaqualanders maintained their attachment to the reserves through their immediate family or ownership of herds, while others moved away altogether (Boonzaier et al. 1996).

Despite colonial and apartheid segregation policies, there was considerable interaction between colored and white farmers in Namaqualand until the 1950s. Intermarriage between people of different ethnic origins was common, and by 1860 it was reported that most inhabitants in Komaggas and Concordia were of mixed descent (Boonzaier et al. 1996). White and colored people also interacted to some extent in terms of access to the grazing areas. The borders between private farms and communal areas were often permeable – white farmers could be given

rights to graze in the reserves, while reserve farmers at times were allowed to graze on white farms (Boonzaier et al. 1996, Rohde et al. 2006).

Stock farming in the communal areas in Namaqualand was (and to some extent still is) based on so-called *kraaling*. *Kraal* is another name for pen or stock enclosure (Benjaminsen et al. 2006), and stock farmers or their herders live by their kraal, and move with their herds during the day. There is also some mobility of the stock posts depending on availability of grazing. This facilitates the use of communal grazing areas by several herds. This system is quite different from the 'camp system' used on commercial farms, where animals are kept in paddocks to facilitate resting the grazing areas, and secure predictable grazing for production of meat to the national markets. The missionaries urged Namaqualand farmers to leave their stock posts and settle in the villages, but until the 1950s many farmers stayed at their stock posts for most of the year (Boonzaier et al. 1996). However, some farmers took up cultivation of wheat (and to some extent barley and oats), and stayed close to the mission station for part of the year (Hoffman and Rohde 2007). In the 1950s and 1960s when schools and shops were established in the villages and people became dependent on these services, they gradually moved into the villages. Mission schools discouraged their pupils from using the Khoikhoi language, as they found that learning Afrikaans was an advantage for those who continued to Afrikaans medium schools (Boonzaier et al. 1996). In a similar way, the Khoikhoi religion was soon replaced by Christianity (Boonzaier et al. 1996), and today Namaqualand communities are known to be deeply religious (May and Lahiff 2007). Today most people live in the villages, and many are dependent on herdsmen to look after their animals (Boonzaier et al. 1996).

The concern about rampant degradation in South African rangelands continued. In 1951 the Desert Encroachment Committee concluded that the degradation evident in South African rangelands could be attributed to poor management and not to changes in rainfall patterns. Again, high stocking levels were addressed as a cause of degradation. The committee advised that the state should take a lead in the work to combat desertification, as the farmers did not know what was best for them (Hoffman and Ashwell 2001, Beinart 2003). In 1969 a stock reduction scheme was introduced in commercial farming areas in response to the warnings about



degradation. In addition to subsidizing stock reduction, this scheme promoted resting of eroded grazing areas and more efficient management. Four thousand commercial farmers in South Africa volunteered to join the scheme over a nine year period, with land holdings representing 17% of South Africa's land surface. The farmers were obliged to reduce stock to levels under recommended carrying capacity, and to rest one third of their area on a regular basis (Hoffman and Ashwell 2001). However, evaluation studies showed little effect of the scheme on veld condition and livestock production (Baard 1978 cited in Benjaminsen et al. 2006).

During the apartheid era, most veld improvement schemes were directed towards commercial ('white') farming areas (Rohde et al. 2006), but the warnings of degradation also inspired grazing regulations for communal areas in Namaqualand. As paper 2 in this volume shows, various grazing regulations made provision for stock limitations in communal areas and movement of stock, as well as culling if communal farmers exceeded these limits (see also Rohde et al. 2006). However, it is unclear whether these provisions were ever implemented (Surplus People Project 1997).

Since the establishment of the mission stations, there have been debates about the benefit of communal tenure. Various legislations have upheld and transformed policy about communal tenure, but in parallel, skeptics have proposed subdivision of the commons into smaller privatized units. These initiatives have invariably blamed poverty in communal areas on poor work ethics and communal tenure, rather than on lack of land (Wisborg 2006). Act 29 of 1909 provided for subdivision of the communal areas, but for more than fifty years this provision was dormant (Wisborg 2006).

A decisive struggle over communal tenure in Namaqualand started in 1963 when the government proposed what were to be called 'economic units' (Boonzaier 1987, Boonzaier et al. 1996). The idea was to privatize communal areas in order to improve the economic prospects of communal farmers. The communal areas in Steinkopf, Richtersveld and Leliefontein were divided into smaller units, which were rented to individual farmers (Rohde et al. 2002). Richtersveld, for instance, was divided into 37 units that were to be managed according to recommended carrying

capacity values. But there were many more families with livestock than there were units (e.g. 150 families in Richtersveld), and people soon began to worry that they would lose their resource base. Farmers feared that even those lucky enough to be allocated a unit would not receive enough land to operate within the recommended stocking rates, as the units were estimated on the basis of herds of 500, and many farmers kept more animals than that. Also, farmers were to maintain the infrastructure from their own pocket, and it was feared that it would be too expensive for them. And, as the units were fenced, farmers worried about the consequences this would have on stock movements. The concern grew into resistance, and in the late 1980s people in Leliefontein took the case to court. The government was forced to end the scheme in all of Namaqualand (Boonzaier et al. 1996).

### **4.3 Land reform in South Africa and Namaqualand**

Owing to the apartheid past, land reform in South Africa is an important symbolic and emotive ambition for local people (Beinart 2001). The land reform process was ambitious and sought to reduce poverty in the rural areas by responding to landless people's demands for land, and to support and expand a new sector of African smallholders (Hall 2004). But despite its high ambitions, land reform in South Africa has been slow and inefficient (Beinart 2001). The initial target was to redistribute 30% of the country's land between 1994 and 2000, but this soon proved to be too ambitious, and in 2000 the target year was advanced to 2015. By 2005 about 4% of the land had been transferred and although the pace has increased a bit since 2001, it is clear that the government needs to speed up considerably in order to reach their goal within the next few years (Hall 2007). The lack of progress is due to different causes. The 'willing seller, willing buyer' approach to land reform has failed to provide enough land for redistribution (Hall 2004). In addition, land on the market is unrealistically expensive, the grants offered to poor farmers are small (maximum 20000 rands), and farmers are not allowed to pool into large groups to submit one application (Hall 2007). There has also been criticism of the lack of support to farmers after the transfer of land (Hall 2007).

The South African land reform program consists of three subprograms. First, the restitution program aimed to redress historical land acquisitions supported by the South African government (Beinart 2000). The land could be restituted directly by means of cash transfer or by purchasing the same land and giving it back to the communities who claimed it. The second program was the redistribution program, which initially sought to distribute land to disadvantaged farmers. Most of the land distribution during the first ten years of land reform, was achieved through the redistribution program (1.9 million hectares) (Hall 2004). In 2001, the Land Redistribution for Agricultural Development (LRAD) was launched, aiming to create a new class of African commercial farmers (Hall 2007). LRAD is but one of the subprograms in the redistribution program, but as Hall (2007: 91) observes, the other components seem to “exist in a state of flux”, in which new programs are introduced and old ones faded out. The third program was the tenure reform program, which sought to address tenure insecurity for communal farmers as well as for workers who lived on privately owned farms.

Namaqualand commonages received 317,898 ha, primarily through the municipal commonage program that was part of the redistribution program. The land was bought from adjacent private farmers in consultation with the so-called ‘transformation committees’ in each community. Some land was also transferred from the state and the municipality to the communal areas. From 2005 to 2006 all the new land was held in trust by the municipality, awaiting a response from the Minister of Land Affairs.

In Namaqualand the tenure program was implemented through the TRANCRAA (Transformation of Certain Rural Areas Act) process (Republic of South Africa 1998). TRANCRAA aimed to secure tenure for communal farmers. In the communal areas, issues concerning farm rights in the commonage, as well as rights to the dryland plots within the commonage were disputed. TRANCRAA addressed these issues and established a set of new rules concerning farming rights (Surplus People Project 2003, Wisborg 2006, May and Lahiff 2007). In practice, however, the TRANCRAA process was more about developing a planning and regulatory system, than the actual reform of land tenure. This priority partly reflected a concern for the environment, and was partly a response to frustration in the community. The

facilitators of the program (the Surplus People Project, SPP) and Department of Agriculture (DoA) officials were concerned that the transfer of more land to communal areas would lead to further degradation (Wisborg 2006). Wisborg (2006) interviewed an official from the SPP who argued that people in the community were frustrated by the lack of clarity of rules and regulations prior to the TRANCRAA process, as well as their implementation. Thus the resulting regulations and management plans emerged after negotiations that took into account the autonomy of the community and the need to protect the grazing land (for which government control was deemed essential) (See also paper 2 in this volume).

The restitution program's retrospective cutoff year was 1913, and the program is amenable to those who lost their land because of discriminatory laws after that date (Hall 2004, May and Lahiff 2007). Most land in Namaqualand was acquired by the Europeans before the cutoff year, and the restitution program was only valid for the Richtersveld.

#### **4.4 Concordia**

The study area, Concordia, is one of six communal areas in Namaqualand and lies in the heart of Namaqualand, north-west of the regional centre Springbok. Concordia is situated on the boundary of the central mountain area and Bushmanland, and thus receive both summer and winter rainfall, which enables them to move between grazing areas according to the seasons. Concordia has approximately 4600 inhabitants and after land reform, it stretches over 137 890 ha. The last census recorded that 168 families farm in the communal grazing land of Concordia (Surplus People Project 2003). The extent of 137 890 ha may sound luxurious for someone inexperienced in dryland rangeland management. However, compared to neighboring commercial farmers who keep farms of between 4000 ha and 12000 ha each to support 400-1200 small stock, an average of 820 ha per farming family is moderate (Hongslo et al. 2009). This disparity between 'white' and 'colored' farm holdings is a legacy from colonial dispossessions and apartheid land and segregation policies.

The mission station in Concordia has existed since 1852, when it was established under the authority of the Steinkopf mission station. In 1891 Concordia inhabitants decided to separate

from Steinkopf (Carstens 1966). At the time, the Concordia area (the area which is referred to as the ‘old commons’ after land reform) was divided between five families (Van der Heever, Saal, Cloete, Engelbrecht and Van Wyk). It was only in 1912 that Concordia was formally established as a ‘colored reserve’ following the 1909 Mission Stations and Communal Reserves Act. The ‘colored reserves’ were owned by the state, and inhabitants had the right to use and graze the areas (Benjaminsen and Sjaastad 2008).

Concordia land is still officially owned by the state and managed by the municipality (local government). Management is presently conducted through a management committee consisting of elected members from Concordia (most of them farmers). Residential plots, as well as sowing plots, are rented on a yearly basis, and owners can be evicted after three years of failed payment. The sowing plots were previously cultivated during the growing season when rains allowed, and opened up for general use during the rest of the year. Due to the rise of input costs and grain prices, and unpredictable rainfall, most people have given up cultivation and now use their own plots for grazing (Hongso et al. 2009). The tenure reform has strengthened the feeling among Concordia farmers that sowing plots are privately owned. Some farmers have also fenced their plots (some before the reform, but most after) in order to keep other farmers’ animals off their land (Benjaminsen and Sjaastad 2008, Hongso et al. 2009).

The rest of the communal area is used primarily for grazing, but people also collect firewood, medicinal plants and building materials there. In addition to the sowing plots, the commons comprises what the farmers call the *old commons* (or the *buite meent*) and the *new commons* (*nuwe meent*). The old commons is located in the winter rainfall area. In addition, Concordia inhabitants had a summer rainfall farm at their disposal before land reform, called Naab, which was bought by the five families and added to the reserve land in 1908. When Concordia’s areas were later increased through land reform, the new areas were called the *new commons*. Today, both Naab and the new commons are managed according to an open-close system. With advice from the extension officer responsible for their area, the management board decides when the new areas are to be opened. The farmers apply to the board for rights to stay on that farm for one

season only. When farmers arrive in the new commonage at the start of the grazing season, they share the camps on the farm between them.

By means of the TRANCRAA process, a set of grazing regulations and a management plan were established for all communal areas in Namaqualand. The new legislation secured grazing rights and rights to rent sowing plots for all inhabitants (*inwoners*). The same regulations oblige farmers to pay grazing fees (30c per unit of small stock per month), and fees for dryland plots. The number of animals per farmer was limited to 350 ewes. Moreover, the management plan stated that new areas must be managed according to carrying capacity and thus there were limits to how many animals were allowed on these areas. According to the NamaKhoi municipality, the grazing fees do not reflect the costs that the commonage incurs, even in the case of full payment of fees (Personal comment, municipal officer 2006).

The implementation of the management plan and grazing regulations has been met with reluctance. Farmers resist paying fees in the NamaKhoi municipality as a whole (Benseler 2003), as well as in Concordia. Farmers in Concordia perceive the grazing fees as being ‘infrastructure fees’, intended to cover expenses for new water points and the maintenance of existing infrastructure. But since they consider the service to be slow or lacking, they are reluctant to pay the fees (Interviews with Concordia farmers 2006). Regulations are in place to take legal action against farmers who fail to pay the stated grazing fees, and many municipalities in the Northern Cape started penalizing farmers by 2003 (Benseler 2003). The grazing regulations entitle the municipality to demand counting and to force farmers to sell off excess animals. Earlier, when the veterinary service offered dipping of all animals, animals were counted regularly. Since this service was scaled down in 2002, no counting has taken place. In 2006 the NamaKhoi municipality planned to count animals in all communal areas, but this was postponed several times and in the end, it was called off. Consequently, the municipality has no recent records of stock amounts in Concordia.

To the knowledge of my interviewees (farmers, extension and municipal officers), the NamaKhoi municipality has never penalized farmers who fail to pay fees or adhere to the regulations. The municipality and the local branch of the Department of Agriculture gave

different reasons for their reluctance to enforce the regulations. A municipal officer admitted that it would be politically unacceptable to take legal action, or to fine even wealthy farmers who exceed the stock limit or fail to pay their taxes (Personal comment, municipal officer 2006). Further, Namaqualand was emerging from a three year long drought, and farmers had experienced enough hardship. Due to the drought, it was unlikely that many farmers exceeded the limit anyway (Personal comment, extension officer 2005).

Since land reform, the issue of semi-privatization of communal areas has re-emerged in Namaqualand. While the commonage program (from 1997–1999) focused on assisting farmers who wanted to continue farming in the commonage and to supplement their income, the subsequent National Land Reform Review (1999) shifted the focus to so-called ‘emerging communal farmers’. New grants provide the wealthier commercial farmers with money to purchase private farm land. In order for emergent farmers to gain enough experience to buy their own land through the new schemes, the new commonage is rented exclusively to farmers who want to commercialize (Ministry for Agriculture and Land affairs 2000, Rohde et al. 2002, Lebert and Rohde 2007). This tendency to favor affluent farmers has happened “despite the government’s commonage policy which privileges access by poorer, disadvantaged communal farmers” (Lebert and Rohde 2007: 818). Five of the six Namaqualand commonages have chosen to rent the new areas to groups of individual farmers on a five-year basis.

Concordia’s open-close system is slightly different and more directed towards equal sharing. Still, access to the commons remains limited for poor people. Most of the new farms are situated far from the villages, and farmers need to hire herders. In both instances, transportation is required. The management committee takes the farmers’ access to transportation into account when they distribute grazing rights. This shift from emphasizing the needs of the farmers to emphasizing the ability of the farmer to farm coincides with the changes in national policy (Lebert and Rohde 2007).

## 4.5 Concluding remarks

We see from the above discussion that the equilibrium theory and policy formation has been closely linked through South African history for a long time. The co-production of the rangeland succession model and rangeland policies has resulted in a perception of communal areas as degraded, and of communal tenure as unsustainable. Increasing evidence suggests that the rangeland succession model is insufficient to understand vegetation dynamics in South African and Namaqualand rangeland (cf. Jürgens et al. 1999, Benjaminsen et al. 2006, Rohde et al. 2006, Hongslo et al. 2009). At the same time, evidence suggests that the links between tenure and stocking rates are weak, and that other factors such as land access in communal areas and previous state subsidies for farmers in private farms can account for the difference in vegetation cover and composition between communal and private areas (cf. Benjaminsen et al. 2006, Rohde et al. 2006). Despite this evidence, land policies in southern Africa still rely on the degradation orthodoxy, and promote privatization of communal land and stock limitations according to moderate recommended carrying capacity values. These policies favor ‘emergent farmers’ in communal areas at the expense of poor farmers.

There is need for more insight into the mechanism of co-production of science and politics in dryland areas as well as into mechanisms of landscape change and ecological dynamics. The three following case-studies contribute to these debates in different ways.



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# Part II

Papers





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Hongslo, E., R. Rohde, and T. Hoffman. 2009. Landscape change and ecological processes in relation to land-use in Namaqualand, South Africa, 1939 to 2005. *South African Geographical Journal* **91**:63-74.

### **Paper 2:**

Hongslo, E. (2011). Why is the notion of ‘carrying capacity’ so persistent in rangeland management? A study of a planning process in South Africa (Manuscript, submitted to *Geoforum* Sept 2011).

### **Paper 3:**

Hongslo, E. (2011). The politics of difference: fence-line contrast photographs as scientific models in ecology (Manuscript).



## **Paper I:**

Landscape change and ecological processes in relation  
to land-use in Namaqualand, South Africa 1939-2005



# LANDSCAPE CHANGE AND ECOLOGICAL PROCESSES IN RELATION TO LAND-USE IN NAMAQUALAND, SOUTH AFRICA, 1939 TO 2005

EIRIN HONGSLO, RICK ROHDE and TIMM HOFFMAN

## ABSTRACT

This paper examines the consequences of land use on vegetation over a sixty-six year period, within various agrarian landscapes across the winter/summer rainfall ecotone in northern Namaqualand. We employ repeat ground and aerial photography and interviews with land users to elucidate the causal factors that explain environmental change and stability. Ecological literature on landscape change in Namaqualand has suggested that communal land-use is detrimental to vegetation cover and species richness. Our study shows that there have been very few changes in vegetation cover and species richness in cultivated and grazed communal areas during the last 65 years, but that there has been a regeneration process in the private and protected areas. We demonstrate that these different vegetation responses reflect different land management histories. This evidence suggests that the potential for increased vegetation cover and species richness in response to land-use change is higher than was previously assumed and provides a new perspective on the latent capacity of communal landscapes to regenerate from changes caused by cultivation and grazing pressure. The environmental history presented in this paper spans a temporal and spatial scale that elucidates the complex relationship between land-use, climate, soils and vegetation change.

## Introduction

In this study we investigate the environmental consequences of livestock grazing and cultivation on vegetation in three distinct land-use categories - a communal farming area, a private farm and a protected area - in Namaqualand, South Africa over a period of 66 years. Using repeat landscape and aerial photography complemented by interviews with land users we provide insights into the region's environmental history. We explore the question of whether grazing and cultivation have long-term impacts on the environment and seek to establish a temporal measure of regeneration of vegetation cover and species richness in areas impacted by agriculture.

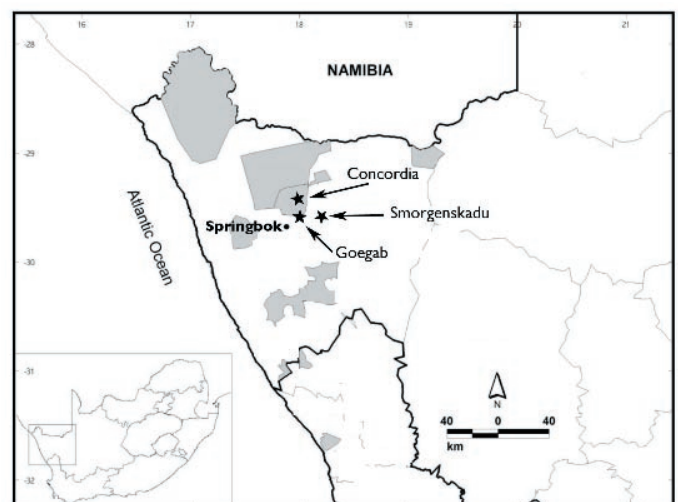
Previous studies from Namaqualand indicate that parts of the communal areas are severely affected by cultivation and grazing (Allsopp, 1999; Todd and Hoffman, 1999; Hoffman and Ashwell, 2001; Hoffman *et al.*, 2003; Anderson and Hoffman, 2007; Hoffman and Rohde, 2007). Perennial shrub species have been replaced by annuals particularly in low-lying flat areas, with few signs of recolonization, and ploughed areas that have been fallow for up to 60 years still contain few perennial shrubs, apart from the unpalatable *Galenia africana* (Hoffman *et al.*, 2003). Our study however, shows that although we find some changes on a local level in species composition and vegetation cover, the changes are not unidirectional. We find that since 1939, few major changes in vegetation cover and composition have occurred in previously-transformed communal farming areas. In both the nearby private commercial farm and in the adjacent nature reserve (which has been protected from grazing and cultivation since 1969), vegetation cover has increased and in some cases there has been a replacement of one growth form (succulents) by another (grasses). This paper explores the implications of this finding.

## Background

Namaqualand District in Northern Cape Province covers 52,600 km<sup>2</sup> of which 28 % is communal agricultural land and 52% private commercial farms. In addition, about 5% of the

land is conservation areas, 8% state land and the remaining 7% is owned by mining companies (Rohde *et al.*, 2002). We use May and Lahiff's (2007) definition of Namaqualand, which corresponds with the historical Magisterial District of Namaqualand as it was before the demarcations of new municipalities in 2000. The former Namaqualand District is now a part of the much larger Namakwa District municipality. Namaqualand has a population of about 66,000 of whom about 45% live in the communal areas which were created during colonial and apartheid eras as 'Reserves' and the remainder of the population reside in towns or on private commercial farms. The population in Namaqualand is almost entirely Afrikaans-speaking, and most people are of mixed Nama descent (Rohde and Hoffman, 2008).

Figure 1: Map of Namaqualand, showing communal areas, Goegap Nature Reserve and Smorgenskadu farm.



## Farming in Namaqualand

Similar to the rest of South Africa, the Namaqualand landscape has been influenced by its colonial and apartheid past. Colonialism resulted in the alienation of indigenous

communities in Namaqualand from large areas of land, which were taken over by white farmers. Until the 1950s, communal farmers coexisted with white farmers often sharing large areas of unfenced grazing land. However, with the apartheid legislation introduced in the 1950s, along with subsidies for white farmers, large tracts of land were fenced, effectively confining communal farmers to small communal enclaves (Rohde and Hoffman, 2008). Today's skewed distribution of land is a consequence of the colonial dispossession and apartheid policies that has resulted in two distinct land-use practices in Namaqualand.

Although they co-exist in the same ecological environment, livestock farming on communal and private land differ in production practices and in objectives. Large-scale commercial farmers live on privately owned farms that usually range between 4,000 and 12,000 ha in size. Stocking rates on private farms are low, and generally below the stocking rate recommended by the Department of Agricultural (10 ha/small stock unit). Production is geared towards sale of high quality slaughter animals (sheep, goats and cattle) for the national market (Rohde et al., 2002; Sullivan and Rohde, 2002). A typical private farmer in Namaqualand has a net income of between R6,000 and R12,000 a month (Rohde et al., 2002).

Communal farmers live and work in state-owned enclaves, previously known as 'Coloured Reserves' and later as 'Coloured Rural Areas'. Such areas generally provide each individual farmer with less than a tenth of the amount of land per individual compared to their commercial counterparts on privately owned farms. Herd sizes per farmer vary from a hand-full of goats to hundreds of small stock and dozens of cattle. Stocking rates in the communal areas are often twice the recommended level set for private farms. The communal production system is oriented towards subsistence and local commercial trade: meat and milk provide important food supplements, sheep and goats serve as reserve capital for school fees, medical expenses and unforeseen emergencies and donkeys provide draught power and transport (Rohde et al., 2002; Sullivan and Rohde, 2002).

### Land use in Concordia and adjacent areas

This study was conducted in three adjacent areas with distinctly different land-use histories: 1) Concordia – communal farms within a previously so-called "Coloured Reserve" in north central Namaqualand; 2) Smorgenskadu – a private commercial farm in close proximity to Concordia and; 3) the Goegap Nature Reserve – a protected area which is also adjacent to Concordia.

Figure 2: Repeat aerial photographs of Concordia case study farms showing very little change in vegetation cover between 1958 and 2003. Figure 2b shows position of repeat photographs illustrated in the text and the slices of the landscape depicted.

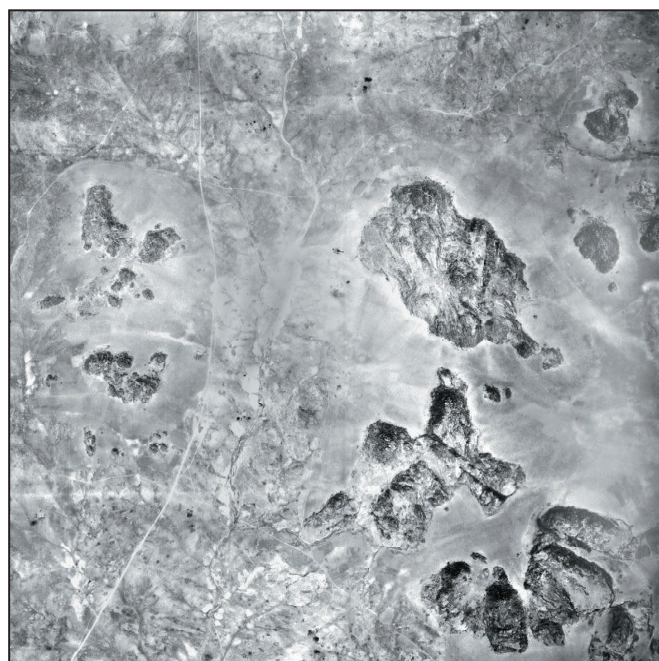


Fig 2a: 1958, November 14, 13.10. Job 408./ Strip 205/ Frame 8513

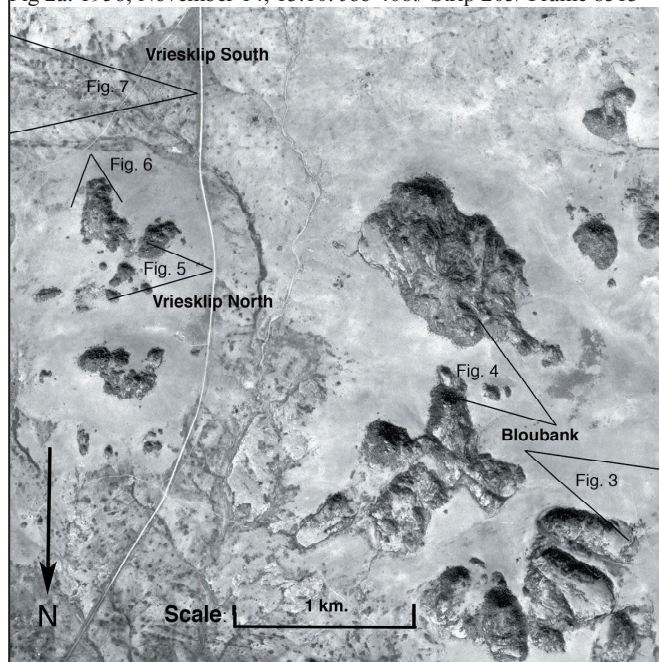


Fig 2b: 2003, August 15. Job 1079/ Strip 019/ Frame 1354

### Concordia

Land in Concordia is used for residential house plots in the village and dryland crop farms (*saaipersele*) in the outlying areas while the general commonage is used for grazing. This study focuses on a cluster of three dryland crop farms (Bloubank, Vriesklip North and Vriesklip South) which are leased from year to year from the Concordia Management Board. There are approximately 300 farms in Concordia, although not all farmers lease their own farms but instead rent land informally from registered leaseholders (Benjaminsen and Sjaastad, 2008). Most farmers live in Concordia village and commute to their farms when necessary. Historically the farms were used for cultivation and grazing. A survey conducted in 2000 by government surveyors at the instigation of the Surplus People Project provided formal registration of the leaseholders

and borders of all dryland farms, which vary in size between 40 and 500 hectares. Although farms do change hands from time to time, most stay in the same family and are passed on from parents to children.

Cultivation in Concordia was introduced by missionaries (Boonzaier, 1996) and dates back to about 1840 (Benjaminsen and Sjaastad, 2008). Croplands within the farms were ploughed and sown with rye, oats and wheat. Because of erratic rainfall in the area, harvests have varied significantly and in many years the harvests have been negligible. However, in good rainfall years harvests have made a significant contribution to animal fodder and household food security. Concordia has one crop growing season that occurs between the start of the rainy season (July - August) and mid-summer (December - January). In recent years most farmers have ceased cultivating as the effort and input costs tend to exceed the output and they now use the former croplands solely for grazing.

### *Goegab Nature Reserve*

Goegab Nature Reserve lies on the southern boundary of Concordia communal area. Previous to being declared a protected area in 1969, it was a privately owned commercial farm used primarily for livestock grazing. Up until the mid-20th century the borders of this farm and that of the Concordia communal area were porous – both communal and commercial livestock farmers grazed this area depending on seasonality and climatic conditions. Since water points close to Concordia village were within 5 km of the study site at Goegab, it is not inconceivable that this area was highly impacted by grazing over a protracted time frame before it became a protected area. Furthermore, cropping on the Concordia side of this boundary occurred until recently and it is likely that small areas were cropped within the frame of the repeat photograph of this site.

### *Smorgenskadu*

Smorgenskadu is a typical commercial farm in the area (average size 6,000 hectares) and has been stocked primarily with sheep and occasionally with goats and cattle. This part of Namaqualand was one of the last areas to be formally titled and privatised, mostly during the first three decades of the 20th century. Prior to this, land-use within the Smorgenskadu landscape was influenced by transhumant pastoralism practiced by indigenous and later trekboere farmers. During the first three or four decades of the 20th century the area in the vicinity of the Smorgenskadu study site was heavily impacted by livestock that depended on a local water source. During the 1940s, land-use practices changed radically with the introduction of boreholes and fencing and transhumance ceased.

### **Plant ecology in the study area**

Concordia lies on the ecotone between two distinct ecological zones (Mucina and Rutherford, 2006). The Succulent Karoo biome, which corresponds with the winter rainfall area, dominates the western part of the study area. The Succulent Karoo biome is an area of high biodiversity (ca 3,500 species), of which about 25% of the species are endemic (Todd and Hoffman, 1999; Anderson and Hoffman, 2007). In the winter rainfall area of Namaqualand the sandy plains are dominated by leaf succulents, while non-succulent shrubs dominate the rocky hills. During good rainfall years, Namaqualand exhibits spectacular scenes of annual flowers in early spring. Trees are rare, and mostly grow along watercourses. The eastern part

of Concordia falls within the Nama-karoo biome, which has summer rainfall and is dominated by annual and perennial grasses. However, when subject to heavy grazing pressure and cultivation, both the Succulent and Nama-karoo biomes tend towards a higher proportion of annual species (Anderson and Hoffman, 2007).

The case study site from the north eastern part of the Goegab Nature Reserve is on the western edge of the Succulent Karoo/Nama-karoo ecotone, but falls predominantly within the Succulent Karoo biome. Although it does receive some summer rainfall (average 50 mm or approximately 25% of total annual precipitation) this is not enough to sustain permanent grasslands. The privately owned, commercial farm of Smorgenskadu is located within the ecotone between the winter and summer rainfall areas. Here soils and substrates have an important influence on vegetation type and Succulent Karoo biome species alternate with more typical summer rainfall Nama-karoo biome grassland species depending on seasonal climate, land-use and geology.

### **Methodology**

The choice of case study sites was arbitrary to the extent that we were limited to a small set of repeat photographs from the area. The six repeat photo sites used in this study were chosen out of a wider collection of thirty-two repeat photos taken across the ecotone north and east of Springbok. The originals used in this study were taken by Hans Herre during the spectacular flower season in 1939 and are representative of changes observed in the repeat photographic collection across a wider landscape. We concentrate on Concordia and the immediate surrounding area because one author (EH) was conducting socio-economic fieldwork research here in 2007. It provided us with an opportunity to create a study with the potential to add up to more than the sum of its parts by combining historical, ecological and socio-economic research expertise. Our selection includes four repeat photographs from a cluster of three communal farms in Concordia, one from Smorgenskadu, a private commercial farm and one from the Goegab Nature Reserve. All photos span 66 years and cover the period between 1939 and 2005.1

Repeat aerial photographs that date from 1958, 1964, 1976, 1997 and 2003 were compared and analysed in relation to the ground photos. Interviews as well as walks through the photo sites were conducted with their respective farmers during which the history of management, land use and perceptions of landscape change were discussed. In addition, we interviewed several other farmers in the area about land degradation and land-use changes.

The use of repeat ground photographs and historical aerial photographs is prominent both in geographical and biological research, and is mostly used to demonstrate vegetation and landscape change (Bass 2004; Hudak and Wessman 1998). Repeat ground photography combined with repeat aerial photographs, have clear advantages when detecting landscape changes as they show the changing state of vegetation cover and species composition over time. As memory may be selective or uncertain, even among the people who have lived on and managed these farms, the photographs can be used to elicit memories by providing a factual record of the physical changes that have taken place.



In this study we encountered challenges in the interpretation of the ground photographs partly due to the difference in season of the matched images. All of the original photographs were taken in September 1939 during a spectacular flower season, whereas the repeat photos were, for practical reasons, taken in March 2005 towards the end of a hot dry summer. This visual impression of change was potentially misleading and for those untrained in interpreting vegetation change from photographs the discrepancy in time of year and difference between seasons is quite problematic. The interviews were to a certain extent also marked by this effect in that some of the interviewees referred to the lack of flowers in the later photos as evidence of degradation.

There are also other fundamental challenges in the use of repeat photography. Used uncritically, repeat photography with only two photographs imply a linear change from one point in time to the next. This is problematic in an area where the climatic variability and subsequently the inter-seasonal vegetation changes are considerable, and may contribute to a skewed interpretation of change particularly with regard to the annual component of the vegetation. In a time span of more than 60 years, and with large variations in rainfall, it is possible that several stages of vegetation change have occurred. Change may have been abrupt or gradual, and trends may have been in different directions. We deal with this challenge by complementing the ground photos with a series of aerial photos taken at different points of time, as well as with in-depth interviews with farmers and archival data.

## Results

### *The Concordia communal area farms*

The three Concordia communal farmers who tenant Bloubank, Vriesklip North and Vriesklip South were each interviewed four, two and three times respectively between November 2005 and March 2006. They have herds ranging from 190 to more than 300 animals which they keep on their farms for part of the year and in the communal grazing areas during the remainder. All three, and their fathers and grandfathers before them, have ploughed parts of their farms, predominantly the sandy pediments. The soils are nutrient rich, and have higher moisture content due to runoff from adjacent hills. Parts of the farms have been ploughed more or less continuously for decades, however this has virtually ceased during the last decade because farmers now feel that the costs outweigh the benefits due in part to the high cost of seed and the low value of wheat and oats.

All three farmers have fenced the perimeters of their farms during the last three decades, and they all have 'camps' (paddocks) within their farms in order to protect their grazing resource from other farmers' livestock. This is somewhat unusual in Concordia, as relatively few farmers have erected perimeter fences or internal camps (Benjaminsen and Sjaastad, 2008). Paul Saal from Vriesklip North fenced the area depicted in Figure 5 about four years prior to the repeat, resulting in renewed grass cover. He avoids grazing during the ripening periods, in order to let the grass set seed before it is eaten and he can see a great difference from his farm to the adjacent farms that are not fenced. The two other farmers have not noticed much change in the quality of their grazing areas yet. However, since the fences were erected only a few

years before the interviews, the land may still need more time to regain vegetation cover and species richness.

The repeat photographs elicited comments by all three Concordia farmers, many of which focused on the changes in the spring flower cover. Piet Cloete (Bloubank) remarked that he had not seen such splendid flower scenes (Figures 3 and 4) since 1957. He remembered all the best flower seasons since then, accurately recounting the years of high rainfall. He maintained that today, the rains tend to start earlier, in June and July, and the flower seasons are not as dense and spectacular: the veld is much barer now.

Memories of the landscape as having more water for the animals and more spectacular flower seasons are explained by the farmers with reference to rainfall:

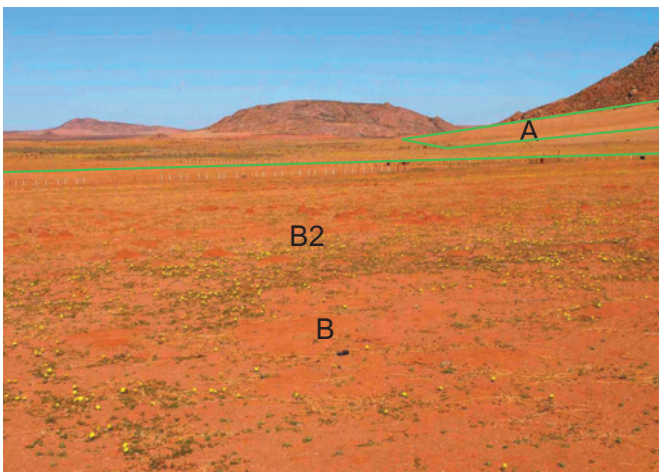
It only depends on the rain [Dit hang net af die reen]. It can still become like the photograph from 1939 again sometimes, but then we must get more rain. Sometimes we can lose courage in March when it looks like this, but then comes the rain, and in June/July everything is changed. There was more rain in the old days. Now the rainfall is pathetic, it is weak. The plants will grow when they get rain, but the rainfall is the problem. There is a big difference here between the photographs, but it is because of the rainfall (Interview with Paultjie Saal with reference to Figure 6, January, 2006).

While claiming that the land has changed very little in their life-time, farmers often referred to the rain as a driving force in vegetation cover. Although rainfall figures do not indicate a decrease in long-term rainfall (Hoffman *et al.*, 2009), this quote may support the notion that the vegetation in the area responds closely to rainfall. We have discounted the effects of long-term rainfall patterns from our analysis. Rainfall data from Springbok reveals a significant point of change around 1925 when precipitation declined from the previous 50 years (Hoffman, unpublished data), however, the long-term rainfall trend has in fact increased slightly since then (see Figure 10). The trendline for Steinkopf, the nearest long-term weather station to the north of the Concordia study sites, is flat since 1900.

### *Bloubank*

The communal farm of Bloubank (Figures 3 and 4) was leased by Piet Cloete's father in the 1940s. It is likely that the farm had been abandoned by the previous lease-holder as a consequence of the droughts in the 1930s, when many farmers emigrated to find work in the mines or in other towns. The area depicted by the photographs was previously more heavily populated, but as neighbours died or for some reason stopped farming, Cloete assimilated these areas and today the farm is about 300 hectares making it one of the biggest in Concordia. The repeat ground photographs from Bloubank farm (Figures 3 and 4) reveal very few changes between 1939 and 2005. The repeat photographs tell a story of a stable environment, where the vegetation has changed only slightly. This is confirmed by the aerial photographs from the same area, which also show few changes throughout their sequence spanning 45 years.

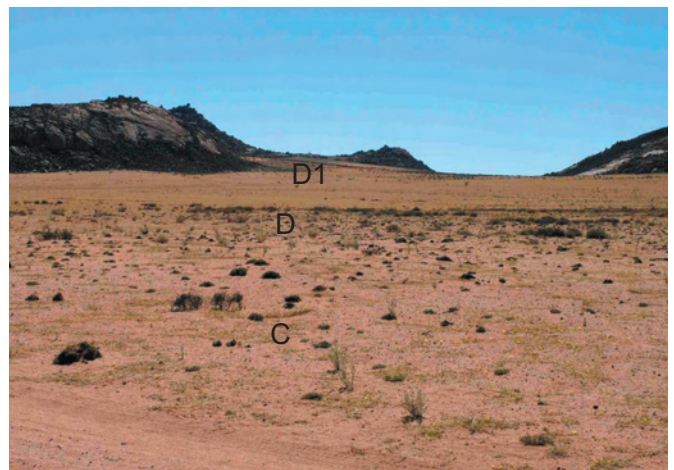
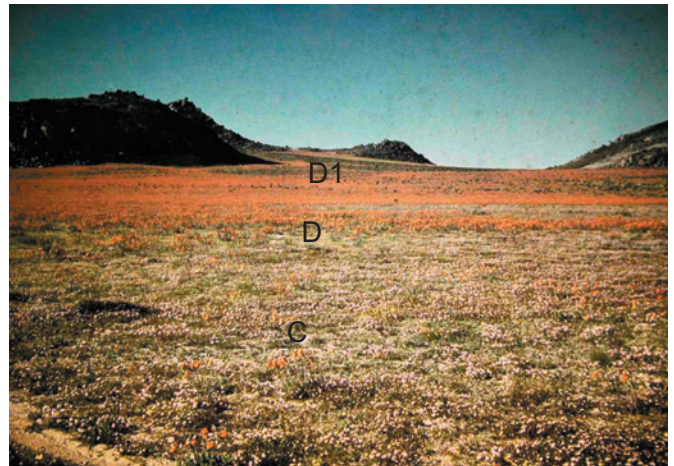
Figure 3: Bloubank Farm looking west. The area is fenced at the perimeters, and internally into small camps. Apart from the few months during high rainfall years when annuals are abundant, this landscape provides very little in the way of grazing potential. The region at the foot of the right koppie (A) is a mobile dune of wind blown sand and has no agricultural value. Area B was cropped until 1996 and as a result the foreground is composed entirely of annuals, such as unpalatable *Tribulus pterophorus* (10%) with no perennials (total cover = 11%). The midground (B2) has not been ploughed since 1996 and is dominated by *Cladoraphus spinosa* (15%) and *Stipagrostis ciliata* (2%) that has expanded somewhat since 1939 and *T. pterophorus* (4%). *S. ciliata* tufts have been heavily grazed but have responded to recent rains – a few flower heads are in evidence. Total cover = 22 % (Original photo by Hans Herre, September 1939; repeat photo by Rohde and Hoffman 23 March 2005.)



Cloete remarked: “In the old days, part of this area (Figure 3) was full of bushes. The farmers removed the bushes to make kraals and use for firewood in the 30’s and 40’s.” In the years following the removal of the bushes, Cloete and his father ploughed the left two thirds of the foreground (B), sowing oats, wheat and rye. It has been ploughed more or less continuously for as long as Cloete can remember, until he stopped in 1996. Only some parts were ploughed in any one season, and then new parts would be ploughed next season. This area is dominated by annuals such as *Tribulus pterophorus*, an agriculturally useless (even toxic) ‘pioneer species’, which thrives on disturbed ground, indicating that the area has either been cultivated or grazed for a protracted period of time. The dune at the foot of the koppie (A) has never been ploughed as it is considered too windy by the farmers.

Figure 4: Looking east from a site 0.8 km south of previous site. The site has never been ploughed but has been fenced into camps. Today it is dominated by annuals, and few perennials are present.

Foreground (C) is dominated by annuals such as *Tribulus pterophorus* (5%). Total cover = 15%. Mid-ground (D) now has a number of *S. ciliata* tufts (basal cover 5-10%). Distant pediment (D1) is dominated by *Cladoraphus spinosa* on sand dunes. (Original photo by Hans Herre, September 1939; repeat photo by Hoffman and Rohde 23 March 2005.)



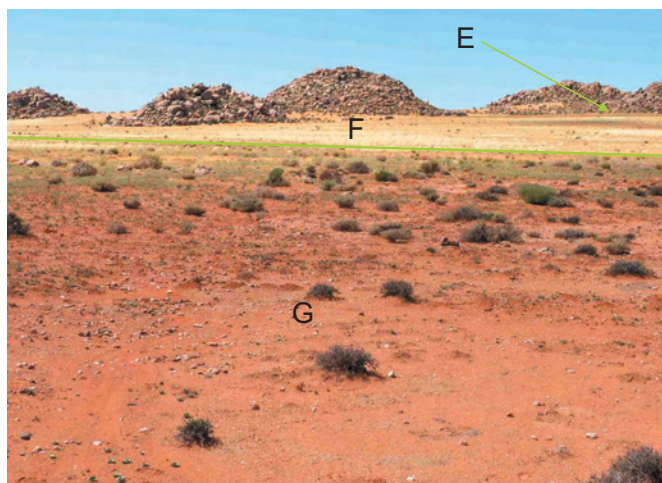
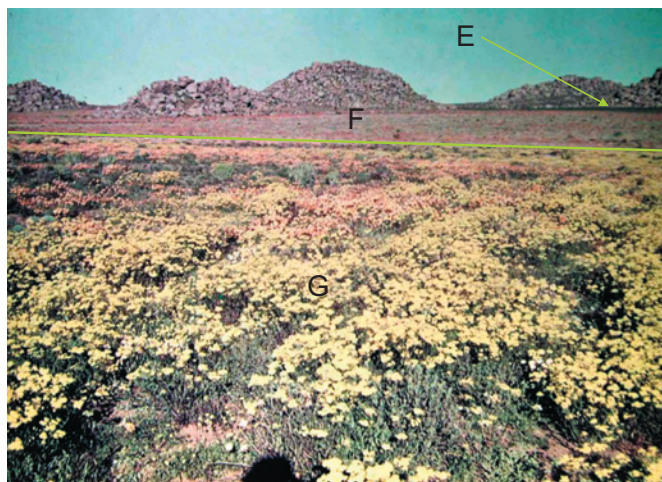
The second set of repeat images from Bloubank were taken less than a kilometre from the location of Figure 3, looking in the opposite direction (east). Piet Cloete remarked that only the upper part in the photo had been ploughed (D1), whereas the foreground (C and D) has not. This corresponds with the evidence from the repeat aerial photographs. The vegetation in the background (D1) has changed from what may have been palatable *Ruschia* spp. in 1939 to barer ground with areas of *Stipagrostis ciliata* and *Cladoraphus spinosa* in 2005. Evidence from this site indicates that a combination of cultivation and high grazing pressure favours annuals and that intermittent cultivation makes the regeneration of perennials impossible.

#### *The communal farms of Vriesklip North and South*

Figures 5, 6 and 7 depict the two adjacent farms of Vriesklip North and Vriesklip South viewed from the main track north from Concordia village. These farms belong to two cousins whose common grandfather was a relatively wealthy farmer at the beginning of the 20th century and who managed an area that comprises at least six farms today. At that time ‘the whole area from Springbok to the Bushmanland’ (i.e. the

whole of Concordia and O'Okiep) was divided between five large extended families. Their grandfather had thousands of sheep, and the family stayed on the farm all year round. At that time cows were kept in the communal grazing area to the north of the leased farmlands and there were hardly any cattle at Vriesklip apart from a few milking cows. In the 1940s he subdivided his farm between his sons. One of his sons kept about three hundred sheep and twenty cattle. Up until the 1960s the sheep and the draught animals stayed on the farm all year, the cows stayed in another grazing area. Later, one of the sons (Bennie Saal's father) subdivided his farm in two between his two sons.

Figure 5: Looking east at Vriesklip North. The area adjacent to the granite koppie (E) shows standing crops in the 1939 photo, and according to the farmer was cultivated until about 1985. The other areas have never been cropped. The grey patches in the original photo (F) suggest that the original grass cover in 1939 might have been *Stipagrostis brevifolia* interspersed with annuals. Also the presence of ungrazed *Hirpicium alienatum* (<1%) and *Tripteris sinuatum* (1%) indicates that the site has been rested in the last several years and the present grass cover shows no sign of having been grazed in 2005 (*S. ciliata* = 10%; *Galenia sarcophylla* = 10%; total cover = 30%). The *Euphorbia mauretanicum* in left foreground (G) shows no sign of either increase or decrease. The site is heavily disturbed by mole activity, which often accompanies grazed and cultivated sites. (Original photo by Hans Herre, September 1939; repeat photo by Rohde and Hoffman 23 March 2005.)



Vriesklip North (Figure 5) is dominated by annuals today and shows little change in vegetation cover between 1939

and 2005. The flower cover in the earlier photo seems to be of annual species only, which indicates that the area has been ploughed at an earlier stage. At the base of the koppie to the right (E) there is a cultivated area with standing crops, probably wheat. Correspondingly, the farmer, Paul Saal, confirms that they ploughed the area to the foot of the rocky outcrops until the mid 1980s. From the earlier photo it appears as though areas in the middle distance (F) are dominated by the perennial grass *Stipagrostis brevifolia* whereas today *Stipagrostis ciliata* is dominant, and although it provides somewhat less cover, it is more palatable and indicates a decline in grazing pressure. Saal has fenced this land recently, and tries to protect this part to some extent, which accounts for the ungrazed grasses and perennials. The rocky area in the left foreground (G) was previously dominated by shrubby perennials whereas today only the unpalatable *Euphorbia mauritanica* is still in evidence.

The aerial photographs confirm that there have been few major changes in vegetation cover in the period between 1958 and 2003. The lack of shrubs and other vegetation in all these aerial photos as well as the testimony of Paul Saal suggest that this area had been ploughed for a long period before the first ground photo was taken in 1939. It has also been used for grazing throughout this period. The major change can be inferred to have been from a perennial shrubland on the more shallow soils and perennial grasses on the deeper sandy pediments, to an annual-dominated flora which is comprised mostly of short-lived leaf succulent members of the family Aizoaceae, grasses with a few remaining perennial grass tufts.

Figure 6: Vriesklip South, fence-line contrast showing grazed (right) and ungrazed (left) camps. Ungrazed camp: *Stipogrostis ciliata* – 10%, *S. namaquensis* 15% cover; grazed camp: *S. ciliata* – <3%, *S. namaquensis* 15% cover. (Photo R. Rohde 23 March 2006)



The ploughed sandy pediment in Vriesklip South, approximately 0.8 km to the south of the site at Vriesklip North, makes an interesting case for the recruitment of annual and perennial grasses on a cultivated and grazed area (Figure 6). Today the area is dominated by *Stipagrostis ciliata*, *S. brevifolia* and *S. namaquensis*. The aerial photos show that this area was cultivated in the early 1970s and according to Bennie Saal, it was last ploughed in 1984. In the aerial photo of 1997 and 2003 we can clearly see a transformation in the ploughed area, as patches of vegetation (*Stipagrostis* spp.)

colonized the lower pediment that was ploughed more than 21 years previously. The area has changed considerably from the time of the latest aerial photograph (2003) when some cover is detectable and until March 2006 when a considerable cover of *Stipogrostis* spp. is visible from satellite imagery. This latter change can be attributed to increased rainfall, as there was a drought during 2002 and 2003 and above average rainfall in the following two years.

Figure 7: Vriesklip South, looking east over drainage area of shallow, stony soil and hard substrate, bordered to north and south by granite koppies surrounded by deep sandy pediments (see Fig. 6). Vegetation in the mid-ground (H) is dominated by *Ruschia robusta* (10%) *Galenia sarcophylla* (10%) *Tripteris sinuata* (2%) *Aptosimum spinescens* (1%). Total cover = 30%.



A large part of the Vriesklip South area is situated within broad rocky drainage habitats dominated by perennial shrubs (Figure 7). The foreground of the repeat photograph is a road verge now used for the transhumance of livestock to and from the communal grazing area to the north – hence the signs of trampling loss of vegetation on the near side of the fence.

Several factors may explain the changes in Vriesklip South farm as seen in the repeat photographs. Firstly, the area has never been ploughed, although aerial photographs do show that stockposts and kraals were sited in this area during the last 50 years. The farmer, Bennie Saal, contends that the palatable perennial shrub commonly known as Perslein (*Tetragonia fruticosa*) and the palatable annual herb Gousblom (probably *Dimorphotheca sinuata*) have always been common in the area. He suggests that the condition or composition of the veld has not altered from when his father was farming. Thus

there has been little or no change from a generation or two ago to what we find today. Secondly, Saal has introduced a camp system with frequent animal movements during the early spring and summer months. The vegetation in the camp seen in the middle distance area (H) was not heavily grazed in 2005 as evidenced by the good growth of palatable shrubs such as *Tripteris sinuata*, *Hirpicium alienatum*, *Hermannia cuneifolia* and *Tetragonia fruticosa*. The mid-ground *Stipagrostis namaquensis* in the ephemeral stream channel (hidden from view in mid-ground) further suggests low stocking rates, consistent with this farmer's erection of camp fences within the last five to eight years.

Despite the fact that this communal farm has been heavily grazed in the past, the diversity of palatable shrubs is relatively high. The vegetation is remarkably similar to that of the landscapes to the south, including the study site at Goegap Nature Reserve (Figure 9).

### *Smorgenskadu*

Smorgenskadu is a private commercial sheep farm in the summer/winter rainfall transition zone approximately 28 km due east of Concordia village. The owner of Smorgenskadu, Jan Kennedy, took over the farm in 1980, and is still an active farmer. His grandfather bought the title to the farm in 1919 and at that time his well was one of the few watering points for 30 km. The original photograph (Figure 8) was taken within a kilometre of the old well where the surrounding area had been trampled by neighbouring and trekking animals daily for decades before the perimeter fences were erected in the 1940s. Subsequently, this area continued to be subjected to considerable trampling and animal movements as this was the only source of water on the farm, until new water points were drilled in the 1950s and 1960s. At about the same time, Jan Kennedy's father received support from the government to put up camp fences. This made the management of the veld a lot easier as they no longer needed herders for each flock of animals. In addition, the new watering points combined with camp fencing distributed the grazing pressure more evenly around the property allowing for a lower stocking rate within this intensively used area. The area has never been ploughed.

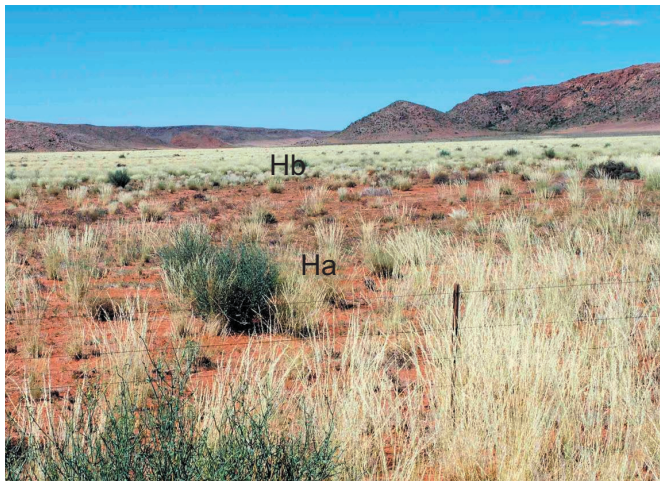
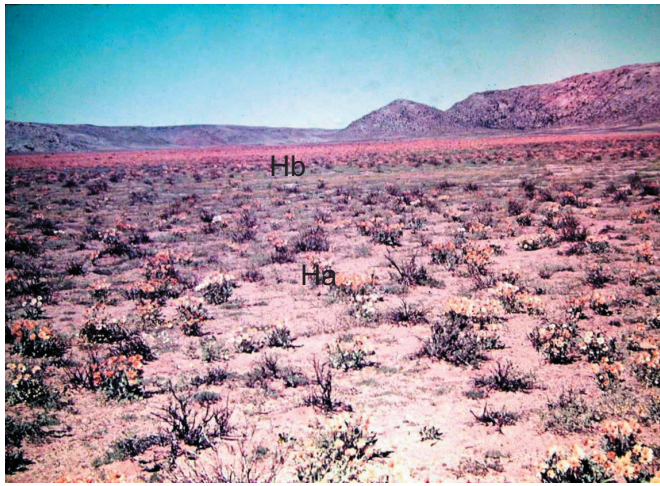


Figure 8: The private commercial farm Smorgenskadu. The shrubs in the foreground (Ha) in 1939 (probably *Ruschia robusta* or *Monechma incanum*) have been replaced with *Stipagrostis brevifolia* and *S. ciliata* interspersed with *Sisymbrium spartea* (1%) and *M. incanum* (<1%). The area mid-ground in the original photo (Area Hb) showed bare ground dominated by annuals with few perennial plants. In 2005 this area has been transformed with the recruitment of *S. brevifolia* (20%), *S. obtusa* (10%) and *S. ciliata* (1%) Total cover = 35%. (Original photo by Hans Herre, September 1939; repeat photo by Rohde and Hoffman 20 March 2005.)

The photo site looks due south from a very slightly raised pediment derived from the outwash of a nearby quartzite mountain. It overlooks a shallow floodplain of somewhat finer red sandy flats and a distant granite ridge. These three substrate divisions correspond with distinct vegetation transitions. This area has changed considerably since 1963, and Jan Kennedy attributes the overall increase in grass cover in the 2005 photo to the reduced stocking rate since 1980. However, the succulent shrubs (probably *Ruschia* spp.) in the 1939 foreground (Ha) have not reappeared. Furthermore, the distinct difference in the 1939 photograph between the vegetation of the bare penneplain in the middle distance (Hb) and that of the raised pediment at the base of the ridge in the far distance is a clear reflection of differences in soil properties. The middle distance site is comprised of looser, coarser and deeper sandy soil while in the distance where the dwarf leaf succulent shrub *Ruschia muricata* dominates, the substrate is finer, harder and more compact. The most remarkable change however is the transformation from

the dominance of annuals and leaf succulent perennial shrubs (probably *Ruschia robusta*) to perennial grass species on the penneplain (Hb) comprised in 2005 of *Stipagrostis brevifolia* (20%), *S. obtusa* (10%) and *S. ciliata* (1%).

### Goegap

The evidence from Goegap Nature Reserve (Figure 9) is indicative of the time scales necessary for vegetation in environments dominated by succulent and deciduous perennials regain cover and species richness. The study site, which is 20 km due south of Vriesklip and Bloubank, was used for grazing until the first phase of the reserve (then Hester Malan Nature Reserve) was fenced in 1969 and turned into a conservation area. The reserve comprises an area of 14, 856 hectares and was established with the goal of protecting biodiversity (Republic of South Africa, 2005). This site was grazed by neighbouring farmers until the owners (a local copper mine) donated it to the conservation initiative. The repeat photographs show a remarkable change both in vegetation cover and species composition.

Figure 9: Goegap Nature Reserve. Since game fences were erected in 1969 there has been no livestock grazing. In the foreground (J) cover has changed increased considerably: *Ruschia robusta* (10%); *Cheiridopsis denticulata* (10%) *Tripteris sinuata* (4%), *Leipoldtia schulzei* (2%), *Hirpicium alienatum* (2%). Midground (K) is now dominated by *Galenia sarcophylla* (25%) and *Drosanthemum hispidum* (4%). Total cover of areas J and K = 35%. The apron at the base of the koppie (L) is dominated by *Leipoldtia schulzei* (10%) *G. sarcophylla* (4%) and *Ruschia robusta* (2%). (Original photo by Hans Herre, September 1939; repeat photo by Rohde and Hoffman 22 March 2005.)



In the foreground (J) the perennial, leaf succulent shrub, *Ruschia robusta* is significantly more abundant and more widely dispersed in 2005 than in 1939. Increased cover of perennial succulents and palatable non-succulent shrubs such as the palatable *Tripteris sinuata*, which are large and outgrown, indicate very low herbivory. In the mid-ground (K), the vegetation has thickened and in the middle distance (L), what seems to be old cropland has thickened and is now dominated by the annual *Galenia sarcophylla* and relatively unpalatable short-lived shrubs like *Drostanthemum hispidum*. This trend towards more cover is supported by the aerial photographs. Such changes, after 36 years of protection, indicate the time frame necessary for a diverse, palatable mix of perennial shrubs to regenerate under conditions of livestock exclusion and very low wildlife herbivory.

### Discussion

This paper is unique in that it studies the consequences of land use on vegetation over a 66 year period, within various agrarian landscapes close to the winter/summer rainfall ecotone in northern Namaqualand. Previous studies of landscape change in Namaqualand (Hoffman and Rohde 2007; Rohde and Hoffman 2008) have focused on vegetation surveys of rocky slopes and sandy bottomlands in the Kamiesberg (Todd and Hoffman 1999; Anderson and Hoffman 2007), which have strikingly different ecological character to the patchy ecotone vegetation communities in the vicinity of Concordia. The Kamiesberg experiences higher and more stable rainfall and the vegetation is dominated by succulent and non-succulent shrub species (Anderson and Hoffman, 2007). Vegetation in the Concordia region is dominated by a patchwork of grasses characteristic of sandy substrates of the Nama-karoo biome summer rainfall areas to the east, and shrublands, which tend to dominate shallow soils on rocky substrates characteristic of the Succulent Karoo biome to the west and south. In many of our study sites, species from these two biomes co-exist in a patchwork of vegetation communities largely determined by substrate conditions (Shiponeni, 2008).

This study illustrates the variety of factors that contribute to vegetation change over time. Land-use practices have not been static over the course of the 20th century - cultivation, livestock grazing and conservation have had important consequences with regard to landscape change in Namaqualand (Hoffman and Rohde, 2007). Cultivation has declined in both commercial and communal areas since 1970, especially in more marginal areas where it is no longer economically viable. The result has been the widespread re-establishment of perennial vegetation on once barren or fallow croplands. Livestock numbers have also fallen by up to 30% since 1960 reflecting a trend in stock reduction on commercial private farms (Hoffman and Rohde, 2007), whereas communal farmers have tended to maintain relatively high numbers of animals over long time periods (Benjaminsen *et al.*, 2006). These changes in land-use, coupled with a highly variable climate across an ecotonal gradient, result in a variety of vegetation responses. However, underlying this complexity are common trends that relate to three ecological processes:

1) *regeneration* of vegetation cover and diversity due to cessation of cultivation, reduced stocking rates or complete protection;

- 2) *ecotonal shifts* due to the combined impacts of climate change and land-use that result in the transformation of shrubland to grassland;
- 3) *stability* of cover and composition over decadal temporal and regional spatial scales under conditions of communal land-use impacts.

There are three interrelated sets of variables, apart from land-use, that further influence these general trends:

- 1) climate: winter/summer rainfall;
- 2) substrate: shallow rocky soil or deep sandy bottomlands and pediments;
- 3) vegetation type: Nama-karoo (grassy shrublands) or Succulent Karoo (leaf succulent shrublands) biomes.

There is no doubt that cultivation transforms natural habitats. Change from this transformed state depends on many factors including time since the area was last ploughed, soil fertility, climate and surrounding vegetation type. Transformation after cultivation is far more rapid in grasslands than in Namaqualand's perennial shrublands, largely due to the seed dispersal mechanisms and seed bank longevity of the dominant grass species in the region. An increase in vegetation cover after prolonged heavy grazing is probably more rapid in grasslands although our findings indicate that shrublands also increase in cover more quickly than previous estimates (Dean and Milton, 1999) under near total protection. We also speculate that the transformation of the ecotonal bottomlands to the east of Concordia from shrubland to grassland has taken place as a result of the reduction in stocking rates after prolonged heavy grazing combined with a possible slight westward shift in the summer rainfall climatic zone. However, in spite of these changes and transformations, we find a significant level of stability in terms of vegetation composition and cover over larger spatial and temporal scales, especially in the communal farmlands. The following discussion provides more detail to these findings.

#### *Cultivation and transformation - grasslands*

There is little doubt that cultivation has had a marked impact on the communal landscapes of Concordia, particularly in the late 19th and early 20th centuries. Although cultivation was introduced by the missionaries of the mid-19th century, the division of the Concordia commons into leased croplands (saaipersele) was most pronounced during the early 20th century (Benjaminsen and Sjaastad 2008). Our photographs of communal croplands (Figs.3 & 5) reveal only minor changes in perennial vegetation cover in the time span from 1939 until today. This suggests that the most dramatic transformation of this area took place before 1939 and possibly more than 100 years ago when these sandy pediments, ideal for cultivation, were probably dominated by perennial grasses and Nama-karoo shrubs. Today, however, these areas have a sparse and variable cover of annual grasses, herbs and leaf succulent shrubs.

The existence of Hans Herre's photographs is almost certainly due to the fact that in October 1939 this landscape was covered in a profusion of colourful annual leaf succulents as a result of one good winter rainy season. However, during periods of increased summer rainfall, with the cessation of cultivation, these areas now show a significant increase in annual and perennial grasses in part due to the long-lived seed banks of grasses particularly within the genus *Stipagrostis* (Skinner,

1964) and their ability to disperse over large distances. This trend indicates that the area has not lost its ability to transform or regenerate to grassland under the right circumstances even after a century of cultivation and grazing.

#### *Cultivation and transformation – shrublands*

Apart from one area in the Goegab site (Figure 9), this study did not incorporate any cultivated shrublands. From aerial photographic evidence coupled to the repeat ground photographs of the Goegab site, it is likely that a cropland was in use here before and after 1939 (Figure 9, mid-ground). By 2005 this area had been colonised by the annual *Galenia sarcophylla* and relatively unpalatable perennial shrubs like *Drostanthemum hispidum*. These species are considered indicators of previous cultivation or heavy disturbance and their presence in this protected area after 40 years is a demonstration of the long time scales necessary to overcome the impact of ploughing on soil structure and fertility (Allsopp, 1999).

#### *Grazing and transformation – grasslands*

In areas with no history of cultivation, where we can compare the response of grasslands to different management regimes, we find a direct correlation between the histories of stocking rates, rainfall and grass cover. This can be observed when we compare change over time at the same site (Figure 5), when we compare camps within the communal area (Figure 6) and when we compare the communal and commercial grazing sites (Figure 5 and Figure 8). Although we are unable to distinguish the relative influence of climate and rainfall on observed changes in grasslands, we can show that both factors are instrumental. The high coefficient of variation of rainfall, coupled with different stocking regimes results in varying degrees of response by grasses in the sandy pediments and plains of the communal and commercial farms.

#### *Grazing and transformation- shrublands*

Recent analysis of Succulent Karoo biome vegetation communities in Namaqualand suggests that heavy grazing over periods of several decades influences plant species composition resulting in a reduction of palatable perennials, an increase in annual species and a reduction in cover (Anderson and Hoffman, 2007). When we compare the photos of shrublands in communal areas (Figure 7) with those in a protected area (Figure 9), we find that a previously heavily-grazed area, where livestock have been excluded for 36 years, displays a remarkable increase in vegetation cover and species composition. There can be no doubt that the area in question was heavily used in 1939 and the vegetation survey carried out in 2005 shows that species typical of the ecotonal transition between the Namaqualand Rocky Hills and Bushmanland have reappeared. Meanwhile, the communal shrubland of Vriesklip South, under heavy stocking rates over a long time-frame retains the basic species composition typical of this vegetation community, although it has relatively less overall cover and perennial species diversity compared to the Goegab site.

#### *Grazing land and ecotonal change*

The temporal scale associated with the regeneration of the Goegab shrublands is similar to what we observe in the grasslands to the east. Here, ecotonal change is related to land-use impacts and changing patterns of summer rainfall over similar time scales. The reduction of perennial shrubs

in the foreground of Figure 8 on the commercial farm of Smorgenskadu took place up until about 1960 when *Ruschia robusta* and possibly *Monechma spp.* were trampled and grazed almost to extinction by livestock. Subsequent to fencing and reduced stocking rates over the last 50 years this slightly raised outwash which previously supported succulent and deciduous shrubs is now dominated by palatable grasses, although there are also many new recruits of *Sisymbrium spartea*, a highly palatable shrub. This change in species composition can only be explained in conjunction with an increase in the summer rainfall as reflected in the records of the nearest summer rainfall weather stations. These show a significant increase in precipitation during the second half of the 20th century (MacKellar *et al.*, 2007). The shift in vegetation type from shrubs to grasses in Smorgenskadu is a dramatic illustration of the transformations which can take place in ecotonal landscapes due to slight shifts in climatic patterns combined with rest from grazing (Pogue and Schnell, 2001).

#### *Stability, change and scale*

The story of landscape change in Namaqualand indicates that a major decline in vegetation cover and species composition in the communal areas took place before 1939, and since then has remained remarkably stable. Such stability may be interpreted in different ways. On the basis of our findings we suggest that the communal farming areas we have analyzed are in a stable state, and neither vegetation cover nor composition has changed significantly since 1939. We hypothesise that this landscape represents a classic case of ‘state and transition’ (Milton and Hoffman, 1994), with the transition having taken place over 100 years ago and stability in vegetation cover and composition maintained since then.

Within short time-frames (less than 10 years), vegetation cover follows climatic variations as do livestock numbers (Benjaminsen *et al.*, 2006), due to the opportunistic management of the farmers in Concordia, in common with communal farmers elsewhere in Namaqualand (Berzborn, 2007; Hoffman and Rohde, 2007; Rohde and Hoffman, 2008). Despite these fluctuations, livestock numbers in Concordia show that secondary productivity has been sustained from the 1920s until today, suggesting that communal livestock keepers are not experiencing deterioration of their resource base, although they are more at risk of stock losses during periods of drought than their commercial counterparts who practice conservative stocking rates (Gillson and Hoffman, 2007; Richardson *et al.*, 2005).

The inherent limitations to repeat ground photographs are that they provide only a small sample of the regional landscape. Our analysis offset this limitation to some extent through the use of repeat aerial photos of the region. These confirm what we see on the ground: the rocky unploughed areas have maintained a permanent population density of perennial shrubs while the sandy pediments have remained subject to short-term climatic fluctuations resulting in either lush displays of annual flowers in the early spring, or sparse annual and perennial grasses (*Stipagrostis spp.*) in the summer.

At the Goegab Nature Reserve we find a classic example of Clementian succession (Tainton and Hardy, 1999) following intensive agricultural activity and rest. We show that the change in a predominantly Succulent Karoo biome vegetation community, from a highly impacted state to one that reflects

the area's biophysical potential for species diversity and cover, was achieved within thirty years. At the opposite extreme, within less than 30 km to the east of Concordia and Goegab, we find an example of a threshold mechanism in a non-equilibrium environment (Gillson and Hoffman, 2007), driven by ecotonal forces of summer and winter rainfall variations coupled with land-use pressures that gives a competitive edge to either shrubs or grasses.

### Conclusion

We believe that this paper presents compelling evidence of the complex impacts of land-use and climate across the Namaqualand/ Bushmanland ecotone. One of the most important insights into the environmental history of the area concerns the long-term stability of the communal farming landscapes of Concordia. Also, the fact that these so-called degraded communal areas still show a potential to transform to a vegetation state that includes greater cover and more diversity is highly significant. Finally, the highly variable patterns of change and stability described above – the interlocking elements of soils, climate and vegetation type coupled with land-use – are perhaps best described as 'complex dynamics' where the idea from chaos theory of a 'moving attractor' provides the best theoretical model for the evidence we find in our repeat photographs (Gillson and Hoffman, 2009). Computer simulations of these variables within this environment predict similar outcomes (Hahn *et al.*, 2005). The evidence presented here comprises empirical support for these theoretical simulations. Such evidence-based environmental history research is able to provide the temporal and spatial scale necessary to understanding the complex relationship between humans and their environments.

### ENDNOTES

<sup>1</sup> These photographs are part of a collection of over 200 repeat images of Namaqualand now in the collection of the Plant Conservation Unit at the University of Cape Town. See Hoffman and Rohde 2007; Rohde & Hoffman 2008 for more details and an overall analysis of land-use and land-cover change in Namaqualand during the 20th century.

<sup>2</sup> Interview with Bennie Saal, March 15 2006.

<sup>3</sup> Interview with Kennedy in the neighbouring farm, February 2006.

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## **Paper II:**

Why is the notion of 'carrying capacity' so persistent in rangeland management? A study of a planning process in South Africa



# Why is the notion of ‘carrying capacity’ so persistent in rangeland management? A study of a planning process in South Africa

By MSc Eirin Hongslo

## **Abstract**

‘Carrying capacity’, as used in rangeland management, has been debated for more than three decades. Notwithstanding the ongoing debate, carrying capacity and stock limitations are treated as straightforward technical policy tools in many countries. In a planning process that was part of land reform in Namaqualand, South Africa, project reports show how the facilitators, from the very beginning of the process, defined communal rangelands as ‘overgrazed’ on the basis of transgressions of recommended carrying capacities. The co-production of knowledge and policy represented the relationship between rangelands and farmers as technical and numerical. Such narrow and technical definitions laid the foundation for new grazing regulations and management plans. The technical and numerical nature of carrying capacity also created opportunities for change in power structure as the facilitators of land reform employed carrying capacity values to argue for more communal land and radical changes in power structures. Thus, the numerical and technical nature of carrying capacity served to legitimize both technical and political claims, which may explain its persistence in rangeland policy in South Africa.

Keywords: Carrying capacity, stock limitations, dryland ecology, South Africa, Namaqualand, political ecology.

## 1. Introduction

Warnings of degradation in communally-managed rangeland areas have been common during the past 100 years. In Africa, colonial governments warned against degradation in pastoralist communities in the early 19<sup>th</sup> century (Beinart 1996), warnings which were reiterated through development interventions in the 20<sup>th</sup> century (Homewood and Rodgers 1987, Homewood 2004, Rohde et al. 2006). In the northern hemisphere, Sámi reindeer herders have, for instance, been blamed for the degradation of the commons in northern Norway since the 18<sup>th</sup> century (Benjaminsen and Svarstad 2010). The logic of these degradation ‘narratives’ was famously captured by Garrett Hardin in his essay ‘The Tragedy of the Commons’ (1968). Hardin’s essay has been widely critiqued in scientific literature (e.g. Ostrom 1990), but its logic prevails in rangeland policies worldwide.

Pertaining to rangeland management, the concept of ‘carrying capacity’ is part of a wider management model known as “the rangeland succession model”. This model is based on private ownership of large tracts of land, divided in an orderly way into paddocks that are grazed in rotation (Benjaminsen et al. 2006, Rohde et al. 2006). The model has been questioned since its inception and has been hotly debated since the 1980s (Homewood and Rodgers 1987, Scoones 1989, Westoby et al. 1989, Turner 1993, Benjaminsen 1997, Rohde et al. 2006, Wolmer 2007).

Stocking limitations and destocking have been prescribed in numerous rangelands and pastoral areas worldwide. In Norway, stock limitations were introduced in Sámi reindeer herding areas in the 1980s (Ims and Kosmo 2001) and were re-enforced in 2002 (Joks et al. 2007). In Australia, the parliament has given overseeing boards the power to demand management plans for all public lands and to impose stock reductions where they deem it necessary. However, only one Australian province (South Australia) has enforced such policies (Tal 2009). In the US, several acts, in particular the Taylor Grazing Act, have granted the federal government authority to regulate stocking rates on federal grazing land (Borman and Johnson 1990, Tal 2009). Stock limitation policies have, for the most part, remained dormant in the US (Tal 2009). Israel’s stock limitation policies on public lands have been fairly consistently enforced and the number of stock has remained stable (Tal 2009). In China, the authority to control grazing is vested in local

governments, and includes adjusting the composition of herds, rotational grazing, restoration of degraded rangeland, and measures for the prevention of degradation (Tal 2009).

In Africa, the rangeland succession model has informed rangeland policies for a century (Scoones 1989, Behnke and Scoones 1992, Scoones et al. 1993, Archer 2002, Benjaminsen et al. 2006, Rohde et al. 2006). However, few if any of the destocking schemes and grazing control policies have been successfully implemented. Several schemes were promoted by the Kenyan government from the 1930s onwards, but they were met with vehement resistance and were not successfully implemented (Fumagalli 1978, Little and Brokensha 1987, Mackenzie 2000). Similar failed attempts have been recorded in Botswana (Abel and Blaikie 1989, Rohde et al. 2006), Tanzania (Kikula 1999, Benjaminsen et al. 2009), Lesotho (Ferguson 1994, Swallow and Bromley 1995, Rohde et al. 2006), Zimbabwe (Abel and Blaikie 1989, Scoones 1989) and Namibia (Tal 2009).

In South Africa, too, has seen perception of degradation in rangeland areas, and subsequent failed schemes has been recorded. Early reports on rangeland degradation in South Africa appeared during the 18<sup>th</sup> century and the Drought Commission Report of 1922-23 presented extensive data to consolidate the impression of South Africa as a future desert, threatened by drought, denudation and overstocking (Beinart 1996). The perception of rampant degradation continued through the inter-war years and concern spread from white commercial farms to African farming practices. The Desert Encroachment Committee of 1951 reiterated the conclusion of the Drought Commission Report and suggested stock limitation as a means of combating desertification ( Beinart 1996). In communally owned black and colored areas, ‘betterment plans’ introduced principles of rotational grazing and stock limitations from the 1930s onwards (de Wet 1995). Despite numerous policies, stock limitation measures were rarely enforced due to resistance on the ground (Hendricks 1989). Still, the models and their scientific assumptions continued to inform South African land policies (Benjaminsen et al. 2006, Rohde et al. 2006).

This article is based on the notion that knowledge and policies are produced as part of the same process (Goldman et al. 2011). Therefore it is crucial to acknowledge how social and political factors affect knowledge production in order to “address the underlying biophysical causes of perceived environmental problems”(Forsyth 2003: 2). Similarly, as Forsyth points out, adopting

“policies based on such unreconstructed science” may produce science that “unfairly penalize many land users – especially in developing countries – and may even increase environmental degradation and poverty by threatening livelihoods”(Forsyth 2003: 2). This sentiment is echoed by Jasanoff (2004: 2) who claims that: “The ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it.” In other words, ordering nature, learning about nature, and conceptualizing nature happen in conjunction with the ordering of society. Policy processes, such as the introduction of carrying capacity in Namaqualand, are part of ordering society. Knowledge-making in this view “is incorporated into practices of state-making, or of governance more broadly” and, conversely, the “practices of government influence the making and use of knowledge” (Jasanoff 2004: 3). Goldman et al. (2011) likewise assert that knowledge is inherently political, and science and society are ‘co-produced’. How nature and the relationship between man and nature are conceptualized, valued and communicated is informed by scientific knowledge and at the same time informs knowledge. This does not mean that I believe rangeland degradation never occurs, but rather that one must take care in both the production and application of such research.

Li (2007) argues that policy makers, in both governments and development organizations, tend to organize and interpret local environmental problems in ways that render them technical, requiring technical solutions. These practices are part of an institutionalized routine, and “programs of intervention are pulled together from an existing repertoire, a matter of habit, accretion, and bricolage.” (Li 2007: 6). But what are these practices? Li (2007) identifies two key routine practices in the everyday life of programmers and policy makers. *Problematization* is the identification of “deficiencies that need to be rectified” (Li 2007: 7). *Rendering technical* denotes a whole set of practices that together represent the domain to be governed as a legible field with defined borders, and with it a set of techniques to improve the field identified. An important part of *problematization* is the ordering of governed areas into “an ‘intelligible field’ appropriate for intervention” (Li 2007:7). In the words of Scott (1998), this makes the governed areas ‘legible’. In their quest to create order, the modern state needs to invent invisible units (1998). These units, whatever they are, “must be organized in a manner that permits them to be identified, observed, recorded, counted, aggregated, and monitored” (Scott 1998: 183).

The processes of *problematization* and *rendering technical* are intimately linked. Problems are defined in ways that make them solvable using the techniques and tools that the government

body or the development organization has at hand. According to Li, “For the most part, experts tasked with improvement exclude the structure of political-economic relations from their diagnoses and prescriptions. They focus more on the capacities of the poor than on the practices through which one social group impoverishes another” (Li 2007: 7). Thus, problems are defined out as political rather than technical, in a similar way to the process described in Ferguson’s *Anti-Politics Machine* (Ferguson 1994). As both authors point out, this process is most often not deliberate: it is routine. The skill of experts resides in defining problems to entities that they can improve with the tools that they have (which are often technical, and less often socio-economic), and as Li points out, that is their job, and is not dubious in itself. An important argument in Ferguson and Li’s analyses is that the practice of *rendering technical* produces a side effect: it simultaneously renders the issues non-political, which is, in itself, a serious intervention (Ferguson 1994). This exclusion of politics “limits and shapes what improvement becomes” (Li 2007: 8).

This case study presents a planning process in which a complex social and ecological system was simplified and rendered technical, thus confirming Li’s (Li 2007) assumptions. As the paper will show, this case is interesting in that this technical rendition of the relationship between land and animals did not only have depoliticizing effects, it also challenged the establishment. The article starts by discussing the concept of carrying capacity as a scientific concept and management tool. I then present the study area before analyzing three project reports written by the local branch of the Department of Agriculture and an NGO that facilitated land reform locally. Together these three projects encompass a near ten year long planning process in Namaqualand communal areas and reveal how co-production of knowledge and state-making may take different forms.

## **2. Carrying capacity as an idea, scientific concept and management tool**

Different definitions of carrying capacity are in use in rangeland science and the concept is used for many purposes and at different geographical scales (MacNab 1985, Sayre 2008). In a strict ecological sense, the carrying capacity of an area is “the number of individuals beyond which no major increase in population size can occur without an improvement in habitat or resources” (Bartels et al. 1993: 92), a definition which corresponds to what Caughley (1979) termed ‘ecological carrying capacity’. Definitions applied in rangeland management describe carrying



capacity as “the maximum stocking rate possible without inducing damage to vegetation or related resources” (Roe 1997: 467), or “the population that can be sustained by the resources which the animals use within a particular area” (Bartels et al. 1993: 90). With few exceptions, writers on rangeland management operate with carrying capacity estimates that are thought to be valid over a broad geographical scale and over long time periods (Bartels et al. 1993). The dominant approach “focuses on management of the stocking rate to maintain high animal production per unit area, and protect the range resource from overgrazing” (Bartels et al. 1993: 99).

From a biological point of view, the validity of ecological carrying capacity is premised on a causal relationship between stocking rate and fodder productivity as well as ‘stasis in nature’ (Sayre 2008). The rangeland succession theory, first introduced by Clements in 1916, assumes a tendency in nature to develop in succession towards a natural climax (Schoones 1996). The succession may be slowed, or even counteracted, by disturbances such as fire, grazing, drought or natural disaster. After such episodes, vegetation continues to develop in the direction of the climax, and the dynamic between succession and disturbance creates a back-and-forth cycle. Thus heavy grazing is seen as a disturbance that causes degradation, while reducing stocking rates leads to the improvement of range conditions (Bartels et al. 1993, Danckwerts et al. 1993). Whereas most disturbances are beyond human control, stocking rate can be fairly easily controlled and is thus considered to be the main tool in rangeland management (Westoby et al. 1989, Bartels et al. 1993, Danckwerts et al. 1993). Grazing pressure is thought to have the same influence on vegetation as natural disturbances like drought or erosion. By adjusting stocking rates in accordance with other disturbances, rangeland managers can maintain a constant level of disturbance and keep vegetation and stocking rates in equilibrium (Westoby et al. 1989).

There are two main criticisms of equilibrium theory and the associated concept of carrying capacity. Firstly, the very assumption of equilibrium in nature has been widely and forcefully criticized. Westoby et al. (1989) argue that rangelands do not develop gradually from colonizer to climax-community, but rather change discontinuously, and sometimes irreversibly and inconsistently. After transitions, an area may stay in a stable state for years or decades before some external event, or sequence of events, causes a new transition (known as the state and transition model). Non-equilibrium models emphasize stochastic and climatic events, rather than grazing pressure, as drivers for change in plant production (Ellis and Swift 1988, Westoby et al.

1989, Friedel 1991, Laycock 1991, Sullivan and Rohde 2002). Others argue that equilibrium and non-equilibrium are not mutually exclusive, but must be understood as a continuum – both dynamics may be found in any one place (Wiens 1984, Sullivan and Rohde 2002).

Secondly, the use of officially recommended carrying capacity as a means to determine degradation has met considerable criticism. Turner (1993) warns that such a definition of degradation overstates the biological causes of degradation at the expense of social causes. Others have warned that such a perspective unduly blames pastoralists for rangeland degradation (Homewood and Rodgers 1987, Vetter 2005). It has also been commented that optimal stocking rates are highly dependent on economic conditions and management goals, and that officially estimated carrying capacity values created for one set of conditions may be irrelevant for the conditions in which they are applied (Benjaminsen et al. 2006). Pastoralists often migrate over long distances and restock and destock according to climatic variations (Caughley 1979, Scoones 1989, Scoones et al. 1993). The carrying capacity values applied by governments tend to ignore the economic objectives of pastoralists. Pastoralists often depend on their stock for many of their livelihood needs, such as the availability of cash, milk, meat and ‘storing of capital’, which means that a range of considerations influences herd size (Scoones 1989). In recognition of this argument, Caughley (1979) introduced the notion of ‘economic carrying capacity’ which denotes an equilibrium held in place by human management. Caughley asserts that a number of different economic capacities are imaginable for any area, depending on the management goals of the system. In many African pastoral systems, the economic carrying capacity is much higher than ecological carrying capacity because production is oriented towards both subsistence and wealth accumulation (Caughley 1979, Scoones 1989, Sullivan and Rohde 2002).

### **3. Farming and rangelands in Namaqualand and Concordia**

Communal areas in Namaqualand (and the rest of South Africa) differ from communal areas found elsewhere in Africa and the rest of the world. Historically in Namaqualand, both colored and white farmers trekked with their animals over large distances. Supported by colonial and apartheid land policies, white farmers settled down and gradually fenced their farms (Boonzaier et al. 1996, Archer 2002, Rohde et al. 2006), and from the 1950s, apartheid laws prohibited colored farmers from entering land owned by whites (Rohde et al. 2006). Thus, areas formerly used solely by colored farmers, or by white and colored farmers, were sealed off from colored

farmers whose seasonal mobility was then limited to village lands within the reserve (Rohde et al. 2006). The resulting reserves are confined areas with marked and often impermeable borders (Rohde et al. 2006) and the management of Namaqualand communal areas is similar to that of a private farm in many respects.

White-owned farms dominate the Namaqualand landscape. When the land reform process started in South Africa in 1994, 385 white farmers owned 52% of the land in Namaqualand, while 1650 colored farmer households had access to only 23% of the land. The rest of the land comprised state land, conservation areas, towns, and mining areas (May and Lahiff 2007). Though land reform has changed these figures to some extent, the pattern persists.

Field research for the current study was done in Concordia, a community of about 4600 colored Afrikaans speaking people, descended from the indigenous Nama and San tribes (May and Lahiff 2007). At the time of the most recent survey in 2002, 168 families in Concordia were active stock farmers (Surplus People Project 2003). Like elsewhere in Namaqualand, some Concordia farmers rely on farming as their only income, but most combine farming with a job in neighboring towns or in the mines (May and Lahiff 2007). Farmers with jobs elsewhere consider farming to be a form of insurance against poverty, in case of retrenchment<sup>i</sup> (Hongslo et al. 2009).

Concordia is in a favorable position due to its location on the border between two ecological zones (Cowling et al. 1999, Desmet and Cowling 1999, Mucina and Rutherford 2006). The western part falls into the Succulent Karoo biome, with winter rainfall from May to September between 100 and 350 mm (Benjaminsen et al. 2006). The Succulent Karoo is dominated by perennial shrubs and exhibits high biodiversity with 3500 species (of which 25% are endemic) (Cowling et al. 1999, Todd and Hoffman 1999, Anderson and Hoffman 2007). Because of its high endemism, Namaqualand is defined as a 'biodiversity hotspot'. Leaf succulents dominate the sandy plains, whereas the rocky hills are dominated by non-succulent shrubs (Hongslo et al. 2009). Trees are rare. The eastern part of Concordia falls into the summer rainfall area of the Nama Karoo. The area receives unreliable rainfall from 100 to 200 mm a year (Benjaminsen et al. 2006) and vegetation is dominated by annual and perennial grasses. Both biomes tend towards higher proportions of annual species when they are subjected to high grazing pressure (Anderson and Hoffman 2007).

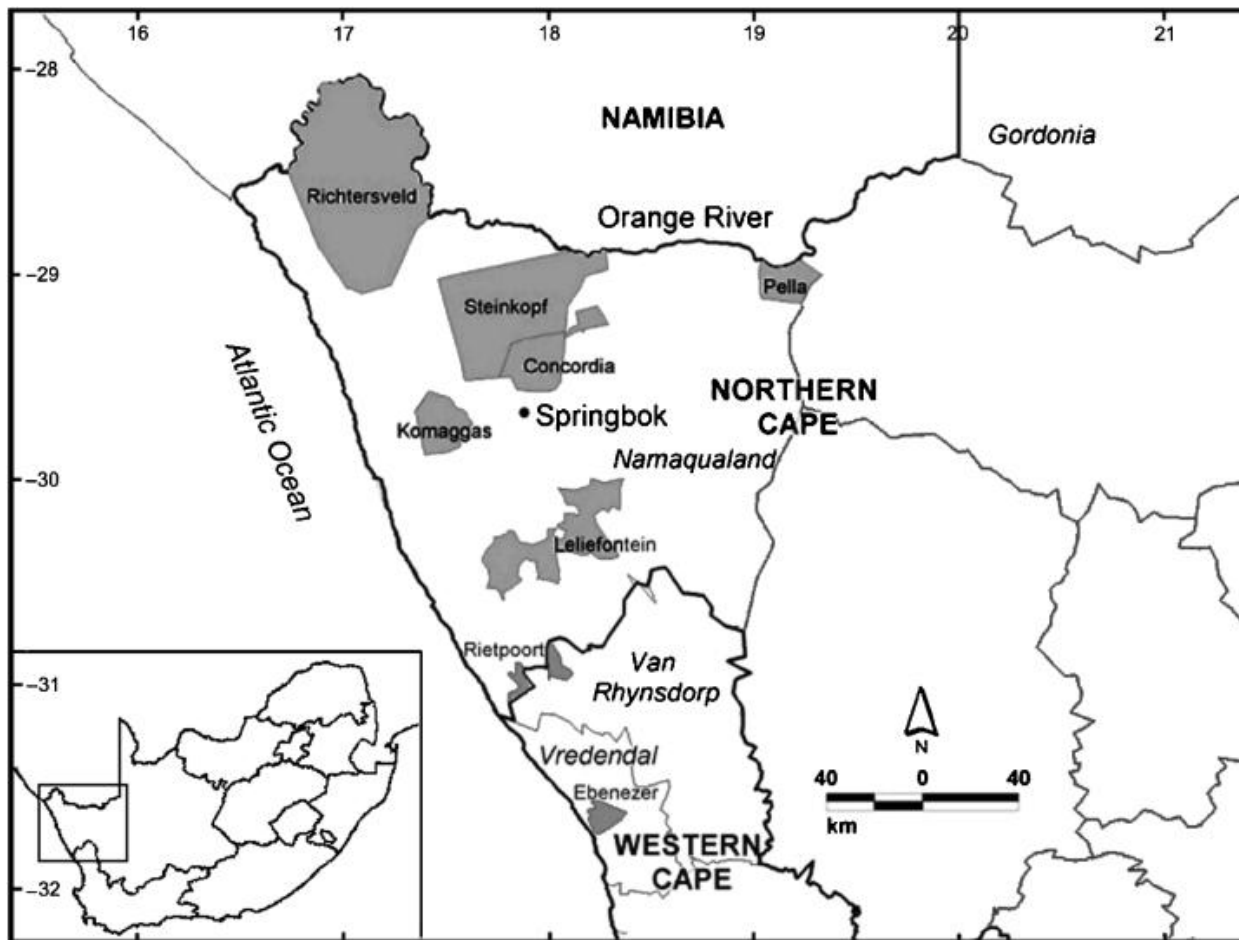


Figure 1: Map of Namaqualand with communal areas shaded. Source: Timm Hoffman. Graphics: Simon Todd.

Today all land in Concordia is communally owned. There are three classes of land: the village, the sowing land, and ‘the commons’. Farmers rent residential plots and sowing plots from the community on a yearly basis. The commons are used for grazing only. When Concordia’s land holdings were increased through land reform, the new areas were called the *new commons*. The management of the *new commons* differs slightly from that of the *old commons*, and these areas are now open for grazing during parts of the year only. Farmers in Concordia keep mostly sheep and goats, with a limited amount of cattle<sup>ii</sup>. At the time of this study, 170 farming families in Concordia shared 137 to 890 hectares of communal land. Concordia has chosen to use the land acquired through land reform to the benefit of all farmers, using a system in which livestock owned by different farmers gain common access to the acquired land after having applied to the management committee for permission. However, the new areas are located at some distance from the village and are only accessible to the wealthiest farmers who can afford motorized transportation for their animals and shepherds.

The debate about ecological models outlined above has, to some extent, been paralleled by scientific research undertaken in Namaqualand. A number of studies indicate that parts of the rangeland have been permanently affected by grazing (Allsopp 1999, Todd and Hoffman 1999, Hoffman and Ashwell 2001, Anderson and Hoffman 2007). However, these studies have been contested on several grounds. A recent study (Hongslo et al. 2009) indicates that vegetation cover in Concordia has been stable for 60 years, despite stocking rates far above the recommended carrying capacity. It has also been suggested that vegetation changes are event-driven rather than density-dependent (Jürgens et al. 1999), and that rangeland dynamics are better understood in terms of complex dynamics, rather than the equilibrium model (Richardson et al. 2005, Hongslo et al. 2009, Richardson et al. 2010). Benjaminsen et al. (2006) argue that there has been no significant change in livestock density despite average stocks exceeding carrying capacity by 100%, and they contest the idea of permanently degraded areas.

#### **4. Carrying capacity in the planning process: a technical tool with contrasting roles**

In this case study, I analyze three project reports that together document the local planning process of land reform in Namaqualand. The analysis demonstrates how a specific conceptualization of the relationship between land, livestock and farmers came to dominate the resulting management plans.

Two institutions play important roles. The Surplus People Project (SPP) is a non-governmental organization with a long history of resisting apartheid and land evictions. Its name refers to the people that were subjected to forced displacements as a consequence of apartheid policies (Platzky and Walker 1985). During the apartheid era, the SPP was engaged in land struggles in Namaqualand against the policy of creating ‘economic units’; this was a management model introduced by the Department of Local Government, Housing and Agriculture in the late 1980s in three communal areas in Namaqualand (Rohde et al. 2002, May and Lahiff 2007). Parts of the communal land were rented to wealthy farmers to allow them to build up larger herds and manage their land according to commercial principles. As a result, the majority were deprived of important grazing areas, leading to fierce protests. The SPP and the communities took the case to court. They won and economic units were abandoned (Boonzaier 1996, Rohde et al. 2002).

When land reform was initiated, the SPP was tasked with facilitating the land reform process in Namaqualand.

The second important actor in the land reform process was the local branch of the Department of Agriculture. This department is both centrally and locally a merger between the earlier Department of Agriculture, formerly responsible for white farmers only, and the Department of Local Government, Housing and Agriculture, which was responsible for farming in the former reserves. The two departments merged after the fall of apartheid in 1994. In the late 1990s, the head of the local branch was from the former Department of Agriculture, while the four extension officers came from the former Department of Local Government, Housing and Agriculture. According to the extension officers, this caused tension between knowledge cultures within the new department.

Namaqualand farming practices have been a focus for conservation for at least a century and both commercial and communal farms have been targeted. On commercial farms, destocking schemes subsidized commercial farmers in order to meet recommended carrying capacities specified during the 1960s (Hoffman and Ashwell 2001). In Concordia, a set of grazing regulations from the 1950s limited the amount of animals to 500 small stock units per farmer, but by the mid-1990s the regulations were no longer observed (Northern Cape Department of Agriculture and Surplus People Project 2000).

In the late 1980s, the local branch of the Department of Agriculture estimated grazing capacities<sup>1</sup> for all veld types in Namaqualand. These were calculated on the basis of climate data (rainfall, evaporation and wind), soil types, and vegetation (Botha 1998, Benjaminsen et al. 2006). In the 1980s, the Department of Agriculture was responsible for the white commercial farming areas only, and not for the communal areas (Northern Cape Department of Agriculture and Surplus People Project 2000). Grazing capacities were calculated on the basis of commercial management goals on privately owned and managed land. Commercial farms are fenced into camps and managed through rotational grazing, producing meat for the commercial market. On the basis of these grazing capacity values, the department generated a map of recommended

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<sup>1</sup> The report distinguishes between grazing capacity and carrying capacity. Both measure the relationship between land and animals. Grazing capacity is the amount of hectares needed per animal and carrying capacity is the amount of animals a given area (i.e. Concordia) can support.

grazing capacities for Namaqualand. This map is often referred to by extension officers and municipal officials as the justification for carrying capacity policies. However, commercial management realities are a far cry from communal farming conditions. Communal areas hold up to two hundred farmers with diverse management goals on an area that would accommodate only 10-15 commercial farmers. As we have seen, carrying capacity values calculated for one type of management are not an objective, omni-relevant measure of sustainable rangeland management. Carrying capacity is a specific way to structure the relationship between land use, economic goals, and conservation and management goals. Tenure organization and management models are crucial for the estimation of optimal range use (Caughley 1979, Scoones 1989).

The land reform process in Namaqualand was initiated in the mid-1990s. I consider the precondition for the transfer of land vested in the notarial deed: “To manage the land in a sustainable way that benefits all farmers without deteriorating the rangeland” (Surplus People Project 1997) to be the point of departure for the planning process in Namaqualand. The precondition was set by the Department of Land Affairs, which was responsible for land distribution. This precondition is crucial for the communities in that it must be met in order to maintain the rights to the land. In practice, this precondition set the stage for the planning process by defining the frames for ‘sustainable management’, and became the justification for installing carrying capacity measures. But taken literally, this condition is much more open to interpretation, both as to who is to benefit (‘all farmers’) and how it is to be implemented. The following analysis shows how the meaning of sustainability was narrowed down and with what consequences.

In the following section, I present the reports in chronological order. Report 1, ‘The stock farming report’ of 1997, was an exercise to map ‘the current situation’ in 20 communal areas. Harry May of the SPP was responsible for the report. Report 2, ‘The extension pilot project report’ of 2000, aimed to establish draft management structures for three of the Namaqualand communal areas (Concordia, Pella and Steinkopf) as well as grazing regulations valid for them all. This report was written by the Department of Agriculture and the SPP in collaboration. Report 3 was written by the SPP. It is a summary of the TRANCRAA (Transformation of Certain Rural Areas Act) process and was published in 2003. TRANCRAA was a consultative process conducted in the period 2001-2003 to facilitate changes in land tenure in the communal areas. The process involved a range of issues: the establishment of rights within new and old rangelands

including the rights to farm and sow plots, the establishment of management structures, and the finalization of management plans and grazing regulations.

#### **4.1 Report 1: Representing Namaqualand rangelands in numbers**

The initiative for Report 1 was taken by land committees in the communal areas in Namaqualand. Each communal area appointed a land committee, consisting of representatives from different sectors of the communities. Land committees were the primary institutional mechanism for driving the land reform process. They were responsible for the identification of land needs, identification of land that was available on the market, and negotiations with neighboring communities when there were conflicts over available farms (May and Lahiff 2007). The role of the SPP was to facilitate the process and to write the report. Despite their important role in identifying land needs, the land committees had limited input in the writing of the report or the choice of carrying capacity as its organizing concept (Harry May, personal communication 2011). The use of carrying capacity was the SPP's choice as part of their strategy to build up a wider argument for land distribution (Harry May, personal communication 2011).

The mandate of Report 1 was to provide an overview of “the current situation” in twenty communal areas in Namaqualand (Surplus People Project 1997: 1). The vastness of this task set the scope for the kind of information that could be gathered meaningfully. The need for information to be comparable necessitated aggregation, both technical and numerical. In acknowledging this need, the aim of the report was specifically to gather information that included the following details: current stock numbers, stocking rates, carrying capacity of the land, management systems, land needs, and authorities involved in management. In addition, the project was required to identify problems, establish management structures with current and future land users, cooperate with the Department of Agriculture and other interested parties, and create a database of stock farmers.

As a consequence of its aims, the research process ended in a representation of the communal areas in Namaqualand in which numbers play a crucial part. Report 1 gathered information regarding stock numbers through censuses in every community, and calculated actual stocking rates<sup>iii</sup> on the basis of stock numbers and total land area in every communal area. By comparing grazing capacity recommendations, with land sizes and actual stock numbers, the Stock Farming Report could conclude that grazing capacities had been transgressed in all communal areas. For



example, in Concordia, the report defined grazing capacity to be 60 hectares per large stock unit, corresponding to the value in the grazing capacity map. The actual stocking rate in Concordia at the time exceeded carrying capacity by 86% (carrying capacity: 1526 large stock units; stocking rate: 2849 large stock units).

Numerical representations of nature involve a range “of practices related to naming, classification, counting, measuring, and valuing” (Agrawal 2005: 34). Aided by the analytical framework of Scott (1998), we can see how the subsequent mapping exercise effectively transformed the areas mapped from vast and diverse pastures to legible and governable areas of quantifiable stock, with clear relationships between livestock and land that readily separated the sustainable from the unsustainable. Carrying capacity thus played a crucial role in structuring what kind of information was considered useful in the mapping of Namaqualand, and at the same time provided unambiguous answers to the question of sustainability.

Report 1 is saturated with numbers (stock numbers, stocking rates, present land holdings, and land needs). It represents communal areas as degraded and overstocked on the basis of transgressions of recommended carrying capacities. The relationship between land area and stock numbers, or more specifically, the relationship between actual and recommended stocking rates constitutes the *problematization*, a process that identifies a need for intervention (Li 2007). If the actual stocking rate is lower than or equal to the recommended rate, farming is by definition sustainable; if not, farming is unsustainable. Unsustainable farming by this definition means that there is a need for intervention (Li 2007). Of course, few actors in Namaqualand conceive farming to be only about stocking rates. Stocking rate is one of many important factors for successful farming, several of which are mentioned in the stock farming report, such as sufficient and well-functioning water points, and rotational grazing. However, these factors are not quantified and, in a report dominated by numbers, they lose importance.

The SPP has drawn interesting conclusions from the numbers. As mentioned earlier, the trend in Namaqualand and South Africa had been to employ recommended stocking rates to propose destocking schemes and stock limitation. In a novel move, the SPP interpreted overstocking as a sign of *land deficit*, the solution to which is a change of wider power structure through the expansion of the communal areas. The stock farming report employed calculated land needs for all communities on the basis of carrying capacity and current stocking rates. In Concordia’s case,

the actual stocking rate was 2849 large stock units on 91569 hectares, which meant that Concordia needed to receive an additional 79380 hectares through land reform (SSP 1997). Carrying capacity was the tool that the Department of Agriculture used to determine overstocking; by employing carrying capacity to demonstrate overstocking, the SPP could show that the communal areas were too small to comply with the department's own recommendations.

Through its ability to turn the argument in favor of land reform as opposed to destocking, Report 1 demonstrated that numerical and statistical facts may also be used to the advantage of local people, despite the top-down tradition dating back to colonial time of using numbers to restrict access to pastures and natural resources. Consequently, *rendering technical* does not only have the depoliticizing effects shown by Li (2007) and Ferguson (1994). While statistical facts can prove to be powerful in redefining the relationship between people, livestock and land, they can also be “yoked to multiple roles” (Agrawal 2005: 35), and in some cases roles that are seen as contradictions. Agrawal (2005: 35) further argues:

Once precise, statistical, generalizing arguments are invoked in the service of policy it is difficult to counter them with vague, descriptive, anecdotal evidence. It is in this characteristic of statistical representation – their capacity to displace non-numerical arguments and advocacy – that their colonizing effects are to be found.

That communal areas should be extended is certainly a possible conclusion on the basis of the numbers alone, but this argument is uncommon in a country where destocking has been a key policy instrument in commercial as well as communal areas. Given the role of statistics, what arguments does Report 1 use to redefine the solution to the problem? Interestingly, the SPP does not employ numbers here, but argues solely on “vague, descriptive and anecdotal evidence” (c.f. Agrawal 2005 ). Towards the end of the report, the SPP defines two factors as being crucial for successful communal stock farming: stocking rates must be adapted to the biological preconditions of the veld, and stocking rates must satisfy the economic needs of the household (Surplus People Project 1997). The authors thereby accept the need for conservation but also introduce the economic needs of the farmer. As stated in one quote from a communal farmer: “the problem is not so much the number of stock (overstocking and overgrazing), but the size of the land. We definitely need more land” (Surplus People Project 1997: 4, my translation). The SPP reports that farmers justify the high stocking rate by the limited income from farming and

the risk in farming in these areas. The SPP also recognizes that stocking rates clearly transgress the recommended carrying capacities in communal areas, but echo the argument expressed by the farmers: “...the problem is not so much overstocking, overgrazing and general veld degradation, but the limited amount of available land for the local communities” (Surplus People Project 1997: 14, my translation).

Although novel in debates about land degradation, the use of the degradation narrative to argue for small-holders’ rights is not new in South Africa. Beinart (1996) shows how scientific and technical thinking, previously employed by the apartheid system, was readily adopted by the anti-apartheid movement. According to Beinart (1996), technical thinking served two purposes for the anti-apartheid movement: firstly to “castigate the greed of the white farmers who were at the core of support for apartheid and were, together with the state, seen as responsible for severe rural dislocation through forced removals” and secondly to help

illustrate the iniquities of the homeland system in which blacks were restricted, as independent occupiers, to a very limited proportion of the country’s land. Whereas the Native Economic Commission had blamed African culture and attitudes for ecological degradation in the reserves, it was not difficult to invert the argument and pin the responsibility on the restrictive policies of apartheid. (Beinart 1996: 61).

The application of grazing capacities to argue for more land contradicts Li’s (2007) thesis that a technical *problematization* rules out solutions that change power structures radically. The identification of the transgression of carrying capacity values as the problem (and need for intervention) had several important functions. As we have seen, collecting aggregate and numerical data eased the task of surveillance of rangelands in 20 communal areas in Namaqualand. It simultaneously rendered the relationship between farmers and their land technical and numerical, and provided room for intervention. Report 1 subsequently treated actual stocking rates in 1997 as if they were fixed values, and estimated land needs on this basis. In a variable environment like Namaqualand, this was a problematic exercise, but it did fulfill two important functions: it created a seemingly neutral ground for weighing land needs between the communities, and it established a scientifically-based platform, acceptable to the government, upon which to place demands for more land. The land needs suggested by the SPP (1997) were much higher than the resulting land transfers, and can be interpreted as a bargaining tactic to achieve as much land as possible through the reform. One may argue, of course, that there was little political controversy in this strategy. Land reform was already legislated and the

mandate of the project was to prepare for land transfer. However, the dominant perception among researchers, agricultural extension officers, and policy makers was that communal farming was inefficient (Kotze et al. 1987, Boonzaier et al. 1991, Benjaminsen et al. 2006) and led to the degradation of land (Boonzaier et al. 1991, Todd and Hoffman 1999, Hongslo and Benjaminsen 2002, Meadows and Hoffman 2002, Wisborg 2006). The proposed solution to the lack of productivity and degradation was normally to replace communal tenure with individual tenure of different kinds. For instance, in the system of ‘economic units’ attempted in Namaqualand in the 1980s (Boonzaier et al. 1991, Rohde et al. 2002, Benjaminsen et al. 2006), the implicit message was that degradation was rooted in the tenure system, rather than in the lack of grazing land. Hence, expanding communal areas, as posited by the SPP, was far from the mainstream approach.

#### **4.2 Report 2: The Extension Pilot Project Report: Development of a management plan**

Report 2 (The Extension Pilot Project Report of 2000) was written by the Northern Cape Department of Agriculture in collaboration with the Surplus People Project (Northern Cape Department of Agriculture and Surplus People Project 2000). It documents a pilot project in three communal areas of Namaqualand (Concordia, Steinkopf and Pella). The aim of this report was to draft management plans for the three areas, along with a set of grazing regulations for all communal areas in the NamaKhoi municipality.

Carrying capacity still plays an important part in this report. Firstly, Report 2 employs stocking rates and carrying capacities estimated in the 1997 Report 1 to support the notion that overgrazing persists. In 1999-2000, the distribution of new land through the land reform process was concluded. Concordia had expanded its areas from 91569 to 137890 hectares through the inclusion of formerly commercial farms and state land (Surplus People Project 2003). This amounted to approximately half of the new land estimated to be required in Report 1. There is no mention of the discrepancy between the two figures. Now a new phase of the reform had started, with little scope for new land transfers, and a pressing need for new management structures for existing and newly transferred land. Report 2 discusses a range of issues, but carrying capacity retains its importance as a structuring concept of knowledge:

Concordia received its first additional commonage<sup>iv</sup> on 25<sup>th</sup> March 1997. At that stage there was little or no management of the old commonage, no record of registered farmers, no stock numbers and inadequate income from grazing fees... The local authority had no

maps of the farms which made up the commonage and were unaware of the number of camps or their carrying capacity (Northern Cape Department of Agriculture and Surplus People Project 2000: 19).

The position of carrying capacity in the management of the pastures was further consolidated in the creation of Report 2. A set of draft grazing regulations attached to the report states that all communal areas must fix an upper limit on animal numbers per household/farmer. The exact figures were left for the communal areas to decide, and Concordia's management plan of 1999, which was drafted through the Extension Pilot Project study, suggests 350 ewes<sup>v</sup> (small stock units) as the upper limit. This was the first mention of a limitation of 350 ewes, a figure that remained unchanged throughout the process. The report does not justify this figure and there seems to have been no debate over the limit between the Department of Agriculture and the SPP or the farmers, before the management plan was published in 1999. Critical voices emerged later and took the writers of the report by surprise:

Issues which had previously been agreed upon by all the interested parties, such as stock numbers, regulations, rights and responsibilities re-emerge and become points of conflict (Northern Cape Department of Agriculture and Surplus People Project 2000: 27).

The degree to which contentious issues had been agreed upon, and what the agreements were, is unclear from the report. There may have been debates around the stock limitations in the communities, but these are not reported. The report attributes the (re)emerging conflict to a failure of communication regarding carrying capacity as a concept and not to genuine disagreement:

Concepts such as carrying capacity are unpopular messages to bring to communities where there is an acute shortage of land. We have observed that the message delivered in the formal meeting/classroom setting is disputed, while when Commonage Management Committee members or farmers visit farms with the extension officer and are shown the condition of the veld or the lack of adequate water they are more receptive to the advice given by the extension officer. Commonage Management Committee members are also more able to defend and explain unpopular decisions to the larger group of farmers (Northern Cape Department of Agriculture and Surplus People Project 2000: 27).

It was a general view among the extension officers that stock limitations were necessary for proper management of the veld. As stated by one extension officer<sup>vi</sup> in 2006:

“You cannot take out the limitation. There must be a limitation of 350 animals like they have in Concordia [...] or else it will go on and on, and you will see deterioration of the veld. The tasteful and protein rich plants will not get a chance to grow. They will disappear and the carrying capacity will go down.”

The management plan and grazing regulations suggest two solutions to the problem of overstocking, both inspired by carrying capacity and rangeland succession theory: limitation of individual herds to 350 breeding ewes, and management according to carrying capacities in the ‘new areas’. The first measure is directed at the conduct of the individual farmer. While the aim of limiting individual herds is undoubtedly to limit the stocking rate in the communal area, it has a weak connection to estimated carrying capacity for the area. If we take a closer look at the amount of farmers, land and carrying capacity, we see that the numbers do not add up. In 2000, Concordia’s land holdings had increased from 91569 (1997) to 137890 ha through land reform. Report 2 uses the 1997 census as the point of departure for calculation. That census revealed that 124 families in Concordia kept a total of 17094 small stock units (SSUs) (Surplus People Project 2003). As the carrying capacity in Concordia is 10 ha per SSU, the communal area should be able to support 13789 SSUs. This means that if all 124 farmers were to keep the maximum amount of sheep and goats (350), Concordia would transgress carrying capacity by a factor of three (43400). Even if we assume that the average herd size (137 SSUs) and the number of farmers remained at the year 2000 level, the total amount of animals (17094) would exceed the carrying capacity for the whole area (13789) considerably. Knowing that the number of farmers increased to 168<sup>vii</sup> and the number of small stock units in the field increased to 26109 by the time of the 2002 census, it is clear that limiting individual stock numbers is not a sufficient measure against transgressions of carrying capacity in Concordia as a whole.

The second measure, management according to carrying capacities in the new areas, and carrying capacity are more closely connected as the management plan states that the new land is to be managed according to carrying capacity. The new areas are opened for grazing for a limited amount of animals for parts of the year, following applications to the management committee. An extension officer provides guidance on when to open the land, and the management

committee is responsible for the surveillance of the rules and for sanctions if the rules are broken. However, since the new management plans are applicable only to areas received through land reform, the rest of the land is managed by local management committees and is not part of the process. Both the management committee members and the extension officers I talked to were uncomfortable with this division of management and the lack of management planning in the old areas, but by 2011 the issue had yet to be resolved.

Report 2 demonstrates how carrying capacity and stock limitations were consolidated through the process of drafting management plans and grazing regulations. Where Report 1 employs the concept of carrying capacity in the argument for changes in power structure, the measures suggested in Report 2 are aimed at changing and limiting communal stock farming. These limiting measures are in line with the theses of Li (2007) and Ferguson (1994). When problems in nature are represented in technical terms, it implies non-political solutions that are aimed at changing farming practices and not the structure of land ownership or similar power structures in society. We may say that the use of carrying capacity to argue for structural changes backfired once the land had been distributed. At that time, carrying capacity had become an ingrained part of the facilitators' argument. During the coproduction of knowledge about Namaqualand pasture and new planning tools, carrying capacity was so intimately linked to the new planning tools that even if there was a desire to change the planning tools, there may have been no opportunity to do so.

#### **4.3 Report 3: Consolidation of carrying capacity in management plans and grazing regulations**

Report 3 was written by the SPP and is a summary of the TRANCRAA project (the Transformation of Certain Rural Areas Act). The aim of the TRANCRAA project was to facilitate tenure reform, but more importantly for this study, it included broad consultation between all affected parties, and the final settlement of management plans and grazing regulations. The report concerns Concordia only. Other communities are covered in separate reports. The report is extensive, including several hundred pages of background (previous reports, information on rights holders, new and old land, official documents and so on). The management plan is only a part of this report, but nevertheless an important part.

The TRANCRAA process started in January 2001 after the draft management plan was first published (1999) and just before the grazing regulations were officially passed (June 2001). The TRANCRAA project involved a thorough consultation process between farmers, the SPP, the Department of Land Affairs (DLA), the Department of Agriculture, and the Legal Resources Centre (LRC)<sup>viii</sup> (Wisborg 2006). The TRANCRAA process discussed a range of issues concerning land rights, tenure and institutions in terms of the communal areas in Namaqualand. Report 3 adopts the perception and argument from Reports 1 and 2 by asserting that Concordia's communal areas are degraded on the basis of discrepancies between carrying capacity recommendations and actual stock numbers. Report 3 provides a table which shows the stocking rates and overstocking at three points in time (1947, 1997, and 2002). Surveys for all these years show a stocking rate of double (or more) the recommended grazing capacity. Few details on practical management are discussed in the report.

When the TRANCRAA process started, the grazing regulations for Concordia were not gazetted, and there was still time for debate over the appropriateness of carrying capacity and stock limitations. However, the report reveals that little discussion of the carrying capacity and stock limitations took place. One workshop on the management plan was held in Concordia (Nov 15, 2001), where carrying capacity was discussed in groups consisting of people from committees involved in farming. Among other things, they discussed what carrying capacity was and if it was necessary to mention carrying capacities in regulations. The minutes from the workshop reveal no conflict about carrying capacity. All the groups agreed that carrying capacities needed regulation in law and that those who did not comply must be punished.

Later in the process, the facilitators opened a discussion among farmers in Concordia regarding the exact stock limit per farmer in Concordia and in Pella. Whereas Pella raised the limit to 500 SSU, the Department of Agriculture convinced Concordia to keep the suggested limit of 350 SSU (personal comment by extension officer<sup>ix</sup>). In a conversation about this difference between Pella and Concordia, an extension officer commented that they could accept a raise in the limit in Pella, because most Pella farmers were too poor to reach this limit in any case (for a thorough discussion on the process in Pella see Wisborg 2006). A raise in Concordia may have had more widespread and serious consequences (personal comment by extension officer). The report does not comment on the consequences that would ensue if all farmers were to reach the limit of 350 animals at the same time, but another extension officer told me that very few Concordia farmers



could afford to transgress the limit of 350 SSU, since most of them had fewer than 100 animals (personal comment). Whether for practical or other reasons, the consultations in both Concordia and Pella were limited to a discussion of *how many* animals each farmer should be allowed, rather than a discussion of the existence of such a limit, or the connection between overstocking and overgrazing. The basic principles of the management models were left unchallenged and key questions were unasked (was Concordia degraded or not; would it help to de-stock?); thus the *problematization* remained intact.

The intact *problematization* may be an effect of the co-production of knowledge and policy. Once knowledge is constituted and has led to a more or less consistent framework, its basis is difficult to challenge. The statistical and numerical nature of carrying capacity values may have also played an important part in upholding the *problematization* (See Agrawal 2005 for similar argument from forestry in India). Most importantly, the resilience of the *problematization* may be an effect of rendering the policy process technical, as shown by Li in “The will to improve” (Li 2007). This case shows how, in the words of Ferguson (1994), development or improvement may be seen as an “anti-politics machine”; a consequence of narrowing down often highly political problems to a question of numbers and technical fixes is that it delimits the room for controversy.

## **5. Conclusion**

In this article I have given an account of how the facilitators of a land policy process used calculations of carrying capacity as scientific basis for the new management plans and grazing regulations, despite the criticism this notion has met during the last decades. The reason for its persistence was that carrying capacity proved useful for the planners at the initial stages in the planning process. Early on carrying capacity became the hub that organized information gathering, as well as the organization of information into knowledge once gathered. The relationship between farmers, animals and land was reduced to a question of how many hectares were available per SSU. Carrying capacity rendered the relationship between land and livestock technical and numerical, and at the same time opened up a space for intervention (a solution) (Li 2007). Historically, the solution to overstocking in South Africa has been to destock, but the SPP introduced another possibility: the expansion of communal areas. By accepting and employing

current stocking rates, the SPP calculated how much land each community needed in order to meet grazing capacity recommendations. Hence, the SPP employed a technical and numerical concept in order to argue for radical land reform. This challenges the propositions by Li (2007) and Ferguson (1994) that *rendering technical* automatically also renders *non-political*. However, as soon as the land was distributed, the argument for more land diminished. By then carrying capacity was a well established part of the policies. Now carrying capacity became part of a traditional discourse and to argue for stock limitation and management according to recommended carrying capacity levels, measures that aim to control farming practices rather than increase the land base for farmers. While rendering the relationship between land and animals *technical* and *political* through Report 1, carrying capacity rendered this relationship *technical* and *non-political* through Reports 2 and 3 thus confirming the argument by Li (2007) and Ferguson (1994).

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<sup>i</sup> The main form of employment for people in Concordia has traditionally been mining, but several mines have been

<sup>ii</sup> As opposed to other communities in Namaqualand that have large numbers of donkeys, donkeys are not common in Concordia.

<sup>iii</sup> Stocking rates in the South African context refer to the amount of hectares needed to support one small stock unit through a year.

<sup>iv</sup> Commonage is a South African phrase for communal areas.

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<sup>v</sup> Lambs are normally sold at the age of 6 months and are not included in the survey.

<sup>vi</sup> I have anonymized informants that preferred to stay anonymous.

<sup>vii</sup> All inhabitants by 1998 have the right to become farmers in Concordia. By 2006 the Concordia management committee had yet to turn down applications for farming rights by Concordia inhabitants. However, after the drought in 2002-2005, they set the stock limit for new farmers to 50 SSUs.

<sup>viii</sup> An NGO giving judicial advice to disadvantaged groups.

<sup>ix</sup> I have anonymized informants that preferred to stay anonymous.

## **Paper III:**

The politics of difference: fence-line contrast  
photographs as scientific models in ecology





# **The politics of difference: fence-line contrast photographs as scientific models in ecology**

By MSc Eirin Hongslo

## **Abstract**

This paper is a study of the use of photographs in scientific articles on dryland ecology. I argue that photographs are not neutral and value-free documentary proofs of 'how things are'. Rather, photographs, like texts, constitute arguments in their own right. The reader interprets photographs against their textual and the socio-cultural context. The photographs in the two articles studied go further than the body text in suggesting significant differences in vegetation cover and species difference. With their emphasis on difference between communal and commercial landscapes, the fence-line contrast photographs thus contribute to a perception of degradation in communal areas. The two fence-line contrast photographs in this study can also be read as scientific models. These models order the causal links between vegetation dynamics, land tenure and land management in communal and private areas and correspond closely to equilibrium models in range ecology, and new land policies that favor private land ownership in communal areas. Thus, the fence-line photographs contribute to a degradation narrative that has been influential on newer land reform policies in southern Africa.

## 1. Introduction

During fieldwork in Namaqualand (South Africa) in 2005 and 2006, I soon encountered fence-line contrast<sup>1</sup> photographs: pictures of fences cutting the landscape in two, under a blue sky. The fence is not the only thing that divides the landscapes; so too do the physical features, with one side displaying conspicuously less vegetation than the other. The first fence-line contrast I saw was on the cover of a book about degradation in communal areas in South Africa, called “Nature Divided” (Hoffman and Ashwell 2001). The only direct reference to fence-line contrasts in the book is the very first paragraph of the preface:

In the same way that South Africa’s population has been divided along racial lines in the past, so too have its landscapes. The land of the former homelands and self-governing territories has been used very differently from that of the commercial areas of the former Republic of South Africa. This division of nature has had important implications for land degradation in the country as a whole (Hoffman and Ashwell 2001: no page number in original).

This paragraph captures the politicized nature of southern African landscapes. Later, I found fence-line contrast photographs in coffee-table books displaying Namaqualand during the flowering season: colorful displays of landscapes covered in flowers, a different color on each side of the fence, providing an obvious contrast. I also found numerous less colorful, but similarly conspicuous photos of contrasts in scientific papers on ecological dynamics.

Fence-line contrasts are not just fictions constructed for scientific purposes: they exist in the landscape for everyone to see. During my fieldwork I found marked differences along fence-

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<sup>1</sup> In fence-line contrast studies, the concept ‘fence-line contrast’ is used with at least three different meanings. First, it denotes a genre in ecological writing, namely ‘fence-line contrast study’. Second, it denotes the physical landscape: a fence separating two diverging landscapes. Finally, it denotes a photograph depicting this phenomenon.

lines within the communal area<sup>2</sup> where I stayed, and between the communal area and neighboring private farms owned by white commercial farmers. Such contrasts have captured the attention of scientists and photographers alike. But what is the essence of this aesthetic difference? Which differences between photographs are conceived of and portrayed as being significant, and how are the differences explained and conceptualized? Why do both coffee-table books and scientific articles focus on the differences in these carefully composed photographs, thereby giving them special significance and meaning? And what *is* this meaning?

The similarity of composition in fence-line contrast photographs is striking. Save for a few aerial photographs and satellite images, most photographs center on the shape of a ‘T’, with the horizontal line marking the horizon and the vertical line marking the fence. The fact that the composition and the choice of perspective are so similar in the fence-line contrast photographs teased my curiosity. The T formation is clearly an aesthetic convention. Conventions influence what photographers judge to be an efficient photo for their publication purpose, including how the photo will interact with the caption text, article title, and body text.

Visual representations in science take many forms: diagrams, graphs, drawings, and photographs, depicting all kinds of objects; and such images may be produced by means of a range of technologies. Visual representations play a crucial role in scientific communication and in the establishment of scientific facts. They “are more than a simple matter of supplying pictorial illustrations for scientific texts. They are essential to how scientific objects and orderly relationships are revealed and made analyzable” (Lynch 1988: 203). Today, photography is used both as evidence, theory, and I will argue, as models, in a range of fields: history, geography, sociology, social anthropology, biology, landscape architecture, and planning.

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<sup>2</sup> ‘Communal area’ is the expression often used to refer to the areas that were designated for colored and black farmers during apartheid, that are now managed communally by all citizens in the community. These areas are often contrasted with commercial areas, which are privately owned (mostly by white farmers). The couplet communal/commercial is considered awkward by many, as ‘communal’ refers to tenure, while ‘commercial’ refers to the relation between production and market, but I utilize it since they are the words most commonly used in southern Africa.

Kwa, Hemert and van der Weij (2009) point out that photographs sometimes play a somewhat confused role in sciences like geography and ecology, and that scientists are often ambivalent to pictures of landscapes. On the one hand, they are used in scientific texts, but on the other hand researchers may argue that models of vegetation dynamics, for instance, are much more important than pictures.

Images, like texts, never “present innocent interpretations” (Rosner 2001: 392), but, I would add, nor do other types of data or interpretations of data. All research processes, starting from raw data, involve interpretations, suppositions, and simplification on their way to becoming published text. Research is about creating meaning out of chaos, and in this process, large amounts of information are rendered redundant or even confusing, and are therefore filtered out. Kjeldsen (2002) contends that photographs simplify and may manipulate ideas, but he questions the claim that they are more powerful and more readily accepted than linguistic arguments. On the contrary, he writes, we tend to argue against visual representations in much the same way as we argue against oral or written representations.

Still, and perhaps because of our lack of education in the interpretation of imagery, we often treat images as products “that tell a story that is single, static, and – if the writer is ethical – true”. (Rosner 2001: 392). We seldom consider the filtering of information leading to a photograph or diagram, and consequently we tend not to scrutinize visuals as we would scrutinize a text. In that sense, we are often illiterate at image-reading (Kress and Van Leeuwen 2006) and in acknowledging the choices behind the image product (Rosner 2001), as well as its effects in building arguments and theory.

This article combines perspectives from political ecology and Science and Technology Studies (STS). It is predicated on the notion of knowledge as inherently political (Goldman et al. 2011). As Jasanoff (2004: 2) describes it: “The ways in which we know and represent the world (both nature and society) is inseparable from the ways in which we choose to live in it”. This is not to say that the production of knowledge is intended to be political, but rather that all knowledge relates to political debates, and can be interpreted as a contribution to those debates.

This article contributes to a discussion on the importance of visual arguments in scientific texts, and uses a particular genre of landscape photographs as a case study. As far as I am aware, this is the first such study of this kind. While the use of photography in botany and microbiology has been studied (Lynch 1988, 1991, Rosner 2001, Tucker 2005), little work has been done on landscape photographs in the field of ecology. Foster (2008) discusses the importance of landscape and visual representations of landscape, but not their use in scientific literature. Kwa et al. (2009) provide a notable exception, as they discuss the contribution of landscape photographs in scientific literature and whether they may be used as theory and data.

In this article I discuss the theory on the use of photographs as arguments and models. Further, I discuss the meaning of 'fences' in southern African landscapes, drawing upon Gregory Bateson's theory on the importance of difference in the construction of knowledge. The analysis presents a case study of two articles that include fence-line contrast photographs. I analyze how the photographs are composed, and how the composition influences the message that is sent. Further, I analyze how the texts interpret the differences in the photographs, the causes of the differences, and how the photos and their textual context are positioned in wider debates on degradation and rangeland management. I conclude that the fence-line contrast photographs actually represent scientific models that themselves help to order a complex world of social, as well as natural, causes and effects, into a more understandable whole.

## **2. Photographs as models**

Photographic depictions have been used in scientific publications in a broad range of academic fields, ranging from cartography, geography and landscape ecology, to physics, chemistry and microbiology. Not surprisingly perhaps, geographers soon took up the use of aerial photography for map-making and studies of environmental change, and during recent years, environmental problems have often been conceptualized through the use of landscape representations (Widgren 2004). Ecologists, on the other hand, hesitated in their use of landscape photography as they found that photographs did not discriminate between important and less important elements, and thus became too 'noisy' (Kwa 2009). But as governments provided aerial photographs, the

skepticism diminished, and in the 1980s, analysis of aerial photographs became commonplace in ecology (Kwa 2009).

Ever since it became a realistic option, the use of photography has been a matter of debate (Tucker 2005). As is currently widely recognized, a photograph is the result of a number of choices made by the photographer and the publisher. The choice of motif, perspective, focus, use of shutter and diaphragm, as well as preparation like cropping and editing, all affect which part of reality is captured and in what way. It is common to regard these external effects as “internal attributes of the subject”, but according to Barry (1997: 150), this is the most problematic effect of interpreting photographs at face value. Thus in an analysis of photography used in science, the external factors require closer investigation.

This paper is premised on the point of view that images, like texts, can convey messages, and, taking this idea a bit further, that they can constitute arguments. Visual representations and text overlap in the messages they can convey, yet they are not quite the same: some things can be expressed both visually and verbally, whereas some things can be ‘said’ only visually, others only verbally, and the way the message is conveyed will differ (Kress and Van Leeuwen 2006). Whereas texts vary in the use of word classes and semantic structures, visual representations vary in their use of color or composition (Kress and Van Leeuwen 2006). Photographs guide the reader to see what the author wants to communicate (Rosner 2001). They are able to capture a wider range of detail in smaller spaces than language, and consequently contain a wider range of meanings (Kjeldsen 2002). This saturation of meaning runs the risk of the viewer being lured into all kinds of directions. The photo may blur the message or argument and demand a broader context for its interpretation.

However, the need for context to construct meaning is not entirely unique for photographs, and certainly does not disqualify photographs from representing arguments. Most oral or written statements need a wider context to be ‘correctly’ interpreted (Kjeldsen 2002, Blair 2004). Visual images and text are equally imprecise and ambiguous, and as they often occur together, the construction of meaning from each form depends on the other (Kjeldsen 2002, Kress and Van Leeuwen 2006). The context provided by the scientific text (e.g. captions, headings, bold text,

layout) invites the reader to interpret the photograph in a particular direction and to “see what is being said” (Lynch 1988: 203, Foster 2003). It opens up some avenues for interpretation and closes others (Scott 1999, Kress and Van Leeuwen 2006). The wider social and historical context further adds new layers of meaning (Kjeldsen 2002, Schwartz and Ryan 2003).

Fence-line contrast photographs are important beyond their use as illustration. Kwa et al. (2009) hold that in landscape ecology and geography, “the aesthetic features of landscape pictures play a role in many stages of research [...]. They have served (and continue to serve) to define the object of investigation. In this sense, pictures contain ‘theory’ as much as they represent data”. Lynch (1988) discusses the importance of aesthetics in defining objects of investigation in research on cell organisms, where researchers are uncertain about what they will find. Raw data, often blurred microscope photographs, are interpreted by researchers, who then draw diagrams of cell organisms. Visual representations at once conceptualize research findings and aid researchers in seeking similar phenomena in their own research, and once a motif is established, researchers will to some degree, consciously or not, look for the same motif in their microscope or field (Lynch 1988).

Like Lynch (1988) and Kwa et al. (2009), I argue that the conspicuous visual appearance of the fence-line contrast is decisive when selecting a study object. But I contend that the importance goes further and that fence-line photographs represent scientific models. Like metaphors, models often represent something by way of something else. In this case, a range of causes and effects may be represented by way of the fence-line contrast photograph. Models further simplify empirical findings, and build theory (Kaarhus 1992). Models are in a sense empty structures that must be filled with observations in order to say something meaningful about the world (Kaarhus 1992). Models do not “contain the ‘essence’ of reality” but attempt to “represent some significant differences” in whatever we want to explain (Kaarhus 1992: 89). In order to analyze how a particular model informs research, we have to go deeper into each research text, as I will do in the following analysis.



### **3. What is a fence? Change and difference in southern African rangelands**

Fences are not just physical constructions. Fences protect animals from predators, thieves, and sicknesses. They protect flowers, succulents and bushes from grazers. They draw the line between ‘hunters’ and ‘poachers’, wealth and poverty, prisoner or free person. Fences have both cultural and physical meanings, and the meanings are intertwined in complicated ways. Fences represent claims to property (Rose 1994, Chaumba et al. 2003). They can exclude people and animals from greener pastures, and may act as manifestations of social divisions (Peters 1992). Although barbed wire is efficient in keeping living creatures away, fences are little more than marks, or statements in a frozen negotiation between the people that live with them. The fence would not have the power to exclude if the exclusion did not have a meaning beyond the physical structure and form part of a social contract between the excluder and excluded themselves (Rose 1994, Fortmann 1995).

The two photographs analyzed in this study were taken in Namibia and South Africa respectively. South African and Namibian landscapes are extraordinary orderly. An effect of the former apartheid regime in South Africa (and South West Africa, as Namibia was formerly called) was the meticulous ordering of people and land into white, colored and black areas (Dodson 2000). These divisions were ‘textual’ in the sense that they were carefully organized according to written plans laid down by the apartheid government (de Wet 1995). The legacy of apartheid prevails. Fences in South Africa and Namibia mark borders between properties, between white and black, poor and rich, communal and private land. A decade and a half after the law that prohibited black and colored farmers from purchasing land and climbing the social ladder was retracted, the fences still mark the landscape, and the economic and structural hindrances that persist.

In South African and Namibian landscapes, fences have an additional connotation, namely they are a sign of proper rangeland management. The rangeland succession model has informed rangeland policies in South Africa and Namibia for decades, and still does (Sullivan 1996, Benjaminsen et al. 2006, Rohde et al. 2006, Lebert and Rohde 2007). The ecological model predicts that vegetation in dryland areas continuously strives towards a natural equilibrium. After

an external disturbance event (e.g. drought, grazing, fire) the area will recover its equilibrium if it is left to rest (Bartels et al. 1993). Continuous disturbance may cause permanent degradation; therefore low stocking rates and resting of pastures become important factors in sound management of the land. The rangeland succession model has been widely criticized; in particular its relevance in dryland areas has been questioned (Homewood and Rodgers 1987, Ellis and Swift 1988, Scoones 1989, Turner 1993, Sullivan 1996, Sullivan and Rohde 2002). The criticism emerged as new ecological models were developed which were more relevant to dryland areas. The non-equilibrium model (Caughley 1979, Sandford 1983, Scoones 1989, Behnke and Scoones 1992, Scoones et al. 1993, Scoones 1996) assumes that climatic factors are drivers of environmental change, rather than grazing. Hence, stocking level is not as important for healthy ranching as was previously thought. In a similar vein, the state-and-transition model assumes that rangelands change discontinuously and sometimes irreversibly and inconsistently (Westoby et al. 1989).

The rangeland succession model recommends that commercial holdings should be fenced into camps (paddocks) that are grazed in rotation, always saving forage for meager years. The South African and Namibian Department of Agriculture have favored rotational grazing in paddocks in commercial rangelands since the 1950s. For decades, white commercial farmers received considerable subsidies to fence their farms, both along the borders as well as for paddocks (Archer 2002). In these rangelands fences and standing grass are marks of successful management, signs that communal and commercial farmers, as well as extension officers and politicians refer to. As we shall see, this is a contrast satiated with meaning.

#### **4. The difference that makes a difference – composition in fence-line contrast photographs**

The social anthropologist Gregory Bateson famously asked: “What is the difference that makes a difference?” Bateson’s (2002) question is pertinent in the case of fence-line contrast. The human mind, Bateson contends, registers difference and change only. As a consequence, all new information is registered as being different from something that we already know, or in other words, in relation to information or knowledge we possess. This may seem obvious, but the way most languages work, it is not. In describing a boat or a horse we would say: the boat *is* blue, the

horse *is* big and so on, as if the object *has* the attribute, in itself, with no relation to other objects or the speaker. In this light, the fence-line contrast resonates with the basic manner in which humans register the world: by way of contrast.

For a difference to be conceived of as a difference, a certain level of ‘sameness’ must exist between the compared elements. But one thing can be similar to (or different from) another, in a wide variety of ways. A bike and a bus, for instance, are similar in the sense that they are both a means of transportation, made of metal and have wheels, but they have different numbers of wheels, are driven in different ways, with different risks etc. Humans tend to communicate through story-telling, and in principle, any object or idea A can be related to any item B, provided a story is told that connects and separates them (Bateson 2002). So in comparing one thing to another, we create a ‘story’; that is, we make choices as to which differences or similarities are important in a particular context. This process of drawing things together and holding apart, can also be conceptualized by Stephanie Lavau’s (2008) concept of *cleaving*. The word ‘cleaving’ has a double meaning (‘to hold firmly’ and ‘to split apart’). In comparing things, that is exactly what we do. We insist on them being equal enough to compare, yet at the same time that they are different in a way that makes a difference. In the same manner, the fence, as well as the photograph, insists on connection and separation at the same time. The cleaving of dichotomies forms the basis of fence-line contrast studies, as we shall see later.

## **5. Methodology**

The first studies of fence-line contrasts, differences in vegetation cover along a fence, appeared in the US in the 1960s (Cook et al. 1965), and the fence-line methodology<sup>3</sup> is still widely used. In preparing this article, I searched a number of internet databases<sup>4</sup> (covering major journals on geography, ecology, botany, soil science, agricultural science) for articles that used the fence-line contrast methodology. I used the keywords ‘fence’, ‘fenceline’ ‘fence-line’ and ‘fenceline contrast’ and when the searches resulted in too large a pool of findings, I combined these keywords with relevant keywords like ecology, species, and soil. I then used the ‘related articles’

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<sup>3</sup> Here I refer to the study of vegetation on two sides of a fence. The particular sampling methodology differs from study to study.

<sup>4</sup> ISI Web of Science, Agris, Biological Abstracts, CAB abstracts and Google Scholar.

function, and searched in the reference lists of the articles to find relevant articles that had not appeared in the database search. In my sample I included all studies that explicitly or implicitly used fence-line contrast, regardless of whether or not they used photographs, and searched until I reached a saturation point, in which searches led to no new findings. The resulting pool of articles (63) included studies from USA, Australia, New Zealand, Mongolia, Germany, Norway and Finland, but the majority of articles were from southern Africa (37). Amongst these articles, I found 13 that contrasted two or more commercial paddocks (camps) or farms, 13 that contrasted commercial farms and communal areas, and 7 that contrasted grazed areas (commercial and communal) and conservation areas. Another 4 articles were classified as ‘other’ (comparing commercial farms with road verges, communal farms and experimental plots, and so on). From the total of 63 articles I purposively selected two articles. I sought articles that contained a fence-line contrast photograph, including at least one communal area. Thus, the choice fell to two articles from southern Africa, one from Namibia and one from South Africa.

This study is a qualitative analysis of two fence-line articles that contrast a communal area with a government scientific farm and a private farm respectively. I investigated how the photographs portray the differences across the fence, and what meaning they attach to the differences, both in terms of ecological and social contexts. I combined methodologies for analyzing photographs in conjunction with text. Firstly, I used compositional and semiotic analysis to analyze the photographs. The tools of compositional analysis are “not often made explicit” in the field of history of art, and include an “element of intuition” (Rose 2005: 70). The method includes analysis of the structure of the image, or how the elements of the picture combine (the content, the light, the colors, how it is organized, how the viewer is placed and so on), and finally the effect of these combinations. Compositional analysis concentrates on the image itself, but offers little in the analysis of the interrelations between the image and the surrounding text (Rose 2005). Barthes (1977) distinguishes between signs which are denotative<sup>5</sup> and connotative, which was useful in my analysis. At the most immediate level is the denoted meaning of the image,

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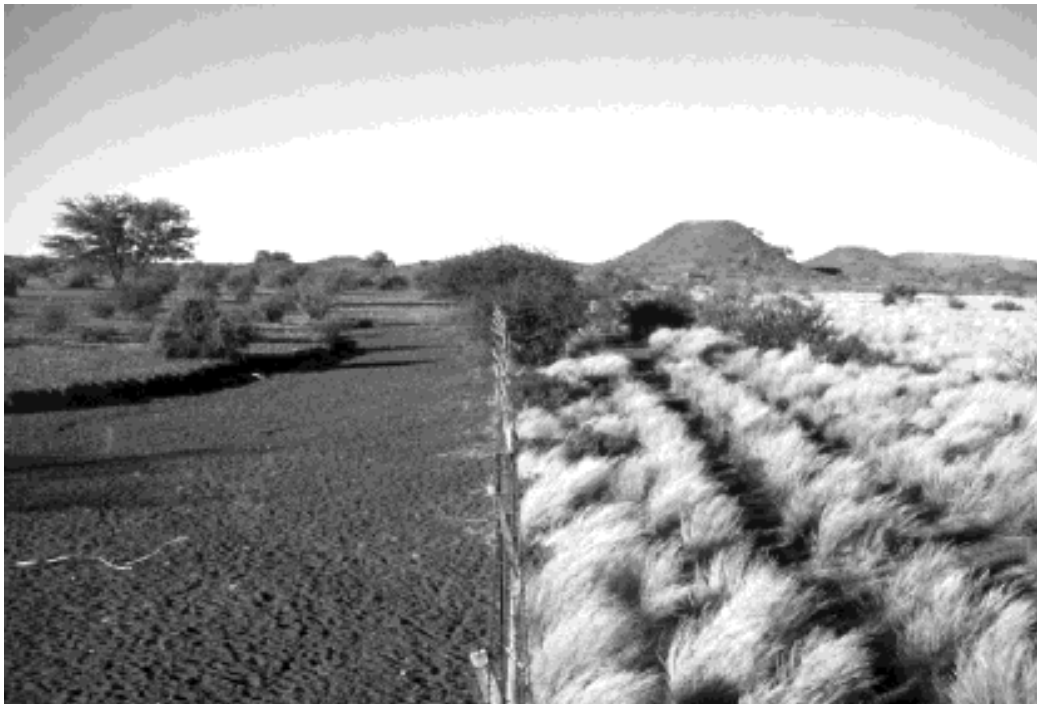
<sup>5</sup> ‘Denotative’ and ‘connotative’ refer to levels of semiotic meaning. Barthes (1977) described the denotative to be the immediate sign, or the sign that one sees in the photograph (a tree, grass, a fence), while connotative meanings are cultural meanings that are associated with these signs (ecological health, good management, exclusion).

which is the image's literal meaning, or what we actually see. Barthes (1977) admits that such a level is by its nature constructed, as the literal meaning can never be fully isolated from its interpreted meanings, but he retains this level because of its usefulness in analysis. The connoted meaning of the image is the meaning that can only be understood through cultural and social lenses. For instance, an image of a man dressed in red with a white beard may remind the viewer that it is Christmas soon. This meaning is, in itself, detached from what we see, but crucial to our understanding and interpretation of the image. Secondly, this study draws on discourse analysis (Rose 2005) to explore the meaning offered by the cultural context of the articles.

## 6. Analysis

The following analysis uses two photos as a case study (Images 1 and 3), while image 2 is included to illustrate a point on composition.

### 6.1. Comparing occurrence of mammals over a fence



**Image 1.** Original caption: “Fig. 1. – Fence-line contrast of the study sites. Left: overgrazed communal farming area of Nabaos; right: moderately grazed governmental farming area of Gellap-Ost” (Hoffmann and Zeller 2005)

Image 1 shows a typical fence-line contrast photograph. It is taken from Hoffmann and Zeller (2005) and denotes a fence separating two landscapes, a barren-looking one to the left and an ordered, grassy area to the right. The fence divides the land left-right, and gives both sides equal position in the photo (as opposed to giving any one side a foreground position). This positioning communicates objectivity and trustworthiness and is often used in scientific imagery (Kress and Van Leeuwen 2006). The photographic angle is wide and shows hilltops in the distance and a landscape that continues into the distance on each side. The viewpoint in this photo is slightly from above, as if the photographer is standing on an elevation point. This vantage point signals detachment and power over the subject (i.e. the land), as opposed to a view from below which would signal smallness and fear on the part of the observer, or eye-level that suggests realism (Barry 1997, Rosner 2001).

One aspect of the caption formulation captured my attention: “Fence-line contrast of the study sites”. The writers are clearly aware that they are contributing to a photographic genre within ecological scientific writing. Here, *fence-line contrast* clearly refers to the photograph or concept, and not to the physical landscape. In their description of the study area, *fence-line contrast* comes to have an additional meaning: “The region is characterized by fence-line contrasts caused by varying land use practices” (Hoffmann and Zeller 2005: 92). Here *fence-line contrast* is represented as a physical ‘thing’ that can be found in nature. Hence, ‘fence-line contrast’ clearly has different meanings that can be tuned for different circumstances: a photograph, a genre of ecological studies, and a physical structure. These meanings are often used interchangeably and sometimes confusingly in fence-line contrast studies.

The fence-line motif in this example can be interpreted as a landscape photo. As Cosgrove points out: “landscape is not merely the world we see, it is a construction, a composition of that world. Landscape is a way of seeing the world” (1998: 13). The perspective in the photograph has repercussions for what differences are communicated to ‘make a difference’. A different perspective would grant importance to another set of differences and similarities, and would offer another way of seeing the world. We could, for instance, imagine a close-up of grass tussocks on one side and bare ground on the other.

So what messages or arguments can a particular landscape photo convey that a different perspective could not? First, the inclusion of a fairly wide area on both sides of the fence gives the impression that the difference portrayed is representative for the landscape. Of course, we do not know if the grass tussocks on the right side of the fence are grazed down to the ground just outside the frame. Nor do we know if the left side is vegetated outside the frame, as the appearance of bush cover to the far left might indicate. As Rosner (2001) points out, we have to trust the ethics of the authors in what they have chosen to portray.

Second, the two landscapes are visually different (one is vegetated and the other less so). Even a fairly simple motif like the fence-line contrast is ambiguous (Kjeldsen 2002), and as Bateson (2002) points out, any A can in principle be connected to any B by way of a story, or a causation link. So what does ‘difference’ mean here? What features, differences and similarities does the photo privilege above others? At one level, the answer is the difference between ‘vegetation cover’ and ‘no vegetation cover’. ‘Vegetation cover’ is specified in the article as a 10% cover of the perennial grass *Stipagrostis uniplumis*.

Third, the landscape perspective privileges harmony and order, with the height of the horizon figuring as the formal organizer. A low horizon produces unity in the landscape, as the “elements are projected onto one another and hence fused, at least to some extent” (Kwa 2009: 72). A high horizon, on the other hand, reveals more of the spatial fragmentation and thus more ‘disorder’. An aerial photograph would be the ‘logical endpoint’ of a low horizon. Similarly, “long distance produces a high depth of field, further enhancing unity in the landscape” (Kwa 2009: 72). The horizon in Image 1 is above the centre, but still fairly low, giving each landscape a harmonious and unified look<sup>6</sup>. We see here how the fairly low horizon orders and harmonizes the landscape, and efficiently communicates the difference in landscape: a 10% cover of grass would look much sparser on an aerial photo than the apparently dense grass cover we see in the photo. But, as Hoffmann and Zeller (2005) point out, it is exactly the difference between the 10% cover on the right side and the lack of the same on the left that makes a difference for the presence of small

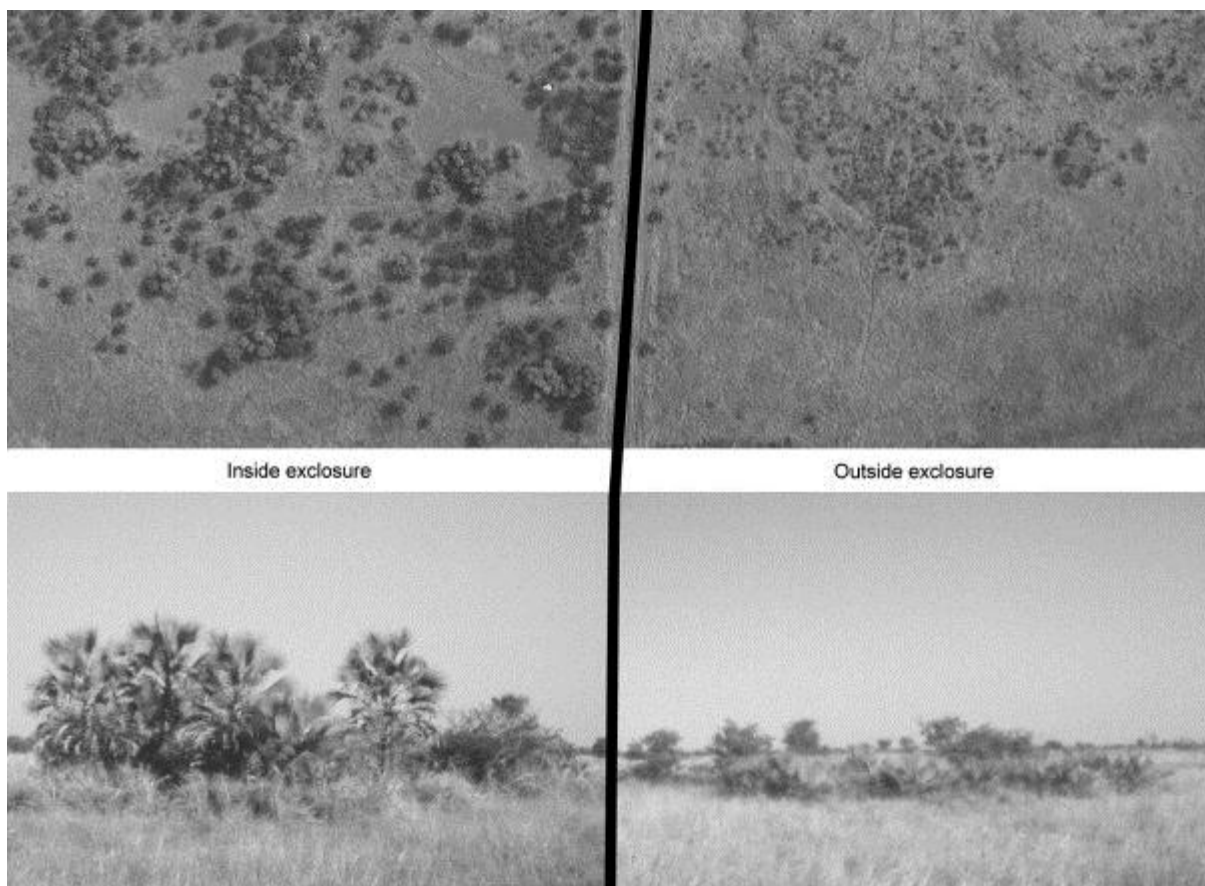
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<sup>6</sup> To some extent this ‘choice’ will always depend on the landscape itself, as a flat landscape provides different opportunities for the photographer than a hilly landscape would.

mammals. The authors indicate that this fairly limited grass cover is a significant source of food for rodents. When grass cover drops to under a certain level, the rodents' survival rates drop. The actual level of coverage required is not specified.

The article also mentions other possible visible differences in vegetation cover that are significant for rodents. Bush cover is low on both sides, but the size of each individual bush is greater on the governmental farm than on the communal area. The difference in canopy size is not represented in the photograph, however.

Finally, the landscape view indicates that the two areas lie in close proximity to each other and consequently are sufficiently similar in physical condition to be compared. One photo from each of the landscapes with a caption declaring that they border each other would not give the same impression. Image 2 illustrates this point:





**Image 2.** Original caption: “Fig. 1. Aerial and ground based photographs of woody structure differences inside and outside of the enclosure. The ground based photographs illustrate differences in Lala palm patches (*Hyphaene coriacea*) with and without the presence of browsers (15 years of exclusion)” (Levick and Rogers 2008)

This photomontage is taken from Levick and Rogers (2008). Their article combines two kinds of photographs: a single aerial photo and two ground photos. The aerial photograph is a ‘true’ fence-line contrast in that it contrasts the two landscapes as they lie. In order to illustrate the connection between the aerial photograph and the ground photographs, a broad line cuts through the aerial photograph, partly covering the fence. The line continues all the way through the ground photos, illustrating a fence-line, but there is no indication as to whether these two landscapes actually lie adjacent to each other. The aerial photograph shows the difference in canopy cover on the two sides. From this, the reader may deduce that the difference between the tree heights in the ground photographs is as they are portrayed, but we are not entirely convinced that the photographer is placed at the same distance from the two clusters of trees, and has thereby pictured it ‘correctly’. We see that a violation of the aesthetic convention in the ground photos causes a breach in the power of persuasion.

The Hoffmann and Zeller (2005) text offers a context for interpretation. The photo caption does not comment on what we see in a material sense. The caption implies that differences in the landscape are the result of diverging management practices and dissimilar land tenure. We see here how the text serves to interpret or connote the image. ‘Overgrazed’ is contrasted with ‘moderately grazed’ and ‘communal farming area’ with ‘governmental farming area’. Overgrazed and moderately grazed refer to different levels of *grazing*. Grazing unites the areas, but its intensity differs. There is a difference in degree on a continuum, and the article does not specify the point at which one becomes the other. The difference between ‘communal farming area’ and ‘government farming area’ is more clear-cut. An area is either one or the other, and each category has a range of implications for management practice.

The fence-line contrast photograph is positioned under the subtitle ‘Study area’, indicating that it is a neutral description and not data, or a model. Underneath the subtitle ‘Study area’ we find this description:

[t]he study was conducted on two neighbouring areas with **different land use practices** (Fig. 1), approximately 20km northwest of Keetmanshoop. One study plot was **highly overgrazed**, mainly by goats within Nabaos **communal areas** (here the exact position is provided). The other plot (distance 1.5km) was within the **government karakul sheep breeding farm** in Gellap-Ost (exact position again). In contrast to the **uncontrolled** grazing in Nabaos, Gellap-Ost uses a **rotating grazing system with a lower stocking rate**. (Hoffmann and Zeller 2005: 92, my emphasis)

The authors explicitly mention the difference in land use practice as being the cause of the fence-line contrast and the text thereby confirms the thesis in the caption: they consider differences in tenure and stocking rates consequential for the interpretation of the visual difference.

‘Uncontrolled grazing’ on the left side is contrasted with ‘rotating grazing systems’ and ‘lower stocking rate’ on the right side, indicating that the left side is different in both respects.

We begin to see how the connotations implied by the text take the form of dichotomies. I argue that rather than the photo representing the difference, the photo becomes a representation of a scientific model that orders the relationship between vegetation dynamics, tenure and land management. If we combine the basic structure of the model ( $A \neq B$ ) with the information we gain from the description of vegetation, grazers and the occurrence of small mammals in the rest of the text, the model appears as follows:

<b>Nabaos</b>	<b>Gellap-Ost</b>
‘Communal farming area’	‘Government karakul sheep breeding farm’
‘Overgrazed’	‘Lower stocking rate’
‘Uncontrolled grazing’	‘Rotating grazing system’
No perennial grass cover	10 % perennial grass cover
Grazed predominately by goats	Grazed solely by karakul sheep
Unsatisfactory occurrence and diversity of small mammals	Satisfactory occurrence and diversity of small mammals
Represented by: bare looking area	Represented by: grass covered area

Table 1. Model represented by Image 1

Here the vertical line symbolizes the fence, while the two columns represent either side of the fence. By dichotomizing the characteristics on the two sides of the fence, Hoffmann and Zeller (2005) indicate that the characteristics are comparable; they are equal and different at the same time (Bateson 2002, Lavau 2008). Simultaneously, the characteristics that represent each side are grouped together, creating new associations and possible causal relationships. So now ‘communal’, ‘overgrazed’ and ‘uncontrolled grazing’ are grouped on one side and are all represented by the bare area, while ‘government karakul sheep breeding farm’, ‘rotating grazing system’ and ‘lower stocking rate’ are grouped together on the other, represented by the grassy area.

If we are to assemble a narrative from the article, it would be that communal management, overgrazing and uncontrolled grazing cause bare areas that lack perennial grass species (depicted) and large canopy bushes. It is implicit that this change is permanent, and cannot easily be reversed. The lack of perennial grasses and large bushes causes low occurrence and diversity of small mammals. On the basis of their findings, Hoffmann and Zeller (2005) argue that there is a need to consider conserving communal areas to improve living conditions for small mammals.

We see how the photograph (Image 1) and the text interpreted by way of the model, contribute to the view that there is a fundamental difference between communal and governmental farms. In this instance, there is reason to believe that the photograph gives a slightly skewed view of the difference in vegetation on the two sides of the fence: the body text in the article reveals that the vegetation in the two areas is fairly similar, in both species richness and cover, while the difference in the photo is marked.

## 6.2 Comparing vegetation difference



**Image 3.** Original caption “*Figure 1.* The fence-line contrast between communal and commercial rangeland. The communal rangeland, dominated by *Galenia africana*, is on the right, while the commercial rangeland, dominated by *Ruschia robusta*, is on the left” (Todd and Hoffman 1999)

The second photograph in this case study is taken from a much-cited article by Todd and Hoffman (1999) entitled: “A fence-line contrast reveals effects of heavy grazing on plant diversity and community composition in Namaqualand, South Africa”. Here, ‘fence-line contrast’ refers to the physical landscape divided by the fence, although it could also refer to the photograph. Like in Hoffmann and Zeller (2005), the photograph is positioned early in the article, after the section describing the study area, within the section on methods. Again, the positioning of the photo within the article indicates that it is intended to be an illustration of the study site, rather than a representation of data or theory.

The viewpoint in this photo (Image 2) is to the right of the fence. The fence meets the lower edge of the photo at the golden section<sup>7</sup> on the left hand side, whereas it is almost centered where it meets the horizon right in the middle of a valley between two hilltops (For more on 'the golden section' see for instance McManus and Weatherby 1997). The distance between each hilltop and the upper edge of the photo corresponds with the distance between the road crossing from left to right in the lower part of the image and the lower edge, thus centering our attention on the middle part of the photo. By adhering to these photographic conventions, the photograph appears to be more aesthetic, more readily conceivable, and curiously more 'true'.

Todd and Hoffman's (1999) primary concern is vegetation, and more specifically, changes in vegetation. The caption gives an indication of which characteristics are thought to make a difference in the photograph. The first sentence of the caption indicates that the difference in land tenure between the two areas (commercial vs. communal) is significant. The second sentence indicates another significant difference: the difference in dominating species (*R. robusta* vs. *G. Africana*). Ecologists and other specialists familiar with southern African grazing systems will appreciate that *R. robusta* is a valued fodder shrub; *G. Africana* is considered a weed and is poisonous to livestock at certain times of the year. This information thus carries an important connotation: *R. robusta* connotes valuable fodder, while *G. Africana* connotes degraded pastures.

The description of the study area details the differences on the two sides of the fence. Stocking rates in the communal areas in Namaqualand have consistently been much higher than those recommended by the South African Department of Agriculture, while the commercial areas have kept within the recommendations for the last 30 years. Further, the commercial farm applies rotational grazing, while the communal farmers have livestock that graze the land more or less continuously. In the article, 'heavily and continuously' is juxtaposed against 'moderately and rotationally'. Again we have the connotations of good and poor land management: 'moderately

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<sup>7</sup> The golden section is an ancient aesthetic principle. It is believed that humans perceive motives as being divided in three horizontally and vertically, thus producing nine imagined squares divided by two horizontal and two vertical lines. Landscape photos can take advantage of the golden section by placing significant features in their motive on these four lines. The effect is that attention is drawn to the object on the line, and the viewer will perceive the image as aesthetically appealing (McManus and Weatherby 1997).

and rotationally' connoting good management, and 'heavily and continuously' connoting poor management.

In their description of the study site the authors write: "The high stocking rate on the communal rangeland has clearly impacted on the vegetation as marked fence-line contrasts are evident (Figure 1) and large areas have become dominated by *Galenia africana* L., a highly unpalatable shrub" (Todd and Hoffman 1999: 170). Here they refer both to the fence-line contrasts in the landscape and to the fence-line contrast photograph. They indicate that fence-line contrasts are indeed common and conspicuous on the borders between communal and commercial landscapes. But a closer investigation of the text reveals that the differences are not as marked as the photograph indicates. Despite the higher stocking rates on the communal side, the study found no significant difference in species richness between the communal and commercial areas. However, the composition of species differed. While the perennial cover was 20% lower on the communal side than on the commercial side, the annual cover was 11% higher. There was no difference in the cover of the unpalatable *G. Africana*, but the number of individual shrubs was much higher in the communal area. Differences were found in the overall shrub volume, and the occurrence of the three most common palatable shrub species was markedly lower on the communal side. While the occurrence of *G. Africana* seedlings was higher on the communal side, the occurrence of seedlings of the three most palatable seedlings was lower. This indicates that recruitment of *G. Africana* is higher than recruitment of the three palatable species on the communal side of the fence. In summary, the reader is struck by the similarities between the two sides. So were the authors, who attributed the lack of difference to the extremely high rainfall in the year of the sampling. We are left to wonder how representative the fence-line contrast photograph is for this specific study area. And if the photo is not representative of the appearances in the field, why was it included?

This thought returns us to the function of a photograph beyond data or illustration, as a model of causes and effects besides purely ecological issues. Fence-line contrast photographs also represent a scientific model that suggests relationships between tenure, land management and vegetation dynamics. We have already established that the 'differences that make a difference' are disparities in vegetation cover and structure, in tenure, and in management (difference in

stocking rate, and continuous vs. rotational grazing in paddocks). Thus we have differences at both the denotative and connotative levels (see Barthes 1977). The vegetation differences are found at the denotative level – we can for instance (with the help of the authors, if we are not experts ourselves), see a difference in the shade of color between the shrub species *R. robusta* and *G. africana*. Other differences, like the difference in seedling activity of the shrubs, are not visible at the landscape level. But they are important in the construction of the connotative meaning of the photograph. On the connotative level we also have the difference in tenure, and the difference in management that were mentioned above. If we aggregate these differences then it suggests a simple scientific model which informs Todd and Hoffman’s (1999) article:

<b>Neighboring private farms</b>	<b>Poulshoek</b>
‘Commercial farm’	‘Heavily grazed communal farm’
‘Stocking rates at 12 ha per small stock unit or lower’	Mean stocking rates twice that recommended for the region by South African Department of Agriculture’ (12 ha/ssu)
‘Moderately and rotationally grazed’	‘Heavily and continuously grazed’
‘Dominated by <i>Ruschia robusta</i> ’	‘Dominated by <i>Galenia africana</i> ’
Represented by: darker area on the left side	Represented by: lighter area on the right side

Table 2: Model represented by Image 3

The vertical line in this table symbolizes the fence, and we see how the fence cleaves the concepts into two sides. ‘Commercial farm’ is contrasted with ‘heavily grazed communal farm’ (the grazing level on the commercial farm is not mentioned, but is assumed to be moderate). ‘Heavily grazed communal farm’ implies both management and tenure issues. In the second point, the stocking rates on the two sides are compared with each other, and also with recommended stocking rates. The third point refers to management practices, while the fourth point refers to the vegetation cover, as represented in the photograph. By partitioning the landscape into two separate sections, the middle line in the model also unites the concepts on each side. They all represent and explain each other, and are represented by the photograph. Hence, we see that commercial tenure, moderate stocking rates, rotational grazing, and *R.*

*Robusta* all connote ‘good management’, while heavy grazing, communal farm, high stocking rates, continuous grazing, and *G. Africana* connote ‘poor management’.

## **7. Fence-line contrasts as arguments and scientific models**

Scientific knowledge, according to Goldman, Nadasdy and Turner (2011: 11), is “the outcome of messy and situated practices: practices that are shaped by particular historical, socioeconomic, political and cultural contexts”. Jasanoff (2004: 2) holds that “knowledge and its material embodiments are at once products of social work and constitutive of forms of social life”. This study investigates how such ‘messy’ processes co-produce knowledge and political assumptions through the use of images. Images are important tools in terms of the rhetoric they embody. They are not innocent and value-free representations of the world (Rosner 2001), but convey messages and constitute arguments in their own right. This analysis of two fence-line photographs supports this point. Rather than being merely objective representations of the field area, the photographs proved to be ripe with theory and often implicit assumptions. These assumptions form causal chains in which communal land tenure is associated with overstocking and land degradation, and private tenure is associated with conservative stocking levels and healthy land management practices.

The argumentative power of images is generally not explicitly recognized by authors of scientific works who employ photographs in their writing. Hoffmann and Zeller (2005), and Todd and Hoffman (1999) include fence-line photographs as part of the description of their study area. These photographs are included to guide us in seeing what the area looks like, in an objective sense. They show a marked difference between two landscapes and substantiate the difference through the collection of data on species richness and vegetation cover. However, using photographs to represent what an area looks like is not as straight forward as one may think. I argue that photographs and images are not neutral, but constitute statements with both denotative and connotative meanings. The point is not that the photo ‘lies’. The scant representation of the landscape in the fence-line photographs in Hoffmann and Zeller (2005) is little different from similar interpretations of data in other texts. Rather, I show how photographs contribute to representations of landscapes and management systems, in ways that readers may not detect on



their first viewing, both through composition of the photograph, and through the interpretation of the photograph in the article text. Further, this paper illustrates how photographs can contribute to a much wider debate about communal management and land degradation.

In the two articles discussed, the recorded differences in species richness and cover are in fact less marked than the photographs suggest. Although the visual differences in both photographs are conspicuous, neither the findings of Hoffmann and Zeller (2005), nor those of Todd and Hoffman (1999) reveal marked differences in species richness or vegetation cover in the two areas. Further, although the differences they do document are significant for the topic they studied, these differences are not always visible on a landscape level, as in the case with the seedling activity recorded by Todd and Hoffman (1999). On this basis, I argue that photographs are not included primarily to show the reader ‘how things are’ at a denotative level, i.e. that the areas are different. Rather, it is at a connotative level that the meaning of a photograph is most significant: the areas are different because the area on one side of the fence is mismanaged, while the area on the other side is well managed. As such, photographs encompass theory (cf. Lynch 1988) and the fence-line photograph, in particular, represents a scientific model that structures knowledge on management, tenure and vegetation dynamics. Fence-line contrast photographs suggest relationships of cause and effect that go beyond ecology and reach into political and socio-economic conditions.

In their seemingly neutral accounts of vegetation differences over a fence, Hoffmann and Zeller (2005) and Todd and Hoffman (1999) indicate causal relationships between land tenure, land management and vegetation cover. They do so in their insistence that the two areas may be meaningfully compared. As we have seen, the precondition for comparison is that the entities compared are both similar and yet different (Bateson 2002), or that they are ‘cleaved’ (Lavau 2008). As a consequence, the act of comparison is in itself a statement. By comparing and contrasting the two areas, the fence-line contrast photograph insists that the areas are *comparable*. In what ways is communal land comparable to private land or a government test farm? First, the photographs document the fact that the areas lie adjacent to each other, and consequently exist in the ‘same’ physical environment. This implies a range of expected similarities in physical condition (soil, vegetation, and so on) and thus provides room for

comparison. Second, both areas are used for livestock production. Besides similarities, there are differences, notably difference in tenure (communal vs. private), difference in stocking rates, and difference in management arrangements (rotational vs. continuous).

The comparison may encompass a normative judgment or an element of surprise that the areas do not look more alike. In the first instance, a normative condemnation of one side of the fence is implied, or alternatively praise for the other side. In the second instance, there is reason to expect that given the similarity in physical condition and use, the areas should be less different than they appear to be. There is little evidence in the articles to support any assumption that the authors were surprised to find differences between the two areas. Thus, a normative argument seems more likely, and I argue that the effect of presenting the fence-line contrast photograph is not so much an illustration of what the areas look like, but rather a representation of difference between ‘well managed’ and ‘poorly managed’ rangelands.

In connecting tenure, land management and degradation, and implicitly assuming a causality between the three, Hoffmann and Zeller (2005) and Todd and Hoffman (1999) contribute to a wider narrative on degradation in southern Africa. Warnings of degradation in communally managed rangeland areas have been common since the early 19<sup>th</sup> century (Beinart 1996). According to this degradation narrative, communal tenure leads to overstocking and consequently to degradation. Therefore, a change in tenure (e.g. privatization) is considered to be a measure to counter tendencies of degradation (Ellis and Swift 1988, Rohde et al. 2006). The degradation narrative is in keeping with the rangeland succession model in the field of ecology, which assumes a tendency in nature to develop in succession towards a natural climax (Scoones 1996). According to the rangeland succession model, stocking pressure can be leveled to match successional trends, thus creating an equilibrium which corresponds to sustainable yield of livestock harvest (Rohde et al. 2006). Another important tenet of the rangeland succession model is rotational grazing, which recommends that areas should be left to rest and recover for a period of the year in order to secure seedling and regrowth (Benjaminsen et al. 2006, Rohde et al. 2006).

The rangeland succession model has been questioned since its inception and has been hotly debated since the 1980s (Homewood and Rodgers 1987, Scoones 1989, Westoby et al. 1989, Turner 1993, Benjaminsen 1997, Rohde et al. 2006, Wolmer 2007). Nevertheless, this model continues to inform land policies in southern Africa (Scoones 1989, Archer 2002, Benjaminsen et al. 2006, Rohde et al. 2006). Land reform processes in South Africa during the last decade have subscribed to the degradation narrative, and subsequently turned away from a pro-poor strategy towards encouraging privatized tenure and support for emergent farmers in communal areas (Benjaminsen et al. 2006, Rohde et al. 2006, Lebert and Rohde 2007).

We could have imagined other conclusions on the basis of the underlying models that the fence-line photographs represent, even without taking discussions on ecological dynamics into account. Both during and after apartheid, the degradation narrative has been applied to argue for small-holders' rights in South Africa (Beinart 1996, Dodson 2000). The degradation narrative actually served two purposes for the anti-apartheid movement. First, it illustrated the 'greed' of the well supported commercial white farmers, who along with the state, were seen as being responsible for the relocation of poor farmers to homelands and rural colored areas. Second, it illustrated the inequalities in a system where black and colored farmers were restricted to small portions of the country's land. Thus, where "the Native Economic Commission had blamed African culture and attitudes for ecological degradation in the reserves, it was not difficult to invert the argument and pin the responsibility on the restrictive policies of apartheid" (Beinart 1996: 61). By searching for the cause of overstocking within apartheid policies, the anti-apartheid movement shifted the blame away from black farmers and sought a solution to degradation problems in the redistribution of land to the poor (See paper 2 in this volume).

A study by Benjaminsen et al. (2006) is an example of an analysis of landscape change that was interpreted without using the logical framework of the degradation narrative. These authors use two aerial photographs of the same fence-line contrast as data, one from 1997 and another from 1960. From the 1997 aerial photograph, the private area is much more densely vegetated than the bare communal side. However, in the 1960 aerial photograph both sides look very similar: equally bare. How can that be explained?

In the interpretation by Benjaminsen et al. (2006), the fence-line contrast represents re-growth on the commercial side, rather than degradation on the communal side. The signs in the photographs are the same as in Hoffmann and Zeller (2005) and Todd and Hoffman (1999). Bare land represents high stocking rates, and vegetated land represents lower stocking rates. But in Benjaminsen et al. (2006) the perception of what changed, and consequently the causes of the changes, is different. The authors argue that it was primarily the private side of the fence that recovered over this period, rather than degradation occurring on the communal side. They contend that the cause of this recovery on the commercial side was destocking by commercial farmers as a consequence of official stock reduction schemes in the 1960s and 1970s. Benjaminsen et al. (2006) recognize the importance of stocking rates in terms of the effect on vegetation cover, but question the explanatory power of tenure as a cause of degradation. Rather than being a consequence of private tenure, the stock density (and subsequently vegetation cover) on the private side of the fence has been influenced by government subsidies and interventions. In addition, since the communal side has remained largely unchanged over decades, the study by Benjaminsen et al. (2006) questions the linkage between degradation and stocking rates, and indicates that high stocking rates are, in fact, less detrimental than the warnings have predicated.

As I have shown in this paper, much evidence exists to question the relevance of the rangeland succession model in dryland areas, as well as the broader links between stocking rates, land tenure and land degradation. Still, much ecological literature passes on these links and thereby reinforces the perception of communal areas as permanently degraded and in need for profound changes. The two fence-line contrast articles analyzed in this study do so by means of photographs and text. I show how the image of the fence-line contrast is put to work as a model that organizes causes and effects in rangeland management, thereby underlining a perception of difference between communal and private tenure and management practices, and consequently contributing to a wider degradation narrative that is still influential in southern Africa.

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