An Ecologically Sustainable Semi-Arid Rangelands in Australia

Investigating rangeland rehabilitation & regeneration techniques in semi-arid environments.

A report for

by Benjamin James Forsyth (Ben)

2008 Nuffield Scholar

November 2008

Nuffield Australia Project No 0803

Sponsored by:

Scholar Contact Details

Benjamin James Forsyth (Ben)
Beefwood Pastoral Company Pty Ltd
Three Rivers Station
Meekatharra
Western Australia
Australia
6642

Phone: +61 8 9981 2932
Fax: +61 8 9955 1414
Mobile: +61 427 551 114
Email: benforsyth@wn.com.au

In submitting this report, the Scholar has agreed to Nuffield Australia publishing this material in its edited form.

Nuffield Australia Contact Details

Nuffield Australia
Telephone: (02) 6964 6600
Facsimile: (02) 6964 1605
Email: enquiries@nuffield.com.au
PO Box 1385, Griffith NSW 2680

Contents

Foreword

"I love a sunburnt country, a land of sweeping plains,
Of ragged mountain ranges, of drought and flooding rains."

So wrote Dorothea Mackellar in 1906, towards the end of the golden era of Australian Agriculture, a time when our economy indeed "rode on the sheep's back".

Well, while a Nation was being built, a country was being torn apart.

Evidence is now before us that conclusively proves that huge tracts of our inland arid shrublands were in fact grasslands on a par with the drier areas of the Kimberley and Barkley Tablelands.

In the short history of white settlement we have hastened the natural attrition of these regions by thousands of years.

These are fragile lands, some of the oldest on earth, and their natural progression is one of steady decline through dehydration caused by water erosion.

There are many ways that the landscape was altered over the millennia, including flood, fire, hail storms, kangaroo grazing pressure and general climate change.

However, with the introduction of tracks, stock pads, fence lines, and roads, the vital features of traditional pastoral management, we have created faces of erosion throughout the cross section of these lands.

This is the legacy of a young Nation finding her feet and making the most of her resources.

This is also the legacy that current landholders have been left with, to deal with, in an ever changing climate with rapidly escalating expenses.

It is a legacy that must be addressed and is of a scale that requires the intervention of not just today's landholders but all the people of Australia who now benefit from the fruits of those earlier times.

My forebears knew no better and then, as it became clear what was happening, often had no choices left in a time of droving livestock and monthly mail deliveries. They were also under advice from Government Departments that did not have a full understanding of this new land and political pressure to maximize production in forging this new Nation.

I believe that it should not be viewed as a failure of pastoral activities as such, more of an activity before its time. If we could go back in time and open the rangelands again with today's knowledge there would be far different outcomes.

The tools are there for us to use and to find, both existing in Australia and from other similar climates around the world. Today we can look to rotational grazing, trap yards, solar power, telemetry systems, irrigation, kangaroo and vermin control, monitoring sites, satellite imaging, large machinery and road trains. We have developed erosion control techniques to slow the natural degradation and reseeding methods to ensure diversity and longevity of pastures.

Running a pastoral property in the new millennium is just as advanced from its origins as cropping is in our southern regions. With the rapidly increasing pressure rising from the Food v Fuel dilemma, it is a production system every bit as valuable as cropping is to our food supply too.

Together, with the knowledge of the landholders and the will of the people, we can not only regenerate these lands to halt the massive degradation occurring, but also turn this land back into the backbone of Australian Agriculture to help feed an increasingly hungry world.

So yes,

I too, love a sunburnt country, a land that's in my veins,
But I'll love it a damn sight more, when there's grass back on those plains!

#01 Amongst the first native perennial grasses returning naturally to the open country on Three Rivers Station, East Gascoyne, Western Australia. A significant milestone development for regeneration on this property.

About the Author

Ben Forsyth lives on Three Rivers Station, which is located on the headwaters of the Gascoyne River, some 200 kilometres north of Meekatharra and 1000 kilometres from Perth in Western Australia. Having been raised on Three Rivers, and earlier the neighbouring Bryah Station, Ben developed a deep love of the Australian outback in general and the land of his childhood specifically. Starting from his earliest childhood and primary school by Meekatharra School of the Air, to boarding school in Perth and working on family farms in the North Midlands Region of Western Australia, Ben has kept a continuous association with Three Rivers, returning annually for mustering and two terms of Managing, in ’95-’96 and ’04 to the present day.

Since returning full time to Three Rivers in 2004, Ben’s passion for his home country has evolved with a greater understanding of the ecological processes that are taking place and the extent of the erosion caused since pastoral activities commenced in the region. He is determined to find ways of rehydrating and regenerating these semi-arid rangelands to ensure an ecologically sustainable future for his property and the wider industry.

Ben is currently on the Ecologically Sustainable Rangelands Management (ESRM) Steering Committee, the Western Australian Farming for the Future Steering Committee and is the Western Australian Director of the Future Farmers Network. Through these networks and his own activities on Three Rivers, Ben hopes to be able to help address the considerable issues ahead for the pastoral industry.

#02 Author, Ben Forsyth, at the Grand Canyon during his Nuffield studies. One man’s natural wonder is another man’s erosion!

Acknowledgments

I would firstly like to thank Nuffield Australia Farming Scholars and the Sidney Myer Fund for providing me with this marvellous opportunity to expand my horizons whilst pursuing a topic I have a great passion for. Nuffield is an inspiring entity to be associated with and it is only through the generosity of sponsors such as the Sidney Myer Fund that they can continue to offer this wonderful opportunity and invest in the future of Australian agriculture.

My gratitude also to Barrick Gold Australia for their assistance in making my travels possible.

I have included a list at the end of this paper of all my hosts who generously gave up their valuable time for me, I thank you one and all.

I do however, need to make special mention of several men who were instrumental in organising my itinerary; Prof Ibo Zimmermann in Namibia, Prof Klaus Kellner in South Africa, Mr. Scott Opbroek and Mr. Gary Sundseth in the United States, Prof Robert Godfrey in the US Virgin Islands and Dr. Juan Carlos Guevara in Argentina. Without the wonderful assistance of these men I would've been just a tourist.

A public acknowledgement and vote of thanks goes to my mentor in all aspects of rangeland ecology, and probably many other things too, to Dr. Ken Tinley. Ken, you have opened my "EMU eyes" and I will be forever grateful for your ongoing mentoring and friendship.

To all those who have played a part in building my knowledge bank in the wonderful Australian rangelands, I also thank you. There are far too many to mention here, I can only hope they may know who they are!

To my nine Nuffield peers on the Global Focus Program, what an adventure we shared and how privileged I feel to have you as my mates. May we have many more years of laughs ahead! And likewise, to my Nuffield year group, both in Australia and globally, what an inspiring group of young people, thank you for your friendship.

My thanks also to my family, who enabled me to be away for such an extended period of time. I know that it wasn't always easy and you have my gratitude.

And finally, to my ever giving parents Graham and Dianne Forsyth, for everything they have done for me, this year and previously in life. You are my inspiration, I cannot possibly thank you enough.

Abbreviations

ABARE - Australian Bureau of Agricultural and Resource Economics

ALRS - Arid Lands Resource Sciences *(USA)*

ARSC - Arizona Remote Sensing Centre *(USA)*

BEHAVE - Behavioural Education for Human, Animal, Vegetation, & Ecosystem Management *(USA)*

BLM - Bureau of Land Management *(USA)*

CCD - Convention to Combat Desertification

CBD - Convention on Biodiversity

ESRM - Ecologically Sustainable Rangelands Management *(Australia)*

EMU - Ecosystem Management Understanding *(Australia)*

FS - Forest Service (*USA)*

FCCC - Framework Convention on Climate Change

FSDA - Free State Department *(South Africa)*

GSSA - Grasslands Society of Southern Africa

HM - Holistic Management

HMI - Holistic Management International®

IADIZA - Instituto Argentino de Investigaciones de las Zonas Áridas *(Argentina)*

IRS - Internal Revenue Service *(USA)*

ICRSE - International Center for Remote Sensing of Environment

KRI - King Ranch Institute *(USA)*

LTRR - Laboratory of Tree-Ring Research *(USA)*

LGP - Length of the Growing Period

NAU - Namibian Agricultural Union

NRS - National Rangeland Strategy

NNSG - North-eastern Nevada Stewardship Group *(USA)*

OALS - Office of Arid Land Studies *(USA)*

REM - Rangeland Ecology and Management *(USA)*

SNR - School of Natural Resources *(USA)*

SWC - Soil and Water Conservation

SRALT - Southern Rockies Agricultural Land Trust *(USA)*

SSA - Sub Saharan Africa

UA - The University of Arizona *(USA)*

WOCAT - World Overview of Conservation Approaches & Technologies

Executive Summary

Currently the Australian rangelands are enjoying a renewed vigour from occupants and agencies alike to pursue ecologically sustainable methods of utilising this vast national asset.

My report is aimed at discovering ways to assist with this process and, as such, I have visited locations in Namibia, South Africa, the United States of America and Argentina to investigate methods used in their rangelands that may be applicable to Australian conditions.

While each country enjoys individual variability's, there are common themes of drying landscapes, diminishing terms of trade, depleting rural populations and out of date methods being exhausted to try and either combat the issues or continue production.

With some 35 million km2 of the earth's surface being rangelands, there are enormous challenges in combating a snowballing desertification, but with that are equally enormous opportunities for combating global starvation and increasing CO2 levels.

I believe the most vital message from my travels has been to pursue international collaboration and cooperation in tackling these challenges, to overcome the tyranny of distance so evident when handling such vast areas. Too often I found groups, who are leading areas of research in their own country, without any knowledge of similar work being done in another country I had visited. This duplication, or at the very least the lack of sharing of knowledge, is a waste of energy and investment in a field that is severely lacking both.

There are the makings of these collaborating functions in place however, they need to be embraced by all and encouraged to redouble their efforts to see significant change occur.

I strongly believe that this is "line in the sand" time for the Australian rangelands. If we are to seriously tackle the issues of the past we must move past dwelling on blame and debate and start to develop and roll out strategies that will genuinely reinvigorate the respective rangeland industries to maximise the potential of this vast national asset in an ecologically sustainable and economically viable model for the world to respect and embrace.

In this report I have given detailed examples of overseas research I am unaware of in Australia, working models of stewardship groups and industry cooperation, successful long term property management methods, localised overseas sustainability issues and potential ways of bringing this knowledge together.

The success or demise of the rangelands now really lies with those who inhabit this area, including pastoral families and corporations, Aboriginals & Aboriginal bodies and the mining companies, to come together and find ways of embracing a common future. It will certainly mean some compromise for all and an understanding, if not acceptance, of the views of those further afield who have their own values attached to this vast area.

The government agencies and other bodies can do all they like to assist or hinder and the politicians and environmentalists can make all the noise in the world to buy votes or impose their will, but until those of us on the ground are willing to pursue a new path forward, together, these outside influences have little hope of making a meaningful positive difference to the future of the rangeland.

It is my hope this report will help generate interest and debate around the extended Australian rangelands community, amongst politicians, environmentalists, indigenous groups, government agencies and mineral & agricultural producers alike, to see a dynamic prosperity return to this vast area in a truly sustainable manner.

Introduction

“To Protect Your Rivers Protect Your Mountains”
-Emperor Yu Chin – 1600 B.C.

"But now, says the Once-ler, Now that you´re here, the word of the Lorax seems perfectly clear. UNLESS someone like you cares a whole awful lot, nothing is going to get better. It's not."
-Dr Seuss

You possibly couldn’t find two more diverse sources for quotable “facts” or “truths” however, I feel the combination of the two accurately tie together the scope of this Nuffield Report.
The objective of my Scholarship was to investigate rangeland rehabilitation & regeneration techniques in semi-arid environments so as to assist in building an ecologically sustainable Semi-Arid Rangelands in Australia.
Having identified the most similar climates around the world through discussions with Dr Ken Tinley and others, I set out to find as many local contacts in rangeland ecology as possible.
This orientated me to Southern Africa, the southern states of the USA and central Argentina.
Circumstances meant I had to forgo plans to visit Israel, Syria, the United Arab Emirates and Inner Mongolia China for an International Congress.
Throughout the course of my resultant travels, I continuously came across new leads that time did not allow me to pursue and, to a certain extent, this has lead to a frustration at not being able to find out more of the “big picture” of global research and practice.
With that said, I was fortunate to be able to visit with some of the most eminent people involved in ecologically sustainable rangeland research, education and management today and my report is only the tip of the iceberg of the knowledge I was provided with.
It has been encouraging to witness the diversity of research and practices being successfully carried out around the world, indicating there really isn’t a single answer to these complex issues, but with collaboration we can together make a vast positive difference.

Chapter 1: Rangelands, a Global Perspective.

"From the earliest of beginnings, our global grazing lands have been essential to human survival. Our relationship with grazing lands has been increasingly exploitive, but there is now a slow reawakening of our interdependence with the many services provided by grazing lands. Sustaining the natural capital of our grazing lands is crucial, as these areas represent a very large part of our global terrestrial ecosystems. This challenge is grounded in the socio-economic expectations of land users and nations." [1]

"Rangelands are the largest land use system on Earth. They constitute some 35 million km2 of the earth's surface, with the majority in developing countries and some 65% (almost 22 million km2) of this in tropical Africa. Over 180 million people in the developing world depend for their livelihoods on these systems, with just over half of them living on less than $2 per day and a quarter on less than $1 per day (Thornton et al . , 2002). Rangelands predominate in dryland areas where they may be defined as regions where there are less than 20 persons/km2 and where the length of the growing period (LGP) is less than 60 days/annum and does not permit significant crop growth.

These systems make use of natural vegetation and other natural resources and play a key role in the protection and maintenance of ecosystems goods and services. However, they have a limited primary biomass production with considerable and increasingly unpredictable temporal and spatial variation. In this respect, a key feature of these systems is the movement of animals to take advantage of spatial and temporal variation in feed and water resource availability (often linked to weather patterns).

Worldwide pastoral and agro-pastoral systems are undergoing unprecedented changes, and combined with the uniqueness of such systems, these present some particular development challenges which in turn imply research cannot be conducted as business as usual, but must be tailored so as to ensure the changing multiple service roles of these ecosystems are taken into consideration in order to have positive impacts on livelihoods and the environment.

[1] Building Bridges: Grasslands to Rangelands. (Joint introduction to the 2008 Combined International Grasslands & International Rangelands Congress).
James T. O'Rourke, Chair International Rangelands Congress (IRC): Chadron, NE, USA;
Gavin Sheath, Chair International Grasslands Congress (IGC): AgResearch, New Zealand;
Vivien Allen, ex Chair IGC: Texas Tech University, USA.

Increasingly, livestock are being recognised as part of integrated solutions for sustainable natural resource management in the broader development context (World Bank 2007)."[2]

These are two key quotes taken from the proceedings of the 2008 Combined International Grasslands & International Rangelands Joint Congress in Hohhot, Inner Mongolia, China, the "Olympics" of grassland and rangeland knowledge, if you will.

They detail the enormity of the area and problem my topic covers, but also record a heartening, if slight, change in focus from a lock up conservation mentality to an evolving sustainable production model for healing the rangelands and slowing or halting soil degradation. It has finally been publically recognised internationally that grazing animals can play a part in ecologically sound management. In fact, as I discovered on several of the sites I visited or was briefed on, grazing animals is the only tool that has actually made a real difference at all. This is a major breakthrough for pastoralists around the globe and indeed, for the health of our rangelands as well.

There are common themes around the world that are affecting the ability for land managers and agencies to roll out strategies to help regenerate degraded rangelands. Primarily this has been the lack of a common purpose and an agreed best practice. Pastoralists need to feed their family, environmentalists generally want to cease production and create reserves. Pastoralists generally need to see macro change, scientists focus on micro issues.

Secondly has been the massive escalation in the cost of fossil fuels and the flow on effect to all inputs required for both a pastoral operation and a successful rangeland regeneration project. Pastoralists no longer have the room in budgets to take their own initiatives to the field. Government programs no longer get the same "bang for their buck" in covering grants.

And thirdly, around the rangelands of the world, rangeland research is forever being squeezed with ever diminishing budgets and staffing numbers. Borrowing a phrase from an associate in Nevada, it is seen as "the redheaded stepson" of agriculture. It's not that "sexy" or exciting for students, it isn't recognised as being important to global agriculture and the rangelands don't carry enough votes to feature at election time. Finally, thanks to the relatively few who have dedicated their life's work to the field, rangelands are starting to come onto the radar as a vital part of a sustainable global future.

[2] Livestock production and poverty alleviation-Challenges and opportunities in arid and semi-arid tropical rangeland based systems. C. Sere, A. Ayantunde, A. Duncan, A. Freeman, M. Herrero, S. Tarawali & I. Wright: International Livestock Research Institute, Nairobi, Kenya. (Presented to the 2008 Combined International Grasslands & International Rangelands Congress).

Chapter 2: The Australian Picture.

The rangelands region in Australia takes up some 86% of our land mass, providing a home to around 11%, or 2.2 million, of Australia's total population and generating well in excess of $20b/annum through Mining, Pastoral and Tourism.

Around 6,000 pastoral enterprises occupy 58% of the land area in the rangelands, producing around 70% of Australia's total beef production and the vast majority of the national sheep and wool production. Approximately a further 18% of our rangelands are under Aboriginal ownership and management.

Fig 1 Australia's Rangelands distribution. A vast area of this continent. Original c/o ABARE

Australia's rangelands are home to a significant number of rare fauna and flora species and habitat for rare, threatened and endangered species and have large representative National Parks and Reserves, including five World Heritage sites.[3]

[3] National Land & Water Resources Audits '01-'07

In some aspects, the situation in Australia is far graver than that which I saw internationally. On average across the rangelands we are a much older landscape with considerably less soil remaining than other countries with similar conditions and, as a result, we have far fewer "second chances" left. We now must make the "right" decision at every possible juncture or risk irreversible degradation. While in the United States they deal in yards of top soil and Namibia they talk in feet, we in Australia are down to mere inches left in some regions.

However, we also have amongst the most dynamic land managers and eminent scientific brains in the field. There are fantastic examples of proactive land management within our own shores that provide a beacon of hope for those who choose to lift their heads.

The opportunity is there to adopt and adapt the work of others, both in Australia and overseas to suit the unique qualities of our own circumstance.

#03 Part of the Gascoyne Floodplain, Three Rivers Station, Meekatharra, Western Australia. Historically there would have been far fewer trees.

Chapter 3: The Namibian Experience.

My time in Namibia was arranged by the generous assistance of Professor Ibo Zimmermann of the Agriculture Department, Polytechnic of Namibia in the capital, Windhoek, Namibia's main University.

Prof Zimmermann has approximately one hundred students working on trial sites throughout the Namibian Rangelands working on Rangeland Ecology, Small Stock Production, Scrub Burning and various other fields.

Namibia is divided into Conservancy Areas, similar in distribution and activity as the Land Conservation District Committees found in Australia.

Research of Agriculture Department, Polytechnic of Namibia

During my stay, I visited two different active research sites to assess the monitoring and success of earlier activities.

Scrub Packing of Gullies

Site 1 was located approximately fifty kilometers south of the capital Windhoek, on the property of Friedel Rusch of farm Lichtenstein-sud in the "Auas-Oanob Conservancy"

The project has been written up in the research paper **"Restoration of a key gully system in the Auas-Oanob Conservancy of central Namibia"** by Shamathe, K.[4] , Pringle, H.J.R.[5] and Zimmermann, I.[6]

A snapshot of the project is found in part of the documents Abstract:

"A gully system with a slope of about 1:70 in an upland fertile valley, in the Highland Savanna of central Namibia, was treated with filters made of branches cut selectively from /Acacia mellifera/ that was growing in dense stands nearby. The branches were packed at strategic locations, with the branches sometimes woven with wire and tied to nearby trees.

If there was no appropriate tree nearby, a steel post was hammered in to tie the wire to. Ten of the treated features are compared with ten similar features in other unfiltered gully systems."

[4] Agriculture Department, Polytechnic of Namibia, P/Bag 13388, Windhoek, Namibia
[5] Bush Heritage Australia, P.O. Box 1705, Fremantle, WA 6160, Australia
[6] Agriculture Department, Polytechnic of Namibia, P/Bag 13388, Windhoek, Namibia

I was fortunate to be able to visit the location with all three of the projects authors.

#04 L-R. Dr Hugh Pringle, Mr. Kuniberth Shamathe and Prof Ibo Zimmermann discussing the progress of Shamathe's project.

The techniques used were very similar to the original scrub packing carried out as part of the Three Rivers EMU Project and, as with that work, was extremely labour intensive for a reasonably modest area of rehabilitation.

Overall, the works had started to filter washed soil and trap it on the upstream side of each filter however, there has been only one significant rain event, of 50mm, since the project was completed.

The principle student responsible for the project and co-author, Mr. Kuniberth Shamathe was on site for that rain event and was able to give an exacting verbal report of his observations.

Mr. Shamathe stated that the treated watercourse ran far slower than the control and the water was much cleaner, indicating the filters were being effective in slowing the flow and filtering out the mobile soils.

While results to date would still be too insignificant to measure by the systems they have available, all attending agreed there was a visual improvement, especially present in comparing the fodder available between the project and the control enclosures.

It is of interest to note that the landholder admitted he had made the erosion on the treated watercourse far worse by innocently tipping his scrap metal into the watercourse in an attempt to repair the existing damage.

According to local accounts, the watercourse "rapidly and dramatically deteriorated" and once again proved Dr Ken Tinley's mantra of "Hard on hard, soft on soft". That is, you must use hard materials only on hard surfaces and soft materials on soft surfaces where soils remain.

With this in mind, it is difficult to picture a less labour intensive method to replicate the works done on this trial.

A key to using this technique in Australian conditions would be to either source low cost labour or to carry out the construction from the head of a given watercourse over several years, accepting that some intervention is better than none.

Incorporating Charcoal Fines

Site 2 was located approximately 260 kilometers to the north east of Windhoek in the Sandveld Conservancy in the Otjozondjupa Region.

At this site there were various activities being researched due to the active encouragement to the Polytechnic by the local landholders.

The project of principle interest was on Wildernis Farm, the property of Emil Diekmann, where various methods of charcoal fines incorporation were carried out to investigate a potential increase of water retention in the deep sands of the area.

The original project has been written up in the research paper **"Contrasting restoration approaches in Namibia for a flat sandy area and a sloping area with firmer soil"**, again by authors Shamathe, K., Pringle, H.J.R. and Zimmermann, I.

An abridged version of the documents Abstract reads:

"The poor moisture holding capacity of Kalahari sand that has been exposed to wind erosion makes it difficult for perennial grasses to establish. Charcoal was tried as a soil amendment because it is good at holding water and because charcoal fines are available on farms where the charcoal produced from encroached bushes is sieved. On a farm in the Namibian sandveld, three different methods of adding 10mm of charcoal fines were applied to 54 strips of 10m each, by pouring the charcoal onto the soil surface, pouring it into shallow trenches and digging it into the top 25cm of soil. In addition, two types of microbial inoculants were

poured on 18 of the charcoal strips each, at a rate of 4 liters per meter of strip, after being diluted 500 times in water with a little molasses. Since there is rarely run-off in this flat sandy landscape, the strips were aligned in a north-south direction to face prevailing wind from the east. Digging in of the charcoal resulted in better establishment of ephemeral plants compared with leaving charcoal on the surface. A few days after rain, some samples of charcoal from the strips held 65% by mass of moisture."

In visiting the location it was established that the results showed slight but statistically insignificant improvement on the treated areas and when the expense of a commercial application was considered the project showed little promise of a viable alternative for graziers. The trial will continue to be monitored for longer term analysis.

It was discussed on site that if a tractor mounted broadcaster was available then properties such as this one, where charcoal production was already being carried out, may have found some long term benefit from spreading the waste fines rather than stockpiling them however, for producers without access to waste fines it is highly unlikely that an economically viable model could be found.

As with Site 1, the activity to establish such a small trial area had been extremely labour intensive and this would be a major impediment to replication in Australian conditions.

Further investigation and possible field trials should however be encouraged in this activity as the concept is one of merit.

Controlled Burning of Encroaching Scrub

On the neighboring farm Okarutuo, property of Gero Diekmann, we visited the research being conducted by student Ms. Lahja Tjilumbu in measuring the benefits of controlled burning on encroaching scrub.

The trial was in its early stages with only one burn and a single rain event with initial measurements commencing on the day of our visit.

Without any data to compare it is difficult to come to any conclusions however, a visual appraisal of the site against its control would suggest significant improvement in the diversity and density of palatable grasses on offer in the treated area.

Prof Zimmermann also gave anecdotal evidence of similar, if not more impressive, results on a neighboring property that we were unable to gain access to on the day we visited.

Namibian National Rangeland Strategy

Thanks to contacts from Prof Zimmermann I was also able to attend the second sitting of the National Rangeland Strategy (NRS) Meeting hosted in Windhoek by the Namibian Agricultural Union (NAU).

Attending the meeting provided me a great insight into the day to day concerns of Namibian Farmers, many of which had similarities to those found in Australia.

Global & Local Issues

Familiar topics were land tenure, climate change, rising fuel prices, falling market prices, staff availability and the increasing average age of those on the land.

Admittedly, there were also some issues that Australians are fortunate not to be faced with, such as "Affirmative Action" in the employment of key research and administrative positions, compulsory lands buy back for resettlement and marketing quota on time and destination of marketed stock.

Currently, for every animal sent to an export market, producers will need to sell six animals to the domestic market in a seemingly misguided attempt to protect domestic availability.

Bush Encroachment on Groundwater

During the meeting there was also two very interesting presentations given.

The first given by Mr. Frank Bockmuhl, titled "Bush Encroachment on Groundwater", reported research conducted on how the water tables of areas were drastically affected by bush encroachment.

At Goabpforte a drop of the water table had been measured of 16 meters in 26 years.

During this period, farmers have made significant changes to their "pleasure usage" of water, such as on extravagant gardens.

Records of the study area showed a decrease of 2.7 million large stock in 1958 to a reported 7 to 800,000 in the 90's and yet water tables continued to plummet and bush encroachment was overwhelming.

It was described that a period between the 1940's and the 1960's saw the area's condition change from "original to disaster".

A Lesson on Woody Weeds

Photos were shown of an area of bush encroachment, remarkably similar in visual appearance to the Three Rivers Gascoyne South Branch, where trees similar to Mulga's (Acacia aneura) and Curara (Acacia tetragonophylla), had a root system extending some forty four meters from the stump.

Generally, it was described to the meeting, anything from +40% scrub cover meant that "Farmers were in trouble". Monitoring shows that the study area averages 60% scrub cover and can experience anywhere up to 90% scrub cover.

The amount of precious rainwater being lost from grass production to this encroachment is immense and I could immediately recognize a direct comparison to vast areas of the arid rangelands of Australia.

#05 Excavation of the root system on a small Blackthorn Bush (Acacia mellifera). Roots from this small shrub measured laterally up to 44 meters. Photo c/o Namibian Ministry of Agriculture, Water and Forestry.

I feel it is imperative that research is commenced to investigate control of scrub encroachment and "woody weeds" in floodplain areas such as the Three Rivers Gascoyne South Branch Floodplain.

Groundwater Monitoring

A message that I feel should be reinforced of Mr. Bockmuhl's points is that we must regularly measure groundwater at fixed locations to demonstrate seasonal versus long term change at a regional level.

In Namibia this is being used as the primary monitoring system of rangeland condition however, in Australia, I would see a greater role in demonstrating success or failure of rangeland rehabilitation and regeneration techniques.

Global Warming Implications for Namibia

The second speaker, Mr. Peter Zensi, provided feedback from the Climate Change Symposium he attended in Lusaka, South Africa in May 2008.

Overall, the information reported was of a similar nature to that currently presented and generally accepted by the majority of producers in Australia.

The localized issues for Namibia and Sub Saharan Africa (SSA) where:

i) Namibia would continue to get drier,

ii) SSA should expect and plan for "More of the same", that is if you get droughts, expect more droughts. If you get floods, expect more floods.

The future for SSA will include more extreme extremes, and

iii) "Sell your house" (in Walvis Bay). Sea levels are expected to rise significantly enough to affect Namibia's few coastal communities.

Namibian Ministry of Agriculture, Water and Forestry

On my last full day in Windhoek I was able to squeeze in a meeting with Mr. Leon Lubbe, a senior pasture expert at the Namibian Ministry of Agriculture, Water and Forestry. Mr Lubbe provided me with a fantastic overview of Namibian Agriculture in general and the role of the Ministry and some of the activities they were involved with. He was most generous with his time and resources and helped me tie all the pieces of the previous week together before I left for South Africa.

Observations of Namibia

In general, from my time in Namibia, I saw a country with many issues but plenty of opportunities as well.

Compared to neighboring SSA countries, they are far further advanced in having a generally well functioning representative Government that is prepared to listen and work with its primary producers.

I was informed by Prof Zimmerman that, under current circumstances, very few primary producers would be economically sustainable from only the production from their land. Almost all have to rely on other income, such as hunting and tourism, and off-farm investments or are otherwise financially "going backwards".

If the Government is prepared to accept the final NRS presented by the NAU then there is every hope for a developing Agricultural Namibia to be able to sustain her own food consumption, if not even become a net exporter of domestic and game meat products.

#06 Typical country on Mr. Gero Diekmann's Okarutuo Farm, in the Otjozondjupa Region, Namibia. Or could it be the West Gascoyne!?

Chapter 4: South Africa, the "Rainbow Nation".

The Grasslands Society of Southern Africa Congress

Prof Klaus Kellner[7] visited Three Rivers during May 2008 and, following his advice, I attended the Grasslands Society of Southern Africa (GSSA) Congress in Badplaas, Mpumalanga Province, South Africa.

The GSSA Congress is the annual opportunity for Southern Africa's rangeland and grassland scientific community to come together to share new findings and discuss future directions in agricultural research.

Although heavily weighted towards the scientific community, it gave me a valuable insight into rangeland and grassland agriculture in South Africa, especially by networking with fellow delegates during the free time.

Water Harvesting Structures in the Western Cape

I was able to have a private session with Mr. Charl du Plessis[8], Mr. Albertus Dyason[9] and Ms Nelmarie Saayman[10], amongst the leading people in arid land erosion control methods with works throughout the Western Cape and into the Kalahari Region. After delivering a briefing of the situation at Three Rivers and semi-arid Western Australia, I was taken through a power point presentation of their combined activities showing examples of structures they have used.

The key message was the need to focus on controlling the energy of the water by either slowing the water through multiple interventions or to spread the water over a greater surface area, allowing the increased friction to take its course. It was also strongly encouraged to incorporate nature in the process by both planting grasses and using scrub lines on the contours.

Of those discussed, a favored method used is to construct large earth contour banks with cement low points for overflow. These are used on flat country to help pool water across large areas in an attempt to absorb precious rainwater in situ and to capture sediment runoff.

[7] School of Environmental Sciences and Development, North West University, Potchefstroom Campus, North West Province.
[8] Western Cape Department of Agriculture, Elsenburg, Western Cape.
[9] Western Cape Department of Agriculture, Elsenburg, Western Cape.

A key feature is to construct a gabion "batter-wall" immediately downstream of the cement structure so as to take the momentum and energy out of the water generated by the water falling out of the overflow.

In all cases, the message was to over-engineer structures for the 1 in 100 year rain event rather than for the average season and risk undoing the good work by experiencing an extreme weather event.

Principles of Controlled Grazing

In a second individual session with Mr. du Plessis, we had an in depth discussion about the options for developing a cell grazing system on Three Rivers and the principles involved in ensuring viability in a semi-arid rotation system. The more important factors were firstly to ensure that a given area was not consistently grazed at the same time of the plant growth cycle and secondly to ensure a nutrition and energy spike for the three weeks before the planned mating period. We agreed this could be achieved in a couple of ways but most likely that it would be a case of both moving into a new cell at that stage and to "spoil" the cows a little by providing feed for just that period.

Mr. du Plessis was keen to ensure I understood that veldt, or rangelands, should only carry what the available natural feed would allow and that long term supplementation of bulk feed and energy would inevitably do the country more harm as the same number of animals would be chasing more fodder. Although not mentioned, this would also indicate a factor against the use of urea in rangeland grazing.

We discussed the merits of having a separate "kraal" or feedlot to remove the annual tail of production at weaning and any cull animals so that the optimum number of breeding cows remained in the rotation and the desired weaning sale weight was maintained.

[10] Western Cape Department of Agriculture, Elsenburg, Western Cape.

Remote Sensing Technology

I also had separate conversations with two of South Africa's leading specialists in Remote Sensing Technology in Ms Linda Kleyn[11] and Dr Theunis Morgenthal[12]. From both researchers I gathered that, while Remote Sensing has a great role to play in the future of Rangeland Management, it is currently very cost prohibitive and is certainly only one leg of the monitoring system "stool".

Both agreed that methods are being improved all the time and possibly in the future Remote Sensing will become a practical tool for land managers to use. Ms Kleyn has carried out extensive field work in partnership with Rangers and researchers at the Kruger National Park and, during the GSSA Session on the topic, the papers delivered certainly illustrated the potential merit of the technology. Currently in the Kruger National Park they are mapping fire scars, sodic soils and spatial & temporal forage production.

Advice from Dr Morgenthal indicated that currently the larger the area and the more basic the required differentiation the more accurate the results would be. As an example, Dr Morgenthal had recently completed a potential grazing day's image for the whole of South Africa.

Dr Morgenthal and Ms Kleyn both confirmed that the current technology could measure and help demonstrate an increase of perennial grasses and a decrease of perennial shrubs on a station scale if cost was not a factor. Ms Kleyn stated that there were good advances being made in the field in Australia though mostly in Queensland. Western Australia should definitely be looking to further research the technology so as to ensure developments in mixed grass/shrub zones to suit the normal conditions in this state.

Following the GSSA, Prof Kellner took me with him to Potchefstroom via Pretoria, visiting Dr Dirk Pretorius, Assistant Manager (Resource Monitoring) Directorate: Land Use & Soil Management, South African Department of Agriculture. Dr Pretorius has a focus in Digital Imagery Mapping and Remote Sensing and it would appear that South Africa may be ahead of Western Australia in this field.

[11] University of the Witwatersrand, School for Animal, Plant and Environmental Sciences, Johannesburg
[12] Eastern Cape Department of Agriculture, Dohne ADI, Sutterheim, Eastern Cape.

WOCAT

Dr Pretorius also introduced me to WOCAT, or "World Overview of Conservation Approaches & Technologies". WOCAT's mission is "*to provide tools that allow Soil and Water Conservation (SWC) specialists to share their valuable knowledge in soil and water management, that assist them in their search for appropriate SWC technologies and approaches, and that support them in making decisions in the field and the planning level."* [13]

"WOCAT was established as a global network of SWC specialists. It is organised as a consortium of national and international institutions and operates in a decentralised manner. It facilitates more efficient use of existing know-how and, consequently, of development funds.

WOCAT also contributes to the implementation of United Nations Conventions, such as the Convention to Combat Desertification (CCD), the Framework Convention on Climate Change (FCCC), and the Convention on Biodiversity (CBD).

WOCAT focuses on making better use of scarce resources with the aim of promoting sustainable land management. In many parts of both industrialised and developing countries, soils are not managed in a sustainable manner.

Moreover, the majority of people in developing countries are directly dependent on land resources. Maintaining or improving the quality of these resources is thus an important step towards improvement of rural livelihood and poverty alleviation, and finally, towards more sustainable development."[14]

From our discussion it was revealed that Australia has no presence in this important project and Dr Pretorius and I discussed finding ways of introducing the concept into the Australian rangelands as soon as possible. In his eleven year association, Dr Pretorius had found WOCAT to be "very worthwhile" for South Africa to be involved with.

[13] WOCAT Website Introductory Page: www.wocat.org
[14] WOCAT Website Information: www.wocat.org

The Vredefort Dome and Pilanesberg

#07 Typical country in and around Pilanesberg National Park, north western South Africa. Natural grasslands with abundant species.

Due to local farmers not encouraging visitors on weekends, we used the two days to discuss Prof Kellner's work with North West University and to visit both the Vredefort Dome World Heritage Site asteroid crater and the Pilanesberg Wildlife Park. In both instances, while there was obvious tourist value, Prof Kellner was also able to give me a running commentary on landscape function as we crossed past farmland and through parkland. The similarities to the arid regions of Australia were remarkable, although it was clear that the areas we travelled through were geologically "newer" and had substantially deeper soils than similar lands in Australia.

Sparta Feedlot

As the working week commenced we travelled south east into the Free State and firstly visited the Sparta Feedlot of Mr. Lou van Reenen and family, a well run operation of some 40,000 head on feed and another 20,000 head in the surrounding 12,000 ha of paddocks, or “camps”, being backgrounded.

Sparta is virtually its own community and due to the relative isolation of the property, all maintenance of the considerable machinery and building of required plant is carried out by the company’s own staff.

There are some 130 personnel involved in the day to day running of the feedlot and stock however, considerably more people were present carrying out maintenance and development projects throughout the property.

Sparta produces the majority of the 51,000 tonne of silage required annually and they are fortunate to have a controlling share in the nearby abattoir that processes their average 12,000 head per month production. Mr. van Reenen chooses not to have set supply contracts with producers but does have certain producers that he favors and regularly negotiates open market based deals with.

Intensive Creek line Rehabilitation with Manure

An interesting project Mr. van Reenen has is with the disposal of the manure from the feedlot. While marketing has now seen most of the annual supply leave the property to become manure compost fertilizer for nearby properties, when he has an excess he uses it in the restoration of a severely eroded creek line, or “donga”, which runs through the property.

The soils are very high in sodium and magnesium and as such are very unstable to run-off. The project sees a Caterpillar D7 battering down the eroded banks and then a thick layer of the composted manure applied to the fresh surface. The works are remarkably successful with re-vegetation occurring in the first season and land returning back to full production within four to six years. Mr. van Reenen admits it is a costly process, especially as it is at the expense of compost sales however, he feels compelled to try and regenerate some of the lands that have been eroded during his family’s tenure on the property.

#08 Cement weir on Sparta Farm, the upstream side has completely filled with soil and pasture. A fantastic example of appropriate engineering.

Sparta Summary

While Mr. van Reenen and his family have much to be proud of in their operation, he did tell me of a saying of his father's that he tries live by; "If you push your chest out your trousers will fall down!" By Australian standards the Sparta Feedlot is majorly overstaffed however, it is one of the biggest feedlots in South Africa and provides a major source of employment for the local population, both directly on the farm and indirectly by supplying the local abattoir and, wherever possible, buying from the local town businesses.

The Free State Department of Agriculture

Travelling on to Ladybrand the next day we met at the office of the Free State Department of Agriculture (FSDA), with host Mr. Andri van Greunen and Bloemfontein based erosion control specialists Mr. Chris Smith and Mr. Frans Lategan.

Ladybrand Erosion Control Trials

Following an introductory to Agriculture in the Free State, we travelled firstly to a breeched cement weir, that hadn't been keyed into the banks far enough or maintained, and then to their nearby erosion control trials.

#09 Cement weir near Ladybrand, Free State, South Africa.
The walls were not keyed into the landscape far enough and have failed.
A total waste of resources due to poor design and lack of maintenance.

Many methods of controlling gully erosion have been trialed and measured for future comparison. The main feature was a large gabion weir structure in the primary control point however, various other structures including log walls, rendered stone and earth baskets were also to be seen and compared.

Discussion focused on the longevity of the wires involved in the construction of the gabions and other structures however, the specialists were confident the double galvanized netting would last at least fifty years, although it could be argued even that isn't long enough when considering the role they are playing in the landscape.

One of the steps taken in consultation with the landholder was to exclude the area from all grazing and to re-locate the watering point outside of this area. We discussed the new erosion line created by burying the pipeline straight up the nearby hill when it was pointed it out. Hopefully action will be taken to protect the rip line before it blows out and bypasses all of the good work they have previously done on the trail site.

#10 Author inspecting various erosion control trials near Ladybrand, Free State, South Africa. Earth Baskets. Photo c/o Prof Klaus Kellner.

There were also trials of the merits of various surface flow controls such as stone terrace lines, palm matting and half moon earth banks. The trial area for each had a tin barrier fence to avoid run-on surface flow and a device for measuring the run-off of each plot. So far the new site hadn't experienced enough rainfall to produce meaningful data for comparison of the methods.

Umpukane

Our final visit was to Umpukane, a diversified farming operation run by the van Rooyen brothers and their respective families. We originally requested a visit to discuss and view their renowned Bonsmara Stud however, it soon became evident that there was far more to Umpukane!

Bonsmara Stud

In 1948 the van Rooyen's father started to clear the land to finally settle on the current 3,500 ha, with a balance of lower grazing land and high plateau agricultural land. After many years as a commercial beef and cropping operation the Bonsmara Stud was founded in 1978, growing to a registered herd of 500 cows and turning off an average of 40 bulls per annum.

#11 The "dynamic" van Rooyen Brothers, Umpukane Farm, Free State, South Africa. Diversification personified! Five businesses, three generations & counting!

Younger brother Hans, who now runs the beef interests, rates the Bonsmara as a stable breed down through the years that has remained a moderate sized docile animal that is always competitive with other breeds that have come and gone in the region.

Developed by Prof Jan Bonsma in the late 1930's, to address a need for a type of cattle suited to both the subtropical and coastal regions of South Africa, and declared a breed in 1961, the Bonsmara has always had a strong emphasis on economical performance measurement in genetic selection.

This has seen the breed become the largest herd in South Africa and spreading around the globe to the rest of Africa, Australia and throughout the Americas.

The Bonsmara has become the forerunner in the stud and beef industries in South Africa and is a functional, fertile, productive and well-adapted breed to fully utilize the diverse scrub and grassland grazing found throughout the areas it inhabits. The Umpukane Bonsmara Stud remains a South African industry leader by both deeds and performance.

#12 Bonsmara herd bull of the van Rooyen's Umpukane Bonsmara Stud in typical pastures of the property, Free State, South Africa.

Certified Seeds

Older brother Piet, although telling us he has declared to the family he has "slowed down", remains an active member of the van Rooyen business, covering two separate divisions of their operations. In running the farming aspect of the company Piet has developed and now started to market the new "super grass" of South Africa, "Tip-Top", a genetically selected Smutsfinger grass that the family have exclusive rights to and market under the van Rooyen Seed brand. Other seeds also marketed include another variety of regular Smutsfinger grass, fodder plant Eragrostis Curvula Ermelo and a 14% Protein pasture maize named "Cloc 1".

Organic Fertilizers

A complimentary cash business that Piet has developed over the years has been "Green Gain" an organic based fertilizer created on site from minerals and manure bought in from the Sparta Feedlot. Green Gain offers various blends to suit the soil test supported requirements of each client, rather than a one blend suits all approach.

#13 Prof Klaus Kellner & Mr. Piet van Rooyen inspecting the "Green Gain" production shed. Umpukane Farm, Free State, South Africa.

Cut Flowers

On returning to the family farm in the mid 90's, Peet van Rooyen, son of Hans, started to investigate growing flowers on Umpukane and after a period of development founded Umpukane Flora as a supplier of cut flowers throughout South Africa. From a niche "hobby" Peet has followed the family tradition in turning an idea into a successful diversification for the family company.

Tourism

As if there weren't already enough irons in the fire for the van Rooyen Clan, on saying our farewells it was also disclosed that the family maintained a very secluded and exclusive hunting lodge at the back of the property.

The van Rooyen's, a Family Success Story

Umpukane, with all of her varied faces, is both a magnificent and scenic property and also a model of a highly successful, multi generational, agricultural family business. Having investigated and resisted the considerable temptations of emigrating during the early nineties, the van Rooyen family has set about building an impressive enterprise for future generations and their local community.

#14 A family success. Brothers Piet & Hans van Rooyen diversified to allow room for all the family. Umpukane Farm, Free State, South Africa.

Observations of South Africa

Throughout my time in South Africa I came across some common themes. Most successful farming operations seemed to be long established family companies, who had a strong link with and high utilization of the local community, rather than corporate and absentee models. Prof Kellner noted, that on the two properties we visited, the white management spoke to the black staff in their local dialect, rather than Afrikaans or English that all South Africans can speak. This showed both a cultural respect and smart business savvy in keeping the local community onside.

There also appears to remain a defiant resistance by the Afrikaans speaking people to expedite the united progress of the "Rainbow Nation" and an ingrained dislike for all blacks. In public there is a "keeping up of appearances" but in white company the blacks are generally derided and ridiculed for their ability to run the country. That isn't to say some of the misgivings aren't without foundation however, it is quite evident that the stance is generally based on racial lines rather than an individuals' merits.

It is a very difficult position the Afrikaans people find themselves in. Throughout their history in Southern Africa the Afrikaners have faced adversity and defended their rights to the land they inhabit, being continually forced from those lands. After finally settling a region successfully for several generations they are again being challenged in their own back yards.

However, this is a battle they can never win. It is a cultural dynamic which has been a long time in the making and, unfortunately, it would appear that it is a situation that will be a long time in healing for those who choose to remain in the new South Africa, despite what the spin doctors would have you believe. The opinion of a couple of seemingly moderate whites I spoke with was that both sides of the fence were still two or three generations away from truly considering each other their equal.

There is a genuine concern for what will happen under the new Jacob Zuma government and also for the potential flash point of Nelson Mandela's eventual death. At 95 years of age, even the great Madiba cannot live forever and many whites fear that there will be a violent uprising sparked by his passing in an era of a more aggressive Zuma leadership.

A public impression from random conversations in Johannesburg is that South Africa is five years away from being the next Zimbabwe and that, without strong cultural and economic leadership in the next year or two, the country is set for a great decline.

While Affirmative Action is seeing far greater numbers of blacks going to University and being put in positions of influence and power, this is being matched or surpassed by the continued flood of the countries “youngest and brightest” white emigrants to countries such as Australia, New Zealand, England and America.

The South Africa I saw still has all the assets required to regain its historical position as a first world power under a new black leadership, but all the signs of plummeting into a third world disaster zone without an immediate change of common resolve.

One can only hope for the rise of a new figurehead to take up the burden that is slipping from the shoulders of the aging Madiba.

The fate of millions of South Africans depends on it.

#15 Pilanesberg National Park, SA.
Zebra, Kudu, Oryx, Warthog, Birds & Crocodile all living in harmony.
Can South African society ever reach this level of cooperation?

Chapter 5: The United States of America.

The majority of my time abroad was spent travelling through the United States during a time of great political debate, during the Presidential Campaigns and Party Conventions of late 2008 to decide who would become the 44th President.

This topic underscored virtually every meeting I had and, as a bystander, gave me a valuable insight of the collective American psyche. Aspects of party politics never seen at an international level were regularly raised in regard to rangelands management and some of the issues may well prove to be a glimpse into the future for Australia.

A lesson in the Rockies

Much of my early travels were in Colorado and Nebraska pursuing the "Heat Adapted Bos Taurus & Composite Breeds" aspect of my Scholarship, for which I have prepared a separate paper on.

What this time did allow me was to traverse the full width of the Rocky Mountains along the Colorado River by train from Denver, Colorado to Salt Lake City, Utah and then later through the Sierra Nevada from Elko, Nevada to Davis, California. These fascinating journeys, while spectacular, gave me an opportunity to grasp the enormity of geological and geographical differences between the United States and Australia.

It became clear to me that I was looking at an "Australia" of a much earlier time. I was seeing a version of Australia that indeed was supporting abundant life in a wetter climate, as scientists tell us Australia used to. What these scientists generally put this down to is indeed the wetter climate however, what occurred to me on that long train ride was that it isn't just the climate that has changed but also the soils to support the growth required.

Over the millennia vast amounts of Australia's topsoil have been depleted by erosion and the shallow soils we see today in areas such as the East Gascoyne are a mere miniscule remnant of what once would have been our Rocky Mountains and Prairie lands.

#16 Colorado River, 100 feet below, cuts a path through the Rockies near the Colorado-Utah border. Erosion and beauty are not always mutually exclusive!

#17 Western slopes of the Rocky Mountains, Utah, USA. Tens of thousands of years "younger" than Australia.

Where we are left with soft "sweet spots" in the rangelands is generally where there has been a natural feature such as a mountain range to slow, not stop, the erosion or a delta fan enjoying the devastation of the inland.

While it would seem it is not within human capabilities to halt erosion on such a continental scale, I feel it is an important message to grasp where as a landmass we have come from if we are to look forward to what is achievable with the remnant we are left with as custodians.

With Barrick Gold in Utah and Nevada

Having left the "green states" behind, I had the pleasure of meeting with Barrick Gold representatives Mr. Ron Espell, Director, Environmental and Mr. Gary Sundseth, Surface Resource Manager in Salt Lake City, Utah. I also had a brief meeting with Mr. Cy Wilsey, Regional Land Manager, North America.

BEHAVE!

With Mr. Espell and Mr. Sundseth, I drove to Logan, Utah to meet with Prof Fred Provenza, Department of Wildland Resources, Utah State University, an eminent expert on animal behaviour. Prof Provenza was a wealth of information on a wide cross section of rangelands issues and I only wish I had had more time with him.

The culmination of Prof Provenza's work comes together with the BEHAVE Program, or Behavioural Education for Human, Animal, Vegetation, & Ecosystem Management in its longer form. Also based out of Utah State University, the BEHAVE mission is *"to inspire people to master and apply behavioral principles in managing ecosystems"*.[15]

BEHAVE is a research and outreach program aimed at understanding the principles that govern diet and habitat selection. This includes the fascinating concept of imprinting animals to be attracted to a given weed or dominant species in a pasture to assist with control.

There are various other interesting livestock projects running concurrently, including developing tolerance to toxins in plants and developing a natural ability to overcome mineral deficiencies.

These are all fields I could see direct applications for in Australia and I feel the rangelands community should be pursuing relations with the BEHAVE Program to facilitate the adaption of these practices and research for our local situation.

[15] BEHAVE promotional material.

Barrick Gold Ranches

From Logan, it was back via Salt Lake City to Elko, Nevada, the US base of on-ground operations for Barrick Gold. Mr. Sundseth most generously hosted me for the week and showed me over two of Barrick's own ranches, "The Tumbling JR" & "The Dean", and accompanied me to the Cottonwood Ranch of Mr. Agee Smith.

All three ranches had a common theme of combating scrub encroachment and dealing with outside influences. For "The Tumbling JR" and especially "The Dean" there was a huge issue of feral horses impacting on their grazing lands and causing massive erosion.

Due to "local politics" of Indian ownership and Government regulation, it seemed the Managers' hands were tied on addressing the situation. It was also obvious the situation was causing Mr. Sundseth considerable distress at his powerlessness to do what was best for the land under his management in removing the horses, due to yet another case of bureaucracy gone mad.

The Dean Ranch is a special piece of land that most rangeland producers would love to tackle however, while the outside influences are there it is difficult to see any ecologically sustainable way forward for Mr. Sundseth and his Manager to pursue.

#18 Feral & Indian "owned" horses on "The Dean Ranch", Battle Mountain, Nevada USA. An official and unofficial bureaucratic nightmare!

The Cottonwood Ranch & Community Consultation

The outside influences on The Cottonwood Ranch for Mr. Smith were more in the historic dealings with the two Government agencies involved with rangelands in the United States, the Bureau of Land Management (BLM) and the Forest Service (FS). However, due to an inspired move by Mr. Smith in 1995, this dynamic changed after he attended a Holistic Management® (HM) workshop in Elko. Mr. Smith takes up the story in a recent press release:

"At the time, the Smiths were battling with the Bureau of Land Management and the Forest Service over mandatory cuts in their cattle grazing permits.

Both agencies supervise grazing permits for the ranch, and one permit covers designated wilderness in the Jarbidge Mountains. "They had cut our numbers to below 300 cows and this operation was no longer viable," Smith says. "I was tired of the fight. Life is too short." As a part of his new management philosophy, Smith tried something almost unheard of in the contentious environment of Nevada's public land management: He invited everyone who was interested in the natural resources on the family ranch – environmental groups, agency personnel, and university and extension people – to create a collaborative management team.

"This is a decision-making body, not just an advisory team," Smith says of the people who direct major decisions on his 1,200 acres of private land as well as 34,000 acres of public land. "Now we have problem-solving meetings, not barrier-type meetings. We all at least respect one another and a lot of us are good friends."

Smith counts this unusual team of managers as one of his biggest successes. "A lot of people want to do this, but can't get it off the ground," he says. "And sometimes an agency will say it takes too much time. It does take time, but so do court rooms."

The group's decisions have been right, at least some of the time. The Smiths have tripled the number of cattle they run."

Mr. Smith also incorporates his highly successful Agro-Tourism venture with his rangelands management by offering packages that include assisting with the daily movement of livestock by horseback.

The Cottonwood Ranch is today a flagship property in the American West for sustainable production and community consultation and co-operation.

#19 Mr. Agee Smith of "The Cottonwood Ranch", Wells, Nevada USA. Facing near bankruptcy, a last ditch HMI® course in nearby Elko changed Mr. Smith's focus to Agro-Tourism and developing his rangeland management strategies.

#20 Mr. Gary Sundseth & Mr. Agee Smith inspecting the pastures on "The Cottonwood Ranch", Wells, Nevada USA.

The North-eastern Nevada Stewardship Group (NNSG)

The North-eastern Nevada Stewardship Group (NNSG) is an Elko, Nevada based initiative that evolved out of a Bureau of Land Management (BLM) sponsored community partnership training program, entitled “Community-based Partnerships and Ecosystems for a Healthy Environment”, in 1998.

While I was based in Elko, Mr. Sundseth organized a meeting for representatives of the NNSG, Barrick environmental representatives and me. Following my giving a brief presentation on my Scholarship, the Western Australian rangelands and the project underway at Three Rivers, we then proceeded to discuss the formation and activities of the Group.

The not for profit Group works to expand natural resource educational opportunities for citizens of diverse interest, local governmental entities, and state and federal agency personnel. Established working groups, known as "pods" focus on issues of concern and make recommendations to the management committee on potential educational forum topics. Following are the current working pods: The Sage Grouse Pod, The Heritage Pod, SWEATCo (Soil and Water Enhancement Action Team Coalition), The Science Pod, The Fire Pod and, The Recreation Pod.

Financial membership is not required however, the Group does have an annual fees structure for those who can help support the initiative. Compared to most other rangelands groups I am familiar with, the NNSG has a quite demanding regular meeting schedule with the eleven member board meeting for an hour and a half on the first Thursday evening of every month and a public meeting for two and a half hours on the third Thursday of every month. There are also annual workshops and tours and of course the Pod activities themselves. NNSG also provide an encouraging example of involving local mining companies at the grass roots level.

Currently NNSG reportedly have approximately 200 non financial members who have an interest in some activities and 50 dedicated financial members who regularly attend meetings and help with the running of the different Pods.

The Group has grown to the stage they are able to employ a part time Executive Director for eight hours per week.

According to founding member Mr. Gary Back, *"We started the group out of frustration with the way land use decisions were being made in this area. Agencies were being responsive to outside interests (various national and regional environmental groups) but not to the local citizens. So this group was created to look at a landscape scale approach to managing the private and public lands, based on input from anyone that wanted to be part of the process.*

We initially had people from adjoining counties attending our meetings as this was a new and interesting experiment. However, there are now fewer people taking an active role and the agency presence has increased, which I don't view as a positive action. I still strongly believe that the citizens of Elko County need to make their voices heard in a positive and constructive way to maintain their heritage and to have input on how land management decisions, which directly impact them, are made."

I would echo Mr. Backs' concern about getting the balance right between private and agency presence when trying to be an effective and relevant voice in the rangelands. While there is certainly an obvious need for input and direction from the agencies, I strongly feel that those with a vested interest in outcomes, and not just landholders but mining, indigenous, animal welfare, recreation etc, need representation proportionate to their stake hold in those outcomes.

It is all too easy, with many examples found around the rangeland and agricultural world, for agencies to work their way into management positions of groups in an appointed role to champion their agencies own agenda, only to see the original initiative fall over as it has lost the community backing that founded the project.

While never acceptable, the rangeland in Australia no longer has the population willing to continually step forward for volunteer roles on committees anymore and I feel all groups should be even more vigilant in "getting the balance right".

In all, this was an enjoyable and thought provoking session for all and, as usual, could have gone on for many more hours.

The Southern States

In Arizona and New Mexico I found the most dynamic and relevant locations for potential benefit to Australia of the places I visited.

Carrizo Valley Ranch

I had the privilege of spending a long weekend at the Carrizo Valley Ranch, the property of Mr. Sid Goodloe. Mr. Goodloe is acknowledged as being the first person to bring the practices of Mr. Allan Savory from Zimbabwe (then Rhodesia) to the United States, following a visit there in 1969 and resultant paper, as published in the Journal of Range Management. On his return, Mr. Goodloe embraced the message of Savory and commenced progressive change on Carrizo Valley over the next 39 years. Gaining a disparaging nickname of "Pyro Goodloe" for his continual burning and clearing over the years in the heart of "Smokey Bear" country, Mr. Goodloe slowly saw his run down overgrown property turning into a model of sustainable grazing.

#21 Mr. Sid Goodloe, still at work on his beloved Carrizo Valley Ranch "masterpiece" after 52 years! Carrizo Valley Ranch, Capitan, New Mexico.

In his recent book,[16] Mr. Courtney White[17] even described Mr. Goodloe's passion by saying:

"If land management is more an art than a science, as many say it is, then Sid Goodloe will enter the history books as one of the West's greatest artists and his Carrizo Valley Ranch…a masterpiece. … I suddenly realized that I was looking at a piece of art, fifty years in the making."

Using History to See the Future

Mr. Goodloe gave me a far greater appreciation of the impact of encroaching plants, or "woody weeds" on properties and re-enforced the concept by showing me a local book with landmark feature photographs being compared up to 130 years apart. Some areas were almost unrecognizable from the original and all had become far more heavily timbered over the period.

Nogal Mesa circa 1900

Nogal Mesa Today

Rush Slowly

My time with the Goodloe's also reminded me that making positive change to the rangelands is a much slower process than making negative change and there are very few magic bullet instant options. It is essential that we take action now however, we have taken up to one hundred and fifty years to devastate our respective rangelands and so we should not expect them to regenerate overnight.

In my mind, it is yet more proof that change needs to be in the hearts of those living on the land rather than in the ever changing hands of those administering or legislating from afar. No amount of Government Agency intervention can possibly compare, or activists protesting compete, with the passion of a landholder who sees and knows his land needs to heal.

[16] Revolution on the Range; The Rise of a New Ranch in the American West by Courtney White.
[17] Co-Founder and Executive Director, The Quivira Coalition, Santa Fe, New Mexico, USA.

The Southern Rockies Agricultural Land Trust

An interesting project I came across at the Goodloe's was the Southern Rockies Agricultural Land Trust (SRALT). The Trust was formed by a group of New Mexico Ranchers who could see the need to protect natural landscapes and ranching traditions from urban development by way of Conservation Easements.

Conservation Easements are strictly voluntary agreements to preserve various types of private land from development, both commercial and residential. This would normally be used to protect open space for uses such as agricultural, wildlife habitat, scenic, historic properties or recreational areas.

The tax benefits vary depending on donation vs. sale of the development rights. The Internal Revenue Service (IRS) must agree to the qualification of the entity which holds and monitors the easements, either government entities or private Land Trusts.

The private property is appraised at the 'highest and best' development use and then appraised at agricultural value. The difference between the two appraisals is the value of the development rights.

In most cases the development rights are donated in a Conservation Easement to either a private Land Trust (501c3 non-profit organization) or a government entity, approved by the IRS to hold and enforce the terms of the Conservation Easement. The requirements to be recognized by the IRS pertain to 'public good' through protection of open or public recreation.

Most Conservation Easement development rights are donated because Conservation Buyers are few and far between, especially in New Mexico. Within the last two years, New Mexico has legislatively approved the sale of State Income Tax Credits on certified Conservation Easements, of approximately 80 cents on the dollar, to persons who have tax liability. This is proving to be an incentive for private landowners however, there are still many ranchers and farmers who are highly influenced by negative information and fear of the possibility of government takeover of their land. The only possibility of such a taking is through eminent domain and that would be possible with or without a Conservation Easement.[18]

[18] Discussions with Mrs. Cheryl Goodloe

#22 Carrizo Valley Ranch, Capitan, New Mexico. Where once was dense Juniper, is now lush "Big Blue Stem", "Blue Gramma" & Carrizo Grass native pastures.

Holistic Management International®

In meeting with the groups Holistic Management International® (HMI)[19] and the Quivira Coalition[20] I was finally among people who, while not on the land could speak the same language as landholders do, people with some degree of hands on experience with rangelands management and regeneration, rather than only research and case study backgrounds as is often the case.

One Global Action Success

HMI is the group responsible for rolling out the living legacy of Mr. Allan Savory in the United States and around the world. Claiming an impact on thirty million acres around the globe, HMI's website states, *"When land is under Holistic Management®, land managers manage the relationships between land, grazing animals, and water in ways that mimic nature"*.

[19] Holistic Management International, Albuquerque, New Mexico, USA.

Meeting with Mr. Peter Holter, HMI's Executive Director, in their Albuquerque head office, we shared a well rounded conversation on the principles of HM, rangeland degradation, my own situation in the East Gascoyne and HM case studies that shared some similarities with my own work. Mr. Holter also provided me the contacts for some of the principle people in HM Australia to make contact with in the future.

In terms of the restorative aspect of HMI for rangelands, much of the focus is on the short term, high intensity rotational grazing practices as set out by Mr. Savory. With various success stories from around the globe, including Australia, the weight of evidence demonstrates that there is merit in this strategy under many circumstances. The principle is that the hoof action of the high numbers of livestock mulches the remnant fodder into the soils, while encouraging renewed growth in perennial plants. This is a very simplistic and brief take on the complex system that Mr. Savory has developed and certainly shouldn't be viewed in isolation from other aspects of the methods he has championed.

The David West Station for Holistic Management

From this visit I was later able to visit with Ranch Managers Joe and Peggy Maddox who run HM's own David West Station for Holistic Management, Ozona, Texas, where HMI have been "practicing what they preach" over 12,000 acres since 2002. Unfortunately, due to heavy rain, I was not able to look over the Station however, Mr. and Mrs. Maddox were able to talk me through the planning process involved with implementing a HMI based property plan.

With these two experiences I certainly gained a greater appreciation for the principles of HM. While I believe those principles do have universal application for rangelands country, I feel that under circumstances such as the East Gascoyne, where so little top soil remains, it would be dangerous to solely implement a grazing based regime without tackling the erosion issues.

[20] The Quivira Coalition, Santa Fe, New Mexico, USA.

The Quivira Coalition

This is where I found the balanced approach, between grazing impact and physical intervention, of the Quivira Coalition to be more appealing to my circumstances. The Quivira Coalition was founded in 1997 by Mrs. Barbara Johnson, Mr. Courtney White and Mr. Jim Winder with the mission of the new group being *"to build resilience by fostering ecological, economic and social health on western landscapes through education, innovation, collaboration, and progressive public and private land stewardship."*

Strength Through Networking

The Coalition is a nonprofit organization dedicated to bringing ranchers, environmentalists, public land managers and other members of the public together and demonstrating to them that ecologically healthy rangeland and economically robust ranches can be compatible. A measure of the respect the Coalition has earned is in the over 450 delegates that attended their recent 2008 Annual Conference.

I met with Associate Director Mr. Craig Conley and, unfortunately only very briefly, with Mr. White to discuss the work of the Coalition. I was most impressed with the strength of the group and the highly successful networks that it had created. Through dedication and a realistic and balanced vision, the Quivira Coalition has been able to source the expertise of amongst the leading rangeland practitioners in the United States for their projects.

I feel they are an organization that Australia should look to build an association with for the benefit of all parties.

"Induced Meandering" & Mr. Bill Zeedyk

One of the many strategies Mr. Conley discussed was the "Induced Meandering" technique of retired FS biologist Mr. Bill Zeedyk. Developed from observing nature, Mr. Zeedyk *"places baffles and riffles, or riffle weirs, according to geomorphologic principles so that meanders, channel width and channel slope will develop as expected, yet over time (with each heavy rain or flood event). Baffles deflect flows; riffles control bed elevation and pool depths; and vegetation planting/removal increases or reduces erosion resistance in banks (to assist the removal of sediments and promote their deposition in the next meander)."*[21]

[21] "Induced Meandering Lets the River Do the Work!" A Surprisingly Easy Way to Stabilize Incised Channels in the Southwest. By Melanie Greer Deason, Wetlands Coordinator, TMDL Development Section

The technique has had a great deal of success in the United States however I would like to inspect some locations with very shallow soils as I suspect it would just lead to accelerated degradation on floodplains of under 300mm of topsoils.

This and several other techniques are explained in the Quivira Coalition's book, "An Introduction to Erosion Control", by Bill Zeedyk and Jan-Willem Jansens, which can be purchased or downloaded through the Coalitions' website.

Finding Common Ground

I also found the Quivira Coalition to be leaders in building reconciliation between the parties involved in the modern day "Western Wars" between ranchers and environmentalists. By providing the forum they have had great success with projects such as "The Radical Centre", "The New Ranch Network" and the Coalition itself. They have brought the parties together to focus on common ground rather than fight over differences. As such, it has often been found there isn't that much difference in opinion between the two diverse groups. In my opinion, these breakthroughs may prove to be Co-Founder Mr. Courtney White's greatest achievement.

The Radical Centre

Following a two day summit between twenty ranchers, environmentalists and scientists in 2003, the "Radical Centre" initiative was developed to explore proactive methods of "taking back the West" to move forward as a united front.

Underpinning the initiative, and evolving from the intense debate of that summit, are the following underlying principles:

- "The ranching community accepts and aspires to a progressively higher standard of environmental performance;
- "The environmental community resolves to work constructively with the people who occupy and use the lands it would protect;
- "The personnel of federal and state land management agencies focus not on the defense of procedure but on the production of tangible results;
- "The research community strives to make their work more relevant to broader constituencies;
- "The land grant colleges return to their original charters, conducting and disseminating information in ways that benefit local landscapes and the communities that depend on them;

- "The consumer buys food that strengthens the bond between their own health and the health of the land;
- "The public recognizes and rewards those who maintain and improve the health of all land; and
- "All participants learn better how to share both authority and responsibility.

In my mind, these are landmark, groundbreaking statements in the combined name of caring for lands and values that all parties ultimately found common ground upon.

The New Ranch Network

As explained by Mr. Conley, the goal of this program *"is to create a network of ranchers, scientists, consultants, conservationists, volunteers and others who will be able to assist a rancher or other landowner in 'making the leap' to progressive stewardship through collaboration. This assistance will be in the form of Referrals, Coaches, Mentors, Specialists, a Grant Program, and a Web-based Directory".* This has proved to be a popular initiative amongst Coalition Members with an encouraging interest in the services on offer. In essence, the New Ranch Network is sourcing the expertise, identifying the "eager learners" and facilitating the implementation of the plans of this union.

#23 A typical Quivira Coalition supported New Ranch Network property visit. Photo c/o of the Quivira Coalition.

The USDA ARS Jornada Experimental Range

The Jornada Basin Long Term Ecological Research program, in collaboration with the USDA ARS Jornada Experimental Range, studies the causes and consequences of desertification, including the broad scale expansion of woody plants into grasslands that results in more "desert like" conditions. They are interested in spatial and temporal variation in desertification dynamics, and how historic legacies, the geomorphic template, transport vectors (wind, water, animals), and environmental drivers (climate, land use, disturbance) interact with the patch structure of the vegetation to determine past, present, and future ecosystem dynamics across scales.

Long Term Monitoring

The study site is located in the northern Chihuahuan Desert, approximately 25 km northeast of Las Cruces, New Mexico, USA. The site includes the 78,000 ha Jornada Experimental Range operated by the USDA ARS and the 22,000 ha Chihuahuan Desert Rangeland Research Center (CDRRC) operated by New Mexico State University.

#24 The USDA ARS Jornada Experimental Range. An example of the sophisticated measuring stations around the Range. This set is for measuring erosion caused by wind and the variation of wind effect at different heights.

As the oldest continual agricultural research facility in the United States, being established in 1912, I felt quite privileged to spend the day touring part of the Jornada Range with leading researcher, Dr. Ed Fredrickson, to witness the ground breaking research being carried out in understanding and combating desertification.

Dr. Fredrickson showed me their long term monitoring sites, which have records running back to the early 1920's, and also their modern sites where they measure plant root growth, wind effects, rainfall variability and many other variables impacting and increasing desertification.

Directional Virtual Fencing Research

The Jornada Range is also the home of the ground breaking Directional Virtual Fencing development research. A vast amount of work has been carried out to develop a method of controlling livestock without the massive expense of traditional fencing structures. This basically involves an animal carrying a sender unit which gives initially an aural and then a physical (electronic pulse) warning that they have approached a predetermined virtual barrier.

Currently the system is too expensive and the units to bulky to warrant commercial use however, the trials are extremely encouraging and there is a confidence that a commercial take up is not too far away. Dr. Fredrickson informed me that the researchers have envisaged that the current "bread loaf" sized units will be closer to the size of a deck of playing cards within two or three years as technology improves. The long term goal is to be able to replicate the same units into an ear tag design.

Assuming a commercially viable system can be created, this technology would prove revolutionary for the rangelands, allowing the ability to control animals on vast areas without the need for fencing. Rotational forms of grazing would become far more affordable to convert to and mustering systems completely changed.

I envisage that while it may be prohibitive to install such units in all animals of a rangelands herd, it may well prove beneficial in the medium term to collaborate with animal behaviourists to develop strategies where, for arguments sake, ten percent of the herd are tagged to act as leaders for the balance of the untagged herd. It is certainly an exciting field of research to pursue.

US Department of Interior BLM, Albuquerque

Through contacts of Mr. Conley, I was able to stop by the US Department of Interior BLM Albuquerque Field Office to meet with Mr. Steve Fischer, the Watershed Team Leader. Mr. Fischer is involved with the New Ranch Network and confirmed the BLM's satisfaction with the relationship. BLM employees in New Mexico care for 13.4 million acres of public lands plus 26 million acres of federal oil, natural gas, and minerals. These lands contain nationally significant energy and mineral resources, a great variety of wildlife, and an abundance of recreational opportunities.

The University of Arizona

The University of Arizona (UA) is involved in a vast number of rangelands specialty fields due to the University's location in arid Tucson, Arizona.

A full Nuffield Report could literally be compiled on just the activities being carried out by the faculty and students at UA. Again, time was the enemy here and I was fortunate to be able to have a joint meeting with Professor Charles (Chuck) Hutchinson, Director Office of Arid Land Studies (OALS) and CEO/President of the International Center for Remote Sensing of Environment (ICRSE); Professor Stuart Marsh, Director and Chair Arid Lands Resource Sciences (ALRS) and Professor Geography and Regional Development, Arizona Remote Sensing Centre (ARSC); Professor Steven Archer, School of Natural Resources (SNR), Rangeland Ecology and Management (REM); Professor Mitch McClaran, SNR, REM; and Professor Thomas W. Swetnam, Director & Professor of Dendrochronology, Laboratory of Tree-Ring Research (LTRR).

Although these gentlemen all gave me valuable information, most unique amongst the group was the work being carried out by Prof Swetnam with fire scars on tree rings. The Laboratory of Tree-Ring Research at The University of Arizona was founded in 1937 by A. E. Douglass, founder of the modern science of Dendrochronology[22]. Prof Swetnam and his team are using the tree ring records to ascertain the fire histories of given areas and determining the increase or decrease in fuel loads and fire severities and frequencies.

[22] **Dendrochronology**; a technique of dating based on the investigation of annual growth rings in tree trunks. From Greek- *dendron* 'tree'. Oxford Dictionary.

King Ranch

King Ranch is widely regarded as the home of ranching in the US, if not globally. Established near what is now Kingsville, Texas in 1853 by Captain Richard King, King Ranch has always been a pioneer and leader in agriculture generally and extensive ranching practices specifically. King Ranch has evolved to today be a global presence through both land base expansion and their instrumental role in developing the Santa Gertrudis cattle and Quarter Horse breeds and their pioneering work in phosphate deficiencies and mineral supplementation.

Along with pursuing a lifelong ambition to visit King Ranch and to see the home of the Santa Gertrudis for my cattle studies, I was also visiting to investigate their ecology and wildlife management practices. As early as 1912 there are signs of an environmental awareness in King Ranch management practices and from 1946 there has been a Wildlife Division that manages the welfare of the now vast game resource and monitors their environment and hunting.

#25 The iconic Coach Stables at the Headquarters of King Ranch. Santa Gertrudis Ranch, Kingsville, Texas. Birthplace of the Santa Gertrudis Breed of cattle the Quarter Horse and leaders of rangelands agriculture since 1853.

Along with their impressive Museum and Visitors Centre, King Ranch has various tours of the Ranch available, aware of their unique place in agricultural and Western history, but they also have various Nature Tours and Hunting that are equally well attended.

Through the generous organizing of Mr. Scott Moore, Area Cattle Manager, I had arranged to meet with the King Ranch Managers of their Range, Wildlife, Cattle and Feedlot Divisions to review their individual operations and with the Director of the King Ranch Institute (KRI) which is based at the nearby Kingsville Campus of Texas A&M.

Unfortunately, due to the imminent threat of Hurricane Ike, most of these men were too busy preparing the ranch for the potential storm or had returned to homes further afield, while the faculty and students of the KRI had also dispersed the day before my arrival. I was given a short personal tour of the nearby facilities, pastures and livestock by Mr. Jarrod Gray, Manger Quarter Horse Division and Mr. Robert Silguero, Manager Pure Bred Unit & Cattle Sales which gave me an insight into the scale and attention to detail of this impressive operation.

Observations of the United States of America

The rangelands in the United States faces competing pressures not yet fully realised in Australia, or at least not Western Australia. Amongst those represented are the traditional owners, the long term ranching families, both radical and moderate environmentalists, lifestyle ranchers, urban developers, government ranching agencies and government conservation agencies. The equivalent parties are certainly in Australia however, so far we haven't experienced the same level of heated debate and open confrontation as has been seen in the Western States of America.

It is safe to assume that this is a possible future for Australia and I would suggest that now is the time for the rangelands community to be proactive and develop similar networks that are all inclusive of the interested parties so as to ensure we never have to experience the decades of divisiveness and acrimony and the genuine open hostilities and danger that have previously pervaded the US Rangelands.

Passionate work has gone into bridging these long held hostilities by a select few in the American West, for the benefit of all. I find it encouraging that there are precedents now that Australia can observe in bringing parties together to help ensure the longevity of our rangelands.

Geologically and geographically speaking there are few similarities between the United States and Australian rangelands however, time and again I found common themes in erosion control systems, agro-politics and the passion of stakeholders for "the West".

Politically, the United States has entered in to a new era and it will be with some heightened interest that I observe from afar the implications for the American rangeland.

Chapter 6: Argentina.

My time in Argentina was unfortunately all too brief, being limited due to a lack of contacts during my planning phase. Having now visited and made contact with key people in the appropriate areas, I am hopeful of finding a way of returning and further exploring rangeland regeneration techniques being researched and implemented elsewhere in Argentina.

Instituto Argentino de Investigaciones de las Zonas Áridas.

I did however, have the good fortune to make contact with Dr. Juan Carlos Guevara, Director Instituto Argentino de Investigaciones de las Zonas Áridas (IADIZA), based in Mendoza near the base of the Andes Mountains. Despite Dr. Guevara's broken English and my non-existent Spanish, we had a productive day at IADIZA discussing the vast array of research being carried out in Mendoza and Argentina in rangeland science. A great deal of work is going into the management and grazing of goats as many subsistence farmers have these animals. IADIZA have also extensive trials going into utilizing cactii as a fodder plant for livestock.

One man's weed is another man's livelihood.

Dr Guevara discussed one of their techniques of rehabilitating denuded areas to provide an income for poor subsistence farmers.

As a Government funded project, Mesquite is being established in forty hectare thickets at a five meter square interval. The seedlings are hand planted and then watered for up to three years, until the plants reach the water table below. There is no concern for the spread of the Mesquite as the areas are too arid for any seedlings to reach the water table without artificial watering between droughts. The two species used are capable of growing to three meters in five years if maintained as instructed.

The resultant thicket provides enough produce through its wood, leaves and seeds to support an average subsistence farming family. The wood is sold for firewood and some timber for construction, the leaves provide grazing for their goats and the seeds can be ground for flour or to be on-sold for the next project.

Considering the weed burden of Mesquite in the Australian rangeland, I would not suggest it as a strategy here however, it was a good lesson in "what is a weed" and also in utilizing what assets you have at hand to assist with rehabilitation and industry creation techniques.

Chapter 7: Heat Adapted Bos Taurus and Composite Breeds:

During my journey, I had the privilege of visiting some of the world's best beef operations and most innovative beef cattle scientists and practitioners.

Of the beef operations, I had the opportunity of spending time with the following industry leaders, in chronological order:

- Mr. Hans van Rooyen, Umpukane Bonsmara Stud in Free State, South Africa;
- Mr. Lee Leachman, Leachman Cattle of Colorado, Washington Colorado;
- Mr. Rob Brown & Donnell Brown, R.A. Brown, Throckmorton Texas;
- Mr. Robert Silguero, King Ranch, Kingsville Texas;
- Mr. Ervin Kaatz, Executive Director Santa Gertrudis Breeders International, Kingsville Texas;
- Mr. Sebastiao De Aguiar, Sacramento Farms, Okeechobee City, Florida;
- Prof Robert Godfrey, Castle Nugent Senepol Stud, Kingshill, St Croix, Virgin Islands USA;
- Mr. Hans Lawaetz, President Senepol Cattle Breeders Association & Annaly Farms Senepol, Frederiksted, St Croix, Virgin Islands USA.

All of these men gave me a great insight into the breeds of heat adapted and composite cattle they represented and each gave a very forthright appraisal of the respective merits of each to adapt to the conditions found in Australia's semi-arid rangelands.

Likewise, the visit to the following beef cattle scientists gave me first hand information on their current ground breaking research, to allow me a greater understanding of my topic:

United States Department of Agriculture (USDA), Agricultural Research Service (ARS), US Meat Animal Research Centre (MARC), Clay Centre, Nebraska, USA:

- Dr John (Jack) Nienaber, Acting Director
- Dr Larry Cundiff, Research Geneticist, Collaborator
- Dr Tommy Wheeler, Research Leader, Meat Safety & Quality Research Unit
- Dr Calvin Ferrell, Research Animal Scientist, Nutrition Unit

- Dr Roger Eigenberg, Agricultural Engineer

Colorado State University:

- Dr Jack Whittier, Professor, Animal Sciences, Extension Beef Specialist
- Dr Mark Enns, Assistant Professor of Animal Sciences, Breeding & Genetics

USDA ARS Subtropical Agricultural Research Station (STARS), Brooksville, Florida, USA:

- Dr Samuel Coleman, Research Leader
- Dr Chadwick Chase, Research Animal Scientist
- Dr Greg Riley, Beef Cattle Geneticist

University of the Virgin Islands, Kingshill, St Croix, Virgin Islands USA;

- Prof Robert Godfrey, Assistant Director Agricultural Experiment Station.

#26 Castle Nugent Senepol breeders grazing a world away from the Australian Semi-Arid Rangelands! Note ship on horizon. St Croix, US Virgin Islands.

I have prepared a separate detailed report of those experiences which is also available from Nuffield, www.nuffield.com.au or by contacting me on the details above.

Chapter 8: Fifteen Key Recommendations

1. To recognise that the current systems are still not working
2. To engage the wider community in addressing the legacy management of building a nation at the expense of the rangelands
3. To move past the “blame game” of the past and bring all of the relevant parties to the table to develop a mutually desirable future path for our rangelands
4. Government to fund more catchment scale rehabilitation projects, regardless of property boundaries and the capacity to contribute by the landholder, to ensure their success
5. Government to continue to financially support the roll out of projects such as ESRM
6. Agencies and others to recognise the vital role of pastoralists in the success or failure of implementing new methods
7. To engage the mining industry intellectually, physically and financially, as part of the way forward
8. To build relationships between Australian researchers, community based sustainable production groups and learning facilities with their international equivalents and to foster meaningful dialogue between all parties
9. For industry driven projects, to continually develop their staff members and leaders by using these international connections for training and a crosspollination of ideas
10. To become international leaders, not followers, in the usage of new technologies and techniques in the monitoring and restoration of the rangelands, such as Remote Sensing Technology, Directional Virtual Fencing and BEHAVE
11. To pursue adopting the BEHAVE Project into Australian conditions for the control of “woody weeds” and other undesirable species
12. To immediately work towards at least one WOCAT partnership in Australia
13. Investigate the true impact of “woody weeds” in the Australian rangelands
14. Develop a rangelands ground water monitoring system to demonstrate ecological change due to combating “woody weeds”
15. Increase research into carbon sequestration potential in the rangelands

Chapter 9: Conclusions

There is a growing collective will in the rangelands community to right the wrongs of the past and to build an ecologically sustainable industry.

While heartening to see, there is also an unfortunate correlation between this increasing collective will and the rapidly diminishing terms of trade in the pastoral sector. Pastoralists are currently being forced to make some very difficult big picture decisions for both their families and their industry and, for the most part, they are being left to face these decisions without the support of the community. This is not unique to Australia however, in my observation, it is far more pronounced than what I experienced during my travels.

There are Government based programs in place however, in reality it is too little, too late for many of our land managers. No longer is it the marginal "old school" operators going out of business, but some of our more proactive, innovative ecologically minded pastoralists, who have been caught in a crippling cycle of drought and soaring input costs for too long with little, if any, real increase in marketplace returns. At a time when consumers are paying record prices at the shelf, we are seeing record numbers of producers leaving the industry for financial reasons. This is not a phenomenon I experienced anywhere else in my travels.

The current model is not working. While those with outside interests, or a vast corporate land base in stronger country, may be able to provide a facade for the industry, the majority of pastoral properties are reaching a viability breaking point in both ecological and financial sustainability due to the current terms of trade.

As we as a nation continue into the new millennium we need to make a decision. Will we recognise the huge role that Australia's vast rangelands and existing land managers can play in food production, environmental management and potentially carbon emissions trading and sequestration, or do we accept the loss of the intellectual property of these land managers, people prepared to live where many others choose to briefly visit in air-conditioned comfort, and continue a self defeating, band-aid approach to natural resource management in the rangelands?

#27 This represents the Western Australian Semi-Arid Rangelands. Still functional, but only barely. Holding together by a few threads and at breaking point. Desperately in need of a major overhaul and rapid intervention.

I say, enough is enough. It is time for the nation that was built on the naive rape of her rangelands to repay that debt by making a real investment in her recovery. The systems are there to use without even searching for them now. This does not involve locking up land for conservation or "constipation" areas, but keeping lands biologically active, productive and responsibly managed by proactive, dynamic people who have an affinity with the lands they manage.

The people, or their remnant, are in place, but staggering under the burden to stay. They are no longer in a position to be capable to pay for the changes they know need to happen. Let us not go past this critical trigger point in time, only to look back and see the error of our ways. Let us instead invest in this fantastic national asset while we still can make major change.

Measure, monitor, experiment, assess, data... the stuff of government agencies for years and yet here we find ourselves, further down the path of continental devastation. What the rangelands need is more doing, implementing and leading with meaningful investment by government on behalf of the community. We need to develop more catchment scale projects that follow through on the investment on each property with expertise from wherever it needs

to be sourced, locally or internationally, to ensure both the best return on investment and a sustainable and viable rangeland.

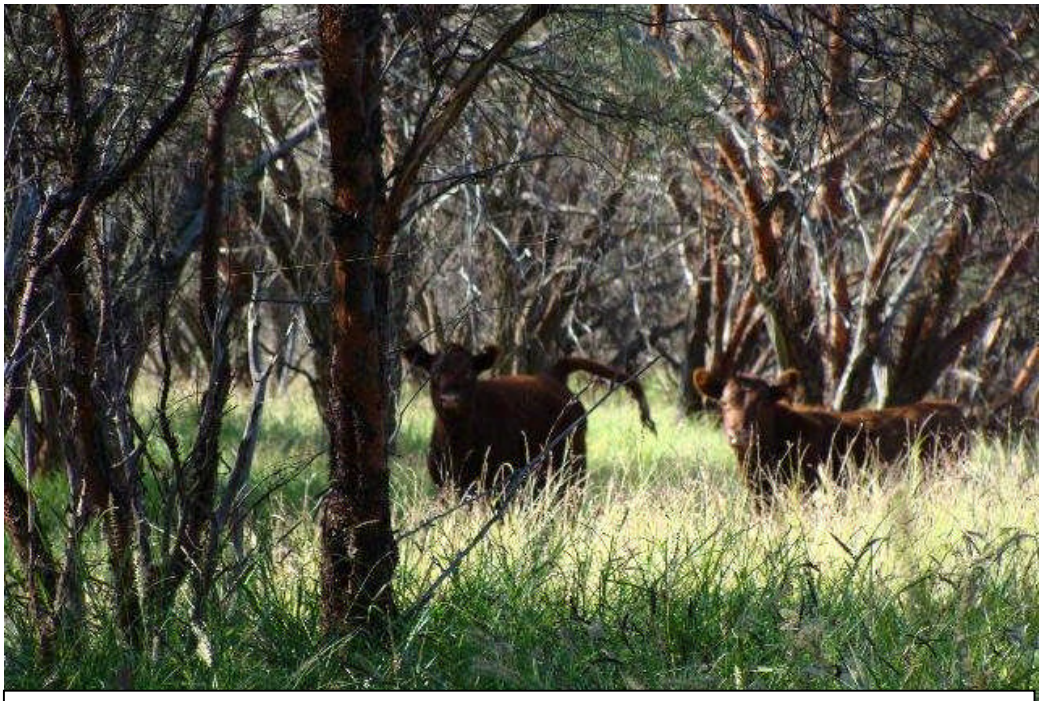
I have found, especially in the US, excellent role model organisations that are being proactive in bringing together all of the parties, to ensure issues are resolved to everyone's satisfaction. These are organisations born of far more volatile times than we have ever experienced in Australia in modern times.

In this modern world of sophisticated communication technologies, I believe we need to be building alliances with likeminded organisations around the globe, to build on mutually beneficial knowledge and to perhaps look towards staff sharing initiatives and international University study placements.

We must be proactive and work towards losing that "redheaded stepson" of Agriculture image and become a field of choice for bright young students and workers, a field that expresses its true diversity and benefits to the Australian community.

The Australian rangelands are a unique and beautiful part of our world, but it is also "dying a death of a thousand gutters". Like an old kangaroo at the last drying water hole, it is showing its ribs and can barely hop. From today, we must take action to rehydrate the landscape, or refill that water hole, and see the meat come back on the ribs of this land.

The alternative is not an option the world will accept.



#28 Abundant growth and contented cattle on Bryah Station, East Gascoyne of Western Australia. Where there is soil there is potential for change.

Chapter 10: Various Erosion Control Tools.

#29 Scrub packing of streams, on the property of Friedel Rusch of farm Lichtenstein-sud in the "Auas-Oanob Conservancy", Namibia.

#30 Simple measures create habitat for plants. Two dead branches on right were left on bare ground a year before. Dead branch placed on bare ground for photo as a comparison. "Auas-Oanob Conservancy", Namibia.

#31 Cement weir in the ForeverSA Resort, Badplaas, Mpumalanga, South Africa. Second structure in background. Very effective design onto rock spillway.

#32 Cement weir in the ForeverSA Resort, Badplaas, Mpumalanga, South Africa, venue for the GSSA Conference.

#33 Cement weir in the Pilanesberg National Park, South Africa.

#34 Cement weir in the Pilanesberg National Park, South Africa. Note half moon design of wall for added strength for minimal concrete.

#35 New cement weir in the Karoo Region, South Africa. Water flows from left to right over the low point in an earth wall. Photo c/o Mr. Charl du Plessis, Western Cape Dept of Agriculture, Elsenburg, Western Cape, South Africa.

#36 Cement weir in the Karoo Region, South Africa. Photo c/o Mr. Charl du Plessis, Western Cape Dept of Agriculture

#37 Stone Gabion and Cement weir in the Karoo Region, South Africa. Note Gabion wall in downstream area to diffuse the concentrated water flow. Photo c/o Mr. Charl du Plessis, Western Cape Dept of Agriculture

#38 Cement weir in the Karoo Region, South Africa. Side view showing channel for dispersing water across the flats. Photo c/o Mr. Charl du Plessis, Western Cape Dept of Agriculture

#39 Radical re-facing and manuring of eroded gullies on Mr. Lou van Reenen's Sparta Feedlot farm, Marquard, Free State, South Africa.

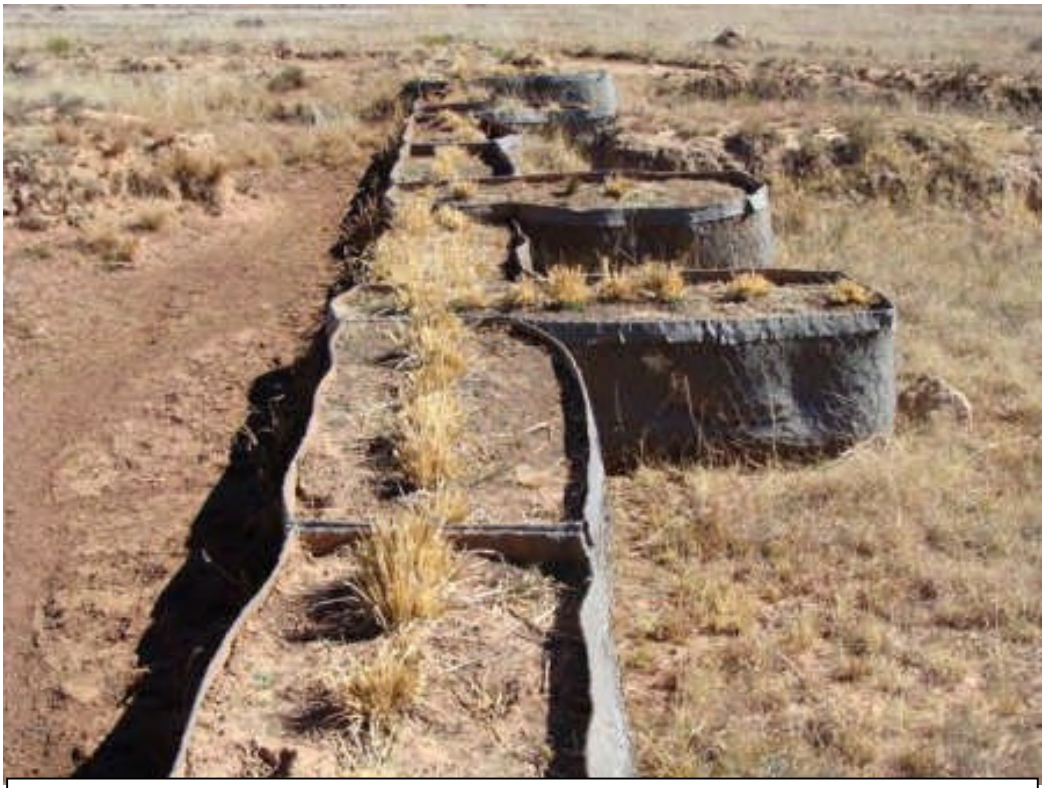
#40 Radical re-facing and manuring of eroded gullies on Mr. Lou van Reenen's Sparta Feedlot farm, Marquard, Free State, South Africa.

#41 Major gabion structure trial, by the Free State Department of Agriculture, near Ladybrand, Free State, South Africa.

#42 Mr. Frans Lategan and Mr. Chris Smith, Free State Dept of Ag, show scale of the structure. Near Ladybrand, Free State, South Africa.

#43 Gabion splash zone pool to dampen the energy of the falling water, near Ladybrand, Free State, South Africa. Photo c/o Prof Klaus Kellner.

#44 Author on secondary gabion structure creating splash zone pool, talking with Mr. Andri van Greunen, Free State Dept of Ag. Protected spillway behind author. Photo c/o Prof Klaus Kellner.



#45 "Earth Basket" trials, by the Free State Department of Agriculture, near Ladybrand, Free State, South Africa.

#46"Earth Basket" trials, by the Free State Department of Agriculture, near Ladybrand, Free State, South Africa. Note eddying out of top section.

#47 A small gabion structure trial by the Free State Department of Agriculture, near Ladybrand, Free State, South Africa.

#48Various trials of erosion control structures by the Free State Department of Agriculture, near Ladybrand, Free State, South Africa.

#49Various trials of erosion control structures by the Free State Department of Agriculture, near Ladybrand, Free State, South Africa.

#50 Various trials of erosion control structures by the Free State Department of Agriculture, near Ladybrand, Free State, South Africa.

#51 Using star pickets and synthetic cloth to form a temporary "silt fence". Photo c/o Mr. Chris Smith, Free State Department of Agriculture.

#52 Using pine bollards twitched together to form a "silt fence". Photo c/o Mr. Chris Smith, Free State Department of Agriculture.

#53 A key-stoned gully in New Mexico. Cap on right indicates scale. Photo c/o Mr. Steve Fischer, BLM, Albuquerque, New Mexico.

#54 An extensive stepped Gabion structure, New Mexico. Photo c/o Mr. Steve Fischer, BLM, Albuquerque, New Mexico.

#55 One of my favourite photos from my journey, taken from the Californian Zephyr train in east Utah. Design is critical in all erosion control structures!

#56 Rehabilitated riparian area on Mr. Agee Smith's Cottonwood Ranch. Achieved with careful stock management under Holistic Management principles. Mr. Smith described the creek bed as being bare for his lifetime.

#57 Implement used for scalloping scalded flats in the Karoo Region. Photo c/o Mr. Charl du Plessis, Western Cape Dept of Agriculture, Elsenburg, Western Cape, South Africa.

#58 Implement used for scalloping scalded flats in the Karoo Region, showing "egg wheel" for regular pitting effect. Photo c/o Mr. Charl du Plessis, Western Cape Dept of Agriculture.

#59 Freshly scalloped flats. Photo c/o Mr. Charl du Plessis, Western Cape Dept of Agriculture.

#60 Scallops after rain, pooling occurring to help promote growth. Photo c/o Mr. Charl du Plessis, Western Cape Dept of Agriculture.

#61 Intermittent chisel ploughed lines across a degenerated "camp" in the Karoo Region. Photo c/o Prof Klaus Kellner

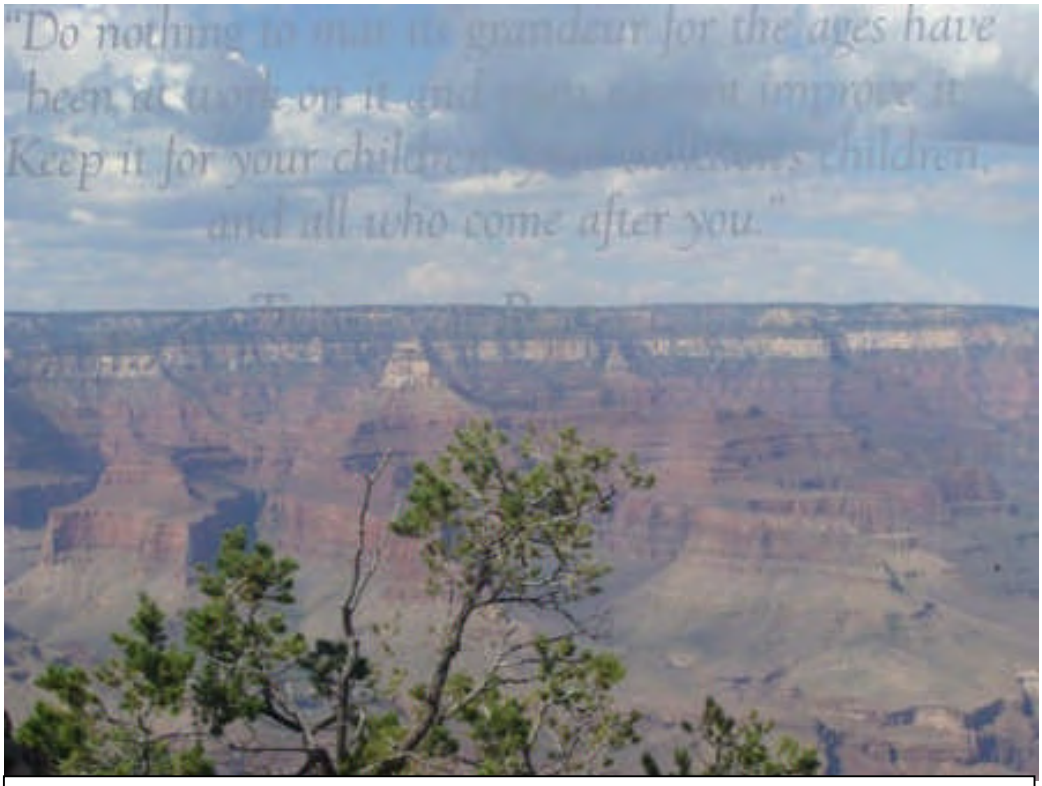
#62 Similar trial to above, in Botswana, following good rains. Photo c/o Prof Klaus Kellner

#63 Re-establishing perennial pastures in Botswana. Photo c/o Prof Klaus Kellner

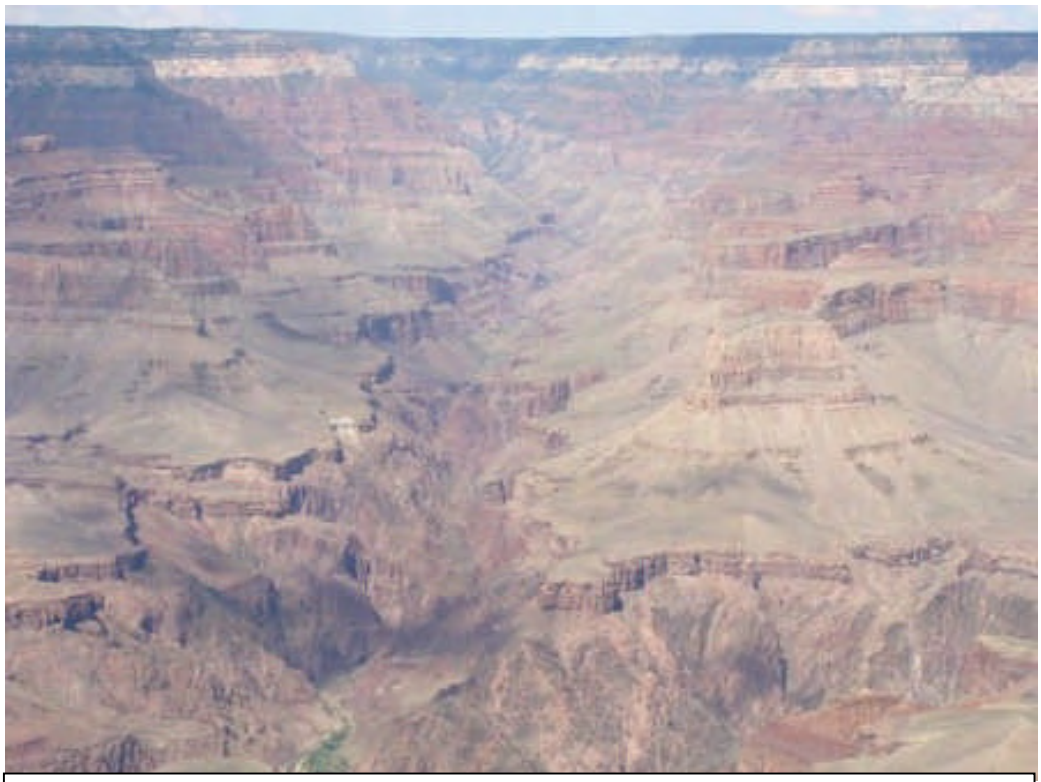
#64 Pasture re-establishment trials after two seasons in the Karoo Region, South Africa. Photo c/o Mr. Charl du Plessis, Western Cape Dept of Agriculture.

#65 Neighbouring hills on Mr. Sid Goodloe's Carrizo Valley Ranch, Capitan, New Mexico.

#66 The second hill one year after clearing, providing a clear indication of the huge load of woody weeds this area had been carrying previously.



#67 "Do nothing to mar its grandeur for the ages have been at work on it and man cannot improve it. Keep it for your children, your children's children, and all who come after you." Theodore Roosevelt. Grand Canyon.



#68 Nature has an uncanny knack of putting humans in their place in the order of things. We are here for but a blip in time, let us tackle that which we can achieve or that we can start for our descendents to achieve.

Appendices

Selected Bibliography & Suggested Further Reading

Literature:

An Introduction to Erosion Control, by Bill Zeedyk and Jan-Willem Jansens

Beyond the Rangeland Conflict, Towards a West That Works, by Dan Dagget

Bob Kleberg and the King Ranch, A Worldwide Sea of Grass, by John Cypher

Bush Encroachment in Namibia, Report on Phase 1 of the Bush Encroachment Research, Monitoring & Management Project, by JN de Klerk

Earth Time, by David Suzuki

Guide to Grasses of Southern Africa, by Frits van Oudtshroon

Holistic Management: A New Framework for Decision Making, 2nd ed. by Allan Savory

Karoo Veld, Ecology and Management, Karen J. Esler, Sue J. Milton & W. Richard J. Dean

Revolution on the Range; The Rise of a New Ranch in the American West by Courtney White.

The Sacred Balance, by David Suzuki

Veld Management in South Africa, Edited by Neil Tainton

Websites:

Education

Nuffield Australia- www.nuffield.com.au

Rangelands Australia- www.rangelands-australia.com.au

Texas A&M University- www.tamu.edu

University of California, Davis, Rangelands Dept. - www.californiarangeland.ucdavis.edu

Properties

Cottonwood Ranch- www.cottonwoodguestranch.com

King Ranch- www.king-ranch.com

Sparta Feedlot- www.sparta.co.za

Umpukane- www.umpukane.co.za

Research

BEHAVE Project- www.behave.net

Jornada Experimental Range- www.usda-ars.nmsu.edu

Laboratory of Tree-Ring Research- www.ltrr.arizona.edu

Office of Arid Lands Studies - www.arid.arizona.edu

Targeted Grazing, University of Idaho- www.cnr.uidaho.edu/rx-grazing/index.htm

Restoration

Dryland Solutions- www.drylandsolutions.com

Global Restoration Network- www.globalrestorationnetwork.org

Holistic Management International- www.holisticmanagement.org

Livestock for Landscapes- www.livestockforlandscapes.com

The Quivira Coalition- www.quiviracoalition.org

Society's

Australian Rangeland Society- www.austrangesoc.com.au

Society for Range Management- www.rangelands.org

Stewardship

North-eastern Nevada Stewardship Group- www.nnsg.org

Managing Wholes- www.managingwholes.com

New Ranch Network- www.newranch.net

Contact List

- Professor Ibo Zimmermann, Agriculture Dept, Polytechnic of Namibia, Windhoek, Namibia
- Dr Hugh Pringle, Bush Heritage Australia
- Mr. Frank Bockmuhl, Namibian Agricultural Union, National Rangeland Strategy
- Mr. Peter Zensi, Namibian Agricultural Union, National Rangeland Strategy
- Mr. Leon Lubbe, Namibian Ministry of Agriculture, Water & Forestry, Namibia
- Professor Klaus Kellner, School of Environmental Sciences and Development, North West University, Potchefstroom Campus, North West Province.
- Mr. Charl du Plessis, Western Cape Dept of Agriculture, Elsenburg, Western Cape.
- Mr. Albertus Dyason, Western Cape Dept of Agriculture, Elsenburg, Western Cape.
- Ms Nelmarie Saayman, Western Cape Dept of Agriculture, Elsenburg, Western Cape.
- Ms Linda Kleyn, University of the Witwatersrand, School for Animal, Plant and Environmental Sciences, Johannesburg, Gauteng, South Africa.
- Dr Theunis Morgenthal, Eastern Cape Dept of Agriculture, Dohne ADI, Sutterheim, Eastern Cape.
- Dr. Dirk Pretorius, Assistant Manager (Resource Monitoring) Directorate: Land Use & Soil Management, Pretoria, South Africa
- Mr. Lou van Reenen, Sparta Feedlot, Marquard, Free State, South Africa
- Mr. Andri van Greunen, Dept of Agriculture, Ladybrand, Free State, South Africa
- Mr. Chris Smith, Dept of Agriculture, Bloemfontein, Free State, South Africa
- Mr. Frans Lategan, Dept of Agriculture, Bloemfontein, Free State, South Africa
- Mr. Piet & Mr. Hans van Rooyen, Umpukane Farm, Clocolan, Free State, South Africa
- Mr. Ron Espell, Director, Environmental, Barrick Gold, Salt Lake City, Utah
- Mr. Cy Wilsey, Regional Land Manager, North America, Salt Lake City, Utah
- Mr. Gary Sundseth, Surface Resource Manager, Barrick Gold, Elko, Nevada

- Professor Fred Provenza, Dept of Wildland Resources, Utah State University, Logan, Utah
- Mr. Chuck Johnson, Manager, Dean Ranch, Barrick Gold, Crescent Valley, Nevada
- Mr. Ben Patterson, Manager, Tumbling JR Ranch, Barrick Gold, Eureka, Nevada
- Mr. Agee Smith, Owner/Manager, "The Cottonwood Ranch", Wells, Nevada
- Mr. Gerry Miller, President , North-eastern Nevada Stewardship Group, Elko, Nevada
- Ms Leta Collard, Director, North-eastern Nevada Stewardship Group, Elko, Nevada
- Mr. Gary Black, Ecologist & President, Great Basin Ecology, Elko Nevada
- Ms Angel Nicholson, Biological Consultant, Great Basin Ecology, Elko Nevada
- Dr Melvin George, Extension Rangeland Management Specialist Plant Sciences Dept University of California, Davis, California
- Mr. Sid Goodloe, Carrizo Valley Ranch, Capitan, New Mexico
- Mrs. Cheryl Goodloe, Southern Rockies Agricultural Land Trust, Capitan, New Mexico
- Mr. Peter Holter, Executive Director, Holistic Management International Albuquerque, New Mexico
- Mr. Courtney White, Co-Founder and Executive Director, The Quivira Coalition, Santa Fe, New Mexico
- Mr. Craig Conley, Associate Director, The Quivira Coalition, Santa Fe, New Mexico
- Mr. Steve Fischer, Watershed Team Leader, US Dept of Interior, BLM, Albuquerque Field Office
- Dr. Ed Fredrickson, Senior Research Scientist, Jornada Experimental Range, New Mexico State University, Las Cruces, New Mexico
- Professor Charles (Chuck) Hutchinson, Director Office of Arid Land Studies and CEO/President of the International Center for Remote Sensing of Environment, University of Arizona, Tucson, Arizona
- Professor Stuart Marsh, Director and Chair Arid Lands Resource Sciences and Professor Geography and Regional Development, Arizona Remote Sensing Centre, University of Arizona, Tucson, Arizona

- Professor Steven Archer, School of Natural Resources, Rangeland Ecology and Management, University of Arizona, Tucson, Arizona
- Professor Mitch McClaran, School of Natural Resources, Rangeland Ecology and Management, University of Arizona, Tucson, Arizona
- Professor Thomas W. Swetnam, Director & Professor of Dendrochronology, Laboratory of Tree-Ring Research, University of Arizona, Tucson, Arizona
- Mr. Rob Brown & Donnell Brown, R.A. Brown, Throckmorton Texas
- Mr. Joe & Mrs Peggy Maddox, Managers, David West Station for HM, Ozona, Texas
- Mr. Scott Moore, Area Cattle Manager, King Ranch, Kingsville Texas
- Mr. Jarrod Gray, Manger Quarter Horse Division, King Ranch, Kingsville Texas
- Mr. Robert Silguero, Manager, Pure Bred Unit & Cattle Sales, King Ranch, Kingsville Texas
- Mr. Sebastiao De Aguiar, Sacramento Farms, Okeechobee City, Florida
- Dr. Juan Carlos Guevara, Director Instituto Argentino de Investigaciones de las Zonas Áridas, Mendoza, Argentina

Plain English Compendium Summary

Project Title: **An Ecologically Sustainable Semi-Arid Rangelands in Australia**

Nuffield Australia Project No: 0803
Scholar: Mr. Benjamin James Forsyth
Organisation: Beefwood Pastoral Company Pty Ltd
Phone: +61(0) 8 99812932
email: benforsyth@wn.com.au

Objectives: Investigating rangeland rehabilitation & regeneration techniques in semi-arid environments so as to assist in building an ecologically sustainable Semi-Arid Rangelands in Australia.

Background: The Australian rangeland has had a torrid ecological past and is faced with vast legacy management issues. There is a growing interest from within and outside the rangelands community to address this legacy and it is becoming apparent that if those with a direct stakehold in the outcomes of decisions and actions do not take control of the management of the legacy then those whose livelihoods are not attached to the outcomes will take that control for pursuing their own single issue agenda. Most forward thinking land managers are aware of making commercial decisions based on holistic considerations of ecological principles while faced with the necessity of generating both a short and long term profit from that land. With the current terms of trade for pastoral production the realities of making a living often force a landholder to make decisions they may otherwise have preferred not to in regard to ecology. The future of the rangelands in Australia will require a considerable investment from the community to ensure the best ecologically sustainable decisions are compatible with the ongoing inhabitation of this region.

Research: The research was conducted over a twelve month period starting in November 2007. The study included approximately four months of overseas travel to Namibia, South Africa, the United States of America and Argentina in July to October in 2008.

Outcomes:

- The Australian rangeland is a vital and valuable asset to our nation, one that takes up some 86% of our landmass and is vastly undervalued in government planning and policy due to the low population and vote winning capacity of these electorates.
- This ambivalent attitude must change in the seats of power to address the legacy of the past and to advance the capacity for expressing its potential in the future.
- There are many strategies and tools available to us as a nation for commencing the long road to righting the innocent wrongs of the past, it is time for both leadership and community support to ensure the best decisions are viable to make.

Implications:

- Pastoral practices in Australia have evolved and must continue to evolve from their primitive beginnings only two hundred years ago.
- Rangelands in general do not benefit from a “lock up” mentality and need to be managed as a dynamic landscape which includes locally appropriate levels of grazing.
- Natural ancient landscape functions, such as fire and flooding, need to be able to express themselves.
- Environmentalists who wish to actually see real ecological change in the rangeland need to come to the table with producers to find common ground that can lead us all forward rather than promote differences that will keep us apart.
- Historical blame can no longer be a consideration, the Australian nation was founded on the naive rape of her rangeland and the Australian community must be engaged in her rehabilitation to ensure a healthy and prosperous future.

Publications:

- 10/10/2008- Nuffield Australia Farming Scholars Spring Tour Scholars Presentations. “Turning Red to Green, *Instaurator Ruinae”,* twenty minute Power Point Presentation.