Diversification in Western NSW Wool Enterprises

- **Multi-species livestock mix**
- **Use of available resources**
- **Managing livestock predation**
- **Improving efficiencies**

A report for

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Executive Summary

If ever there was a case for this study into diversification in the rangelands and the need to explore the potential for improving efficiencies on property and spread risk, the drought that is gripping much of eastern Australia, this is it. However, the drought was not the driver for this report. The driver was about managing for the future and improving long-term economic viability and sustainability, in a climate that is predictable in as much as the rainfall is unpredictable.

The author, who works more than 121,000 hectares (ha) in Far Western New South Wales (NSW) – along with members of her family – returned from her Nuffield research to mustering stock for trucking out. Normally, the task would have been lamb marking and crutching but in the previous 18 months, a large portion of ewes and lambs and nearly all cattle had been sold due to a lack of rain. From January to October 2017, only 50mm had fallen and by year's end the tally was around 160mm, coming in lots of 2mm and 4mm here and there, which does little for growing feed. The following year (2018) received 111mm of total rainfall.

This is not new. In the Western Division of NSW, the rainfall is at times well below averages and unreliable, with stock numbers managed on a groundcover basis, rather than rainfall totals. Management of this groundcover and the availability of water for livestock use are the main limiting factors facing pastoralists in the region. The low rainfall also means that the available pasture needs to be managed and utilised in the most appropriate manner. Recent resurgences of wild dog numbers are also of growing concern to pastoralists across NSW.

The family business, centred between Broken Hill and Wentworth, is focussed on Merino sheep, beef cattle and more recently Dorpers, along with managing the rangeland goat population. Against this backdrop, this study set out to investigate how wool growers in the Rangelands of the Western Division of NSW can:

- Run a multispecies enterprise;
- Optimise use of available resources;
- Manage predation issues;

- Explore possibilities for improving efficiencies on property, that help decrease costs and streamline the day-to-day running of the business.

The author's travelled to Brazil, India, Denmark, Qatar, the United Kingdom (UK), the United States of America (USA), South Africa and New Zealand. The research found that producers had diversified into everything from tourism to Oryx and on the infrastructure front, there were trap yards and fencing dug four feet into the ground to keep out Coyotes. There were lessons to be learned, including the control of predators not seen in Australia but just as devastating as wild dogs, such as the Black Backed Jackal.

USA farmer Phillip Glass, from Texas, demonstrated how to make diversification work by thinking outside the box. He has a Dorper stud and Angus cattle, Addax deer, Arabian Oryx and has real estate interests. For the past nine years he has also been raising a desert adaptive goat antelope – the Nubian Ibex – which are sold into Texan game parks for hunting. The kids at six months sell for US$2,500 to $US4,000, while adults can make $8,000 a head.

At 4HF Ranch in Texas, David Fisher shared his views on how diversification was key. A mix of three livestock species allowed the best utilisation of the brush covered rangelands.

Others found that by diversifying livestock species, there were benefits in reducing vegetable matter in fleeces and controlling weeds and brush. This allows grass growth which resulted in better sheep and cattle feed.

Diversification, infrastructure and predator control across rangelands can be narrowed down to particular country and vegetation types, along with market access, materials and staffing availability.

It is also vital to do one's homework and understand the resources at hand. One example of this were properties that used feed supplements to improve utilisation of available vegetation, enabling earlier turn-off of stock on one property and easier mustering on another. A take-home out of this was that small changes can go a long way to improving the bottom-line.

In Brazil, it was the farmer's understanding of the desert plants and the inter-relationships between sheep and goats that that made the diversification mix work. Amazingly, the goats

remove the thorns from a rope cactus, allowing the sheep to benefit from the flesh of the plant, which has a protein content of 8%.

The author saw first-hand how valuable it is to learn from other experiences and expertise, especially when diversifying into a new enterprise. This, and the importance of researching every component of any new enterprise, including on property aspects such as fencing and shelter or feed requirements, as well as any legislative aspects and doing a deep dive into the business and marketing, cannot be underestimated.

A key approach to achieving the best outcome for any enterprise, particularly with regards to predation, is the need for integration and adoption of technologies that create efficiencies such as remote water monitoring systems.

A number of those visited identified that a combination of fencing, hunting, baiting, trapping and close observation of stock and land was needed to keep on top of the constant barrage of predators. It is also important to recognise that, at times, what works well on one farm – such as Maremma dogs – may not be suited to another area in a higher population density.

Table of Contents

Table of Figures

List of Tables

Foreword

I grew up on Coombah Station, in Far Western NSW and my siblings and I were always part of the workforce. Whether it was in dusty sheep yards, on a broom in the woolshed, or following dad over the red sand hills and through the Mallee scrub on a motorbike bought for us at a young age, that was strictly “just for work”. Occasionally this even included driving the tractor, working up the vast grey lakebeds in preparation for a cereal crop.

Over the years I have watched my parents, Andy and Fiona McLeod, through their hard work, make sound and measured business decisions, and having an ability to recognise opportunities available to them. They have built and expanded from the original block of 40,000 ha to 121,000 ha across three properties. All this whilst dealing with an unreliable rainfall, with an average of 200mm per year, at times dropping to just 75mm.

The business runs Merino sheep, beef cattle and more recently Dorpers, along with managing the rangeland goat population. At times, goat sales make up over 50% of the annual income for the business. We also have sections of Popiltah and Popio lakes, which form part of the Murray Darling Basin system. Following flood events in Queensland, these lakes fill and the moisture in the deep clay soils is capitalised on by planting crops on the lake beds. Crops and goats add a much welcome income bolster during dry years, helping with property improvements and infrastructure that enables us to manage with minimal staff. At present this comprises of my parents, Andy and Fiona, myself, my younger brother Alex, my younger sister Annabelle and brother-law Johnny coming to help out when they can, particularly at busy times.

During a stint at Coombah in 2015 to have a break from university studies, the decision was made to expand and purchase one of the neighbouring properties, Tor Downs. This is where most of the Merino flock is run, and where I have called home for the last two years. On departure on my Nuffield travels in April 2017, we had at least six different wild dogs that we knew of across the properties and had been applying an integrated approach to control wild dogs and foxes. This includes trapping, shooting and 1080 baiting. The occasional pig has also been shot on site.

During my Nuffield travels, it was fantastic to meet people so passionate about wool and fibre, who looked to Australia and followed the markets here with keen interest. Also, the genuine interest, along with the staggering amount of knowledge people possess, on the flora and fauna that shares the surrounding landscapes and soils on their properties with them.

I returned straight into mustering stock for trucking out, rather than lamb marking and crutching, as a large portion of the ewes and lambs were sold due to lack of rain. Nearly all the cattle had been sold in the previous 18 months. During 2017, the rainfall total for Tor Downs was around 160mm, made up of 2mm and 4mm here and there, which does little for growing feed. Up until the start of October only 50mm of that total had fallen.

Figure 1: Author Felicity McLeod measuring up some fencing. Brasillia, Brazil, March 2017



Figure 2 (L-R): Sheep dog 'Bill' waits to push Merinos up the race at Coombah Station (March 2015), wild dog tracks at Tor Downs Station (December 2017) and rangeland goats at Tor Downs (January 2018).

Acknowledgments

First and foremost, this Nuffield journey would not have been possible without the investment from Australian Wool Innovation (AWI) and my selection by the Nuffield Board, so thank you.

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Thank you to my bosses, Andy and Fiona McLeod, for allowing me the time to study, travel, and complete my Nuffield journey. Also, to family members and friends whom had interest in this journey and supported me during it. My sister and her family, Annabelle and Johnny Walsh (and Toby), mum and dad for the airport runs.

To the India 2017 Global Focus Program (GFP) group, for helping to inspire me to look outside the box. For Emma Ward (ANZ, Broken Hill) and Steve Wilkins (Nuffield NZ) for being my sounding boards during individual research.

I am very grateful for Ian Symonds's help for keeping the stock up with water, and the garden alive whilst I was away.

I thank Carol-Ann Malouf (National Federation of Merino Breeders), for all of the people that you connected me with along the way. I hope that we can meet in person one day.

There are too many people to thank individually for allowing me to visit their farms, businesses and universities during my time in Brazil, USA, South Africa and New Zealand. As well as those farms and businesses our group visited during the India GFP. I appreciate your patience taken to answer questions, allowing photographs to be taken and for sharing your knowledge, insights, family time, meals, and very gratefully guest bedrooms and washing machines.

I have been aware of Nuffield Australia for some time, however a big thank you goes to Christine Ferguson (2009 Scholar), for suggesting that I apply. It has certainly been an incredibly rewarding, engaging and eye-opening experience.

Abbreviations

AWI	Australian Wool Innovation
GFP	Global Focus Programme
Ha	Hectares
MLA	Meat and Livestock Australia
NSW	New South Wales
SAMM	South African Meat Merino
TGP	Total Grazing Pressure
UK	United Kingdom
USA	United States of America

Terminology

Global Focus Program (India 2017 GFP): A six-week, intensive agricultural study trip, participated with nine other Scholars. Travelling to Singapore, India, Qatar, Denmark, UK and USA in May and June 2017.

Kangaroo: Given the total number of species within this marsupials Macropus genus is 14, and a number of them are found in the Western Division of NSW, kangaroo is used as a generally descriptive term, unless otherwise stated.

Meatmaster: Composite breed of fat-tailed, wool shedding sheep developed in South Africa, with Dorper and Damera genetics base.

Total Grazing Pressure: The sum total of all the animals, both livestock and native, on a pasture at a given time.

Wild Dog: Any dog living outside a domestic state.

Objectives

To investigate ways that wool growers in the rangelands of the Western Division of NSW can:

- Run a multispecies enterprise.
- Investigate utilising available resources.
- Establish how to manage predation issues.
- Explore possibilities for improving efficiencies on property, that help decrease costs and streamline the day-to-day running of the business.

Note:

The NSW Government Department of Trade and Investment: Crown Lands, states in April 2014 Western Lands Leases Tenures and Conditions publication that:

> "*The department encourages diversification into alternative land uses e.g. aquaculture, farm tourism, recreational hunting, filmmaking and feedlots.*"

With the conclusion that the department be consulted about changes to the lease purposes and authorisations. This therefore gives woolgrowers and other pastoralists in the Western Division ample scope to explore and implement diversification for an existing business.

Chapter 1: Introduction

The Western Division covers an area of over 42% of NSW, stretching from the Queensland border in the North, to the South Australian border to Victoria and cuts a line along river systems from Balranald up to Mungindi. This encompasses an area of over 32.5 million hectares and is mainly Crown Land, governed by various land acts.

Classified as semi-arid to arid rangelands, made up of open grasslands and plains, sandy mallee country, bluebush, woodland stands of belah, oak, pine and other trees, and a large amount of sand hill and mulga country. Weeds such as the mesquite, introduced from South America, prickly pear, and the native varieties of woody weeds are found in many areas of Western NSW. (Brooke. G., 2006) The rainfall is at times well below average and unreliable, making feed budgeting and grass measurement redundant. Instead, stock numbers are managed on a groundcover basis, rather than rainfall or strict set seasonal patterns. Management of this groundcover and the availability of water for livestock use are the main limiting factors facing pastoralists in the area. Along with employment of reliable and suitable staff.

The rangeland goat, (*Carpa hircus*) is an animal that has adapted well to Australian conditions, having stemmed from escaped goats when Australia was first settled, with the genetic pool been added to by fibre and meat goats over the years. More recently, the increased popularity of the Boer goat across Australia has bolstered the genetics and increased the frame size of the animal, resulting in more meat coming from the same number of carcases.

Coupled with the unpredictable rainfall and the high kidding rate of goats, the need to continually monitor and manage the Total Grazing Pressure (TGP) in Western NSW is paramount. The Land Act states:

<u>Western Lands Act 1901- Section 18D</u>

1 (e) "A lessee shall not overstock or permit or allow to be overstocked the said land, and the decision of the Commissioner as to what constitutes overstocking shall be final."

Therefore, removing excess numbers is a necessary land management practice in maintaining groundcover, and with the prices in Australia reaching a high in 2017 of AU$7.20/kg, carcase weight the sale of rangeland goats in the Western Division is also a valuable income stream. Australia is the world's largest exporter of goat meat, with 95% coming from rangeland goats.

Around 75% of these rangeland goats come from properties in the Western Division (Goat Fast Facts, MLA, 2011).

In uncertain markets, and during lulls in production, having a diverse income from more than one source can be a welcome relief, with many people in the Western Division having changed, or are looking at, changing their core enterprise.

It has long been established in various studies that grazing different species of livestock can have a beneficial impact on production when grazing and browsing habits do not overlap too greatly. Goats fit well into a Merino production system given their browsing habits and palate for trees, shrubs and rougher vegetation, which to the Merino comes as a second preference after grasses.

Kangaroos, practically in sandy country, increase the need for regular checking and maintenance of fences due to their use of arms for digging. They also need to be taken into consideration when planning and building fencing, water points and infrastructure. Kangaroo numbers in the Western Plains of NSW are at an all-time high of over five million (Office of Environment and Heritage), increasing the need to control, where possible, on the TPG within pastures.

Figure 3: A patched Kangaroo hole in a dam enclosure fence. Western NSW, January 2018

Between 1 July and 31 October 2017, the marked Merino lambs in Far West NSW was at 71% (AWI Wool Survey Report, 2017).

Given the livestock losses to wild dog attacks are estimated to be approximately $66 million a year (Professor Tony Peacock, Invasive Animal CRC), along with the stresses afflicted on individuals dealing with the damaged livestock. Along with feelings of depression, being overwhelmed and impacting personal relationships, (Saan. E., 2017) stress on sheep can also adversely affect wool and lamb production. Control of wild dogs and reduction of predation would improve bottom lines.

"I decided to go to hell,
So, I run sheep."
Ian McLachlan, September 2016, Adelaide, SA

Chapter 2: Multi-Species Livestock Mix

Alternative Livestock Species

Whilst feed and water availability calculations are the first requirements when looking at the best types of livestock to run in certain areas, considerations of the animal's behaviour, as well as the suitability of the breed to country type and topography, also need to be considered.

New Zealand: Deer

This is evident in the change that the Wilkins Farming Company saw when adjusting where they ran a class of their deer at Athol, in the South Island of New Zealand. Fawning rates in the hinds increased from 80% to 92% in the first year after they were returned to the hill paddocks, rather than grazing on the flats, close to roads and traffic (S. Wilkins, per comms, 2017). This also allows the stags to be run closer to the deer sheds for easier access during velveting and sales, therefore improving the logistics and reducing time spent on handling stock.

Figure 4: Stags running on flats at Wilkins Farming Co. Athol, New Zealand, Nov-2017

America: Goats

Alongside Merino sheep and Angus cattle, Angora goats have been run on the Hillingdon Ranch, in rocky hills near Comfort in Texas, by the Giles family since the 1980's. Mr Giles believes that this has attributed to reduced amount of cedar (also known as red juniper) and prickly pears on the property in comparison to the neighbouring countryside. This allows more grass growth and availability to the Merino sheep and Angus cattle. Angora goats are an adaptable animal (Figure 5) and well-suited to the rough terrain and can be run in the worst

paddocks across the holding. Whilst the Angora Goat is a fibre producing animal, Mr Giles explained that they base their genetics on animals that have a good frame so they can produce enough meat to make them a dual-purpose animal. This principal is also applied to the family's Merino flock, therefore spreading their risks and diversifying the income of the ranch.

Figure 5: Angora bucks grazing amongst Prickly Pears, Comfort, Texas, USA, July 2017

At the 4HF Ranch near Sonora in Texas, David Fisher stated that diversification is the key to managing the country type that covers his spread. Having mix of three livestock species, David believes they are allowing for the best utilisation in the brush covered rangelands. David, along with his sister and father, run Angus mix cattle, Rambolliut x Merino sheep, Spanish x Boer goats (Figure 6) and a Poll Hereford stud.

Figure 6: Spanish x Boer goats making use of the brush for cover in Sonora Texas, July 2017

Brazil: Goats

When visiting the Juazeiro region of Bahia state in Brazil in March 2017, the rainfall for the previous two years had only been 150mm. However, they are also able to access water for small fodder irrigation from the Rio São Francisco. On Zilton Filho's 400 ha block, he finds that running goats and a mixed breed sheep, picked for hardness, works well with the plant species present. With a great knowledge base of the different plants and the protein contents of the leaves, flesh and seed pods, he demonstrated where the goats remove the thorns from a rope cactus, (Figure 7), allowing the sheep to benefit from the flesh of the plant, which has a protein content of 8%.

Figure 7: Cactus that has been eaten by livestock, made accessible by the goats using their horns to remove the thorns. Juazeiro, Bahia, Brazil, March 2017

America: Nubian Ibex

For USA farmer, Philip Glass West of San Angelo, Texas, at the Half Circle Six Ranch Dorper Stud, stated that diversification is the key to helping with the economics of land taxes and agricultural costs when it comes to livestock in Texas. Particularly when it comes to exotics (animals), along with having real estate interests, Angus cattle, Addax deer and Arabian Oryx, Phillip, whom is an avid hunter himself, has spent the last nine years raising Nubian Ibex (*Capra ibex*). These desert adaptive goat antelope are sold into game parks for the abundant hunting market in Texas. On a small hilly section of his ranch he is currently running 75 of these valuable animals. Phillip sells the kids at six months for US$2,500-4,000, the two-year olds US$3,500, adults can be worth anywhere from US$4,000-8,000. Female stock sell for a higher price than the males. Figure 8 shows one of the breeding bucks and some young kids with the tall deer fencing in the background.

Figure 8: Nubian Ibex (Capra ibex) in an enclosure, San Angelo, Texas, July 2017

Phillip also feedlots his Dorper lambs when the season permits. He also castrates' rams because the loses are too much on the tail end of the mob due to the lambs riding each other. In his location, close to San Angelo, he is able to have same day delivery on ordered feed, allowing costs associated with feeding to be minimal due to the short distance and reduced requirement to stockpile feed.

Infrastructure

Fencing

In South Africa, the Aardvark (*Orycteropus afer*), which uses its clawed front feet to tear open termite and ant nests, stands 60cm at the shoulder and can weigh up to 70kg. Covering a home range of up to 385 ha (MacDonald. W., 2009), it can be rather destructive to fences by making holes that allow jackals and other predators access to properties. After trying to prevent the damage caused by having large rocks stacked along the boundary fence to no avail, Jo van Wyk, whom lives near Loxton in the Karoo region, has settled on the use of an electric outrigger wire. This wire is regularly tested for shortages, by a handheld meter that Jo keeps in the bakkie (ute/work truck) with him (Figure 9).

Figure 9: Jo van Wyk testing the outrigger at the base of his boundary fence. Loxton, Karoo, South Africa, July 2017

What was originally a Merino enterprise on Reitpoort, has now become a Meatmaster stud, with a small herd of cattle and some native species of deer, antelope and small number of Zebras. Given the costs associated with fencing and the unreliability of staff from the local township, Mr van Wyk has yet to upgrade much of the interior fencing from the original Merino fences. Given his evident pasture management and small flock sizes the only spots where he has added netting to the fences is between watering points, for example when there are troughs on either side of the fence, where the chance of the stock straying from their paddocks into the other mobs is increased. This is working, however the long-term goal is the gradually improve the fences, where necessary, across the property as time, prices, staffing and costs permit.

Other Infrastructure

The Giles family at Comfort in Texas have a number of small yards scattered around the property so that if stock, such as unmarked lambs or stock missed during gathering, are sighted they can be easily yarded and collected by trailer later in the day. This removes the need to walk stock for long distances and reduces time shifting stock. Use of these yards can also allow gathering to be done and stock moved later during cooler parts of the day. One of these is

shown below in Figure 10, where possible these yards are constructed so that they can be utilised for all three of the stock species: sheep, goats and cattle.

Figure 10: Merino ewes with a long-tail lamb in a simple "trap" yard, constructed of mesh and steel pegs. Hillingdon Ranch, Texas, USA. July 2017

Robin Giles is also happy to spend money on infrastructure that helps improve working conditions for both the staff, dogs and the livestock, referring to the large roof covering the main set of yards at the house as his "lake house". Mr Giles stated that he would rather work in comfort most days of the year, and have the stock out of the Texas sun, than have a holiday house that only gets used a few times a year.

Chapter 3: Use of Available Resources

Hunting

"Rangeland, noun [mass noun] (also rangelands):

open country for grazing or hunting animals."

Oxford Dictionary

In Texas, the large abundance of introduced types of deer, antelope and other animals, including the Greater Kudu (*Tragelaphus strepsiceros*), from Africa, provide trophy animals that are sort after by hunters. At the 4HF Ranch near Sonora, hunting licences make up at least 50% of the business income, supplementing the sheep, goat and cattle operations.

Figure 11: An introduced Greater Kudu in a stock water yard, 4HF Ranch, Sonora, Texas, July 2017

Tourism

In New Zealand, the MacMillan family have added farm hosting to "Glenfellen", a short drive off one of the busiest highways on the South Island, just South of Queenstown. Judi McMillan explained that they made a decision to do farm hosting with her husband Ross, so they could improve the current homestead for themselves and future residents. Also, given that one of their sons was returning to the farm partnership, it was a way to supplement the extra living costs. The McMillan's also enjoy sharing their New Zealand family farm and way of life with guests, and Judi thrives on meeting new people. They feel that having people visit and doing tours to see the everyday workings of a farm, which is not changed for guests, is of a benefit to promoting New Zealand farming as a whole. Since adding the farm stays, it has allowed

their son, Shannon, to take on the management of the farm, whilst Ross and Judi are still there to help and offer guidance when needed.

For the dual-purpose sheep, beef cattle and grazing property of “Glenfellen”, diversifying into tourism has allowed the McMillan’s to maintain a comfortable lifestyle and enhance the farming business where required. However, the downside of running a business in a small community is access to reliable part-time staff for tasks such as cleaning, and this can take at times take its toll, particularly during school terms when Judi is teaching at a local school. Judi explained that the biggest learning from the experience is that the farm still has to come first and given that guests are there for the farm experience they are generally understanding of this.

Nutrition and minerals

In Southern Montana, in the prairies near Lavina, at Eric and John Lehfeldt’s Merino operation, the introduction of minerals and amino acids that have been developed to suit the country and feed profile, has increased lambing percentages by 30%. The lamb gains have improved from .80 pounds to 1 pound (0.36-0.45kg) per day, the 5:1 ratio is in a powder form, allowing them to be turned off earlier, therefore freeing up feed for ewes (per comms, June 2017).

At the Hillingdon Ranch in Texas, the Giles family use a feed cube, which protein content of 20% enables the stock to better utilise the rougher, less palatable grasses during drier periods. The use of these feed cubes also has the added bonus making light work of gathering stock when it comes to mustering, decreasing the amount of time and effort required to yard stock. This, along with the use of working dogs, reduces the need for extra labour units and frees up the family’s time to focus on other areas of the business.

Lakebeds and river flats

Following heavy rains, at David Fishers 4HF Ranch near Sonora in Texas, they plant pasture species on small lakebeds for an extra feed source to graze stock on. In the Karoo of South Africa, with the availability of good groundwater, the le Riche family at Rietfontein farm grow lucerne on the river flats, which is then cut and baled for supplementary feeding during the year and is also used for feeding ewes that are lambing in pens near the homestead. Both these practices are similar to the farming of lakebeds that is carried out across the Western Division of NSW on the Murray Darling Basin lake system.

Alternative Opportunities

Value adding

Kitzan Family Farms in South Dakota have value added to their meat sales at markets, by utilising the tallow from their sheep to make soaps and skin products (Figure 12), along with toys and rugs from the wool and skins. This has allowed them to turn an otherwise waste product into a supplementary, be it small, income for the family by allowing them to have an extra product to sell at markets alongside their meat products, and during the off season when their meat supplies are low.

Figure 12: Products produced by the Kitzan Family Farm, from their own tallow at Nisland, South Dakota, June 2017

Research

Allowing research groups and universities access to land to run trails can help gain understanding and more knowledge of the properties production, resource uses and in turn can potentially reduce running costs. In the Otago region of New Zealand, farmer Richard Subtil utilises water monitors (installed by a conglomerate group, including the likes of Landcare), which has seen the irrigation on Omarama Station to become 99% efficient (pers comms, October 2017), though the feedback of data received about how much water and nutrients is moving through the soil structure.

Chapter 4: Managing Livestock Predation

Predators

Jackal

The Black-Backed Jackal (*Canis mesomelas*) is the predator that poses the greatest risk of livestock loses in South Africa. In the Karoo region, this medium sized, dog-like carnivore (C and M Stuart, 2011) is controlled by a number of methods. The jackal has been a long-standing issue for farmers in South Africa, as is evident by the historical stone trap from 1889, pictured below, on Jo van Wyk's farm near Loxton, in the Karoo Region.

Figure 13: A historical Jackal trap built in 1889 on Rietpoort, Loxton, Karoo, South Africa, July 2017

At Fraserburg in Karoo, President of the Wool Growers, Gillau de Toote, explained that the group was working on a forum on predation, and did acknowledge that "*each industry has its own way of doing things*". They are currently working on predator management solutions that suit all producers. In areas where training has been carried out, the Jackal predation has decreased from 15% to 5%. This training has included government accreditation for night shooters, paying RAD$800 per Jackal, plus a kilometre levy. Integrated approaches also include the monitoring of dens, so if there are a pair of Jackals living on a property who are not killing sheep, the pups are removed, and the adult pair left, to manage the population.

Cats

To a lesser extent than the Jackals, the Caracal (*Caracal caracal*) is a robust medium sized cat weighing up to 19kg that poses less risk to the sheep in South Africa but at Rietpoort, farmer Jo van Wyk has trialled running an electric wire along the top of the boundary fence. However, this was later abandoned, given the agile nature of the Caracal, when the cat jumped over the top of the fence the wire was shorting out as soon as it come into contact with the wire below.

At the Tierboek farm near Calvina (Figure 14), Francois van der Merwe has a conversation-based approach to dealing with the leopard (*Panthera pardus*) that lives in the range behind their house, by not placing lambing ewes in the paddocks that the cat is known to frequent.

Figure 14: Merino ewes and lambs at foot on Tierboek, with the range in the background where the Leopard lives. Calvina, Karoo, South Africa, July 2017

Pigs

Remaining vigilant and observant allows David Fisher from 4FH Ranch to asses which of the Texas pests and predators are currently moving through the properties, so he can act appropriately. In the case of discovering pig damage, shown by the freshly rooted ground in the Figure 15 below, and damaged fencing, local hunters specialised in that field would be contacted to come out and control the pigs. This is achieved via shooting and trapping in large steel cages with sliding doors, so that the animals can be humanely destroyed.

Figure 15 (L-R): An area that has been freshly uprooted by pigs and an area previously uprooted by pigs regrowing with invasive species, including nightshade and prickly pear, at 4HF Ranch, Sonora, Texas, July 2017

Coyotes

When checking on livestock and waters David Fisher also checks and resets Coyote (*Canis latrans*) snares in holes under the high netting fences that criss-cross the land in an attempt to stop the predator from gaining access to livestock. David also offers the hunters that use his land a monetary reward for any coyotes and cats they destroy during their visits.

West of San Angelo Phillip Glass was applying a reactive approach to the coyote problem with his stock by using a helicopter and bikes for spotting and shooting problem dogs when they gained access. However, after losing stock worth US$50,000 to just two coyotes that had developed a taste for sheep, he decided to become more proactive in his predation control. This involved installing a buried two-foot net wire apron footing around the entire boundary fence. Philip stated that now you see when a coyote gets to the fence and after it has four digs along the fence it then leaves. However, with the large deer population in Texas, it is still vital to regularly check the fences, as only one broken wire, caused by bucks fighting through the boundary, can allow a coyote to gain access to the property.

Guard Animals

Dogs

Guardian dogs have been used to protect livestock for thousands of years and they can be found in a number of countries with livestock charges. However, the first Maremmas were

bought to Australia in 1982 (van Bommel. 2010). Since then the numbers have grown and the use of guardian animals in Australia has increased as the knowledge on the best ways and situations to use them in has become more understood.

In the state of São Paulo in Brazil, a team of nine dogs was observed looking after a sheep feedlot, stud sheep and bull herd, across 50 ha. Since the introduction of the dogs ten years ago, the stock loses to jaguars has dropped from 26 head a night, to zero, with only the occasional sighting of a cat paw print along the edge of the sugarcane fields. The manager also stated that the dogs, (Figure 16), can become extremely protective of the sheep, to the point where he had to "rescue" would be sheep thieves from the back of their own truck one night. The dogs also killed one of the neighbour's bulls that had jumped a fence into the property. To the north, in the state of Bahia at Zilton Filho's holding, given the poor socio-economic conditions of the drought-stricken region, the main reason for having Maremma dogs is not so much for the cats, eagles and hawks, but is to deter livestock and property thieves.

Figure 16: A Maremma keeping an eye on some young Suffolk stud rams at São Paulo, Brazil, April 2017

In Australian case studies presented by Lisa Bommel in the Guardian Dogs Best Practice Manual, Maremma dogs were trialled in different locations, with the below table showing the improvements lamb survival rates for a sheep and cattle property in Victoria.

		Previous control - shooting	Maremmas
Initial investment			
	Time	-*	3 – 6 hours per week
	Cost	-*	$1520 (see initial costs)
Ongoing operation			
	Time	50 – 60 hours per week	1 hour per week
	Cost	$600 (equipment)	$1600 per year (see running costs)
Annual sheep loss			
		1% lamb survival rate, representing lost income from a lifetime of wool production of the 99% of lambs that were lost 100 adult sheep lost, equal to $7000	70% lamb survival rate No adult sheep lost

* No initial investment

Note: Calculations in time investments are approximate, and assumes one person's workday averages eight hours. Cost does not include expenses associated with time investment in the method. All monetary values are in Australian dollars.

Table 1: Cost and Benefits outcomes of predation control by Maremma dogs on Riversdale, north-east Victoria (van Brommel. L., 2010)

Herbivores

Donkeys have become the guard animal of chose for the Kitzan Sheep SAMM and Suffolk breeders at Nisland in South Dakota (Figure 17). This was after finding that due to their proximity to other neighbours, guardian dogs were not suitable as they had too many problems with them wandering onto other people's land.

Figure 17: A donkey in the night shed with his SAMM charges at Nisland in South Dakota, June 2017

Back at David Fishers ranch in Texas, he employees the use of llamas to future decrease the risk of predation in his enterprise, with mixed results. They have found that some of the animals have bonded with the correct stock well, were as others have turned up at the holding paddock gate looking for food and company or moved into guarding the cattle, rather than the sheep and goats.

Chapter 5: Improving Efficiencies

Telemetry

During his time at Tandou Station, near Menindee in NSW, the now General Livestock Manager for Websters Limited, Paul Martin, identified that one of the largest inefficiencies on the property at was the amount of time spent doing water runs. During summer, this daily checking of tanks and troughs to ensure that livestock had access to water was taking a full labour unit, around AUD$55,000 per year, plus diesel and upkeep on a vehicle. The installation of an observant telemetry system for monitoring the water and starting or stopping pumps remotely, the initial cost of AUD$33,000 for three main water points, followed by a yearly fee of around $700, paid for itself within the first year of operation. It also meant that a staff member who was leaving did not need to be replaced, thereby reducing the companies running costs. Working off the Next G phone system means Paul is able to check on these waters from anywhere in the world, along with sending out alerts when tanks fall below a specified level. Paul stated that this system saved a lot of peace of mind, and that he "*can sleep much better at night*" because of it with the information available to him at the end of his fingertips, rather than a 3am drive to check pumps.

Webster Limited is now looking at installing telemetry systems on their new sheep property, Kalabity Station in South Australia. Checking 91 water points across 202,000 ha is a two-day job, meaning full-time staff dedicated just to ensure stock have access to water. Given the issues surrounding lack of phone service, along with spate of recent power outages that affect the Next G phone towers, Paul and the company are currently researching newer technologies. These include the use of systems that run off solar and transmit the data via satellite back to Pauls' phone. The use of satellite technology has allowed the company to be proactive in reducing the risk to staff whilst they are working on the property, via the use of a hand-held GPS unit. Staff are required to carry the units with them at all times so that help or assistance can be asked for at the push of a button, the units also leave a breadcrumb trail, so staff can easily be located if they do not return in the expected time frame. Paul stated that these "*must have devices*" only cost them AUD$219 per unit, plus a yearly fee, however the value of someone's life is not something that any price can be placed on and it means that he knows people can be quickly located when need be.

Conclusion

Many small factors, when compiled, can have a large effect on overall efficiencies, and therefore the bottom line of any business.

Understanding and investigating the appropriate livestock species and class that is going to be the most productive for the type of country type and the enterprise is critical. This includes considering staffing, business set-up, time, legalities, paperwork, area restrictions, extra costs and running maintenance requirements. Most importantly, the saleability and market access for the end product must be considered.

Ensure that appropriate and suitable infrastructure is in place prior to stocking with a new breed of livestock, to ensure they are properly contained and controlled. This will help maintain good neighbour and community relations and allow the best chance of running the stock to their full potential. In addition, time will be saved from retrieving animals from neighbours or recovering stock loses due to wandering.

Worldwide, there are multiple examples of rangeland livestock producers successfully utilising their existing resources to value add their existing enterprises including: hunting, tourism, value adding and improving feed efficiency.

Understand the mineral requirement of animals as well as potential deficiencies of the feed sources being utilised to explore options surrounding potential gains. Identify ways to efficiently implement mineral supplementation suitable to the enterprise as seen in Montana by the Leidfliedt family to increase the bottom line.

Remain vigilant for signs of predation such as stock behaviour, tracks, carcases being quickly cleaned up, disturbed ground and dogs barking at night. Use an integrated approach to control and be proactive, rather than reactive, to prevent any loses. Implementing integrated approaches towards predation, such as strategies David Fisher implements in Texas, can help reduce stock loss. The government training of Jackal shooters in South Africa has also worked well within the integration of observation and trapping, along with fencing. Most of all, approach it from a proactive standpoint to prevent predation occurring.

Recommendations

- Understand the country, the rainfall patterns, the vegetation and soil types prior to looking at feeding, livestock species or infrastructure changes in the business.
- Research and investigate all aspects of any changes in livestock species prior to implementation, including fencing, yard requirements, area/district laws and feed requirements.
- Understand potential markets and sale points and factor these into costings to ensure any changes will be profitable.
- Research the many potential opportunities for the business, taking care to assess all projected outcomes, both positive and negative.
- Understand own skills and assets, along with any limiting factors, prior to adding to, or diversifying, the business.
- Use integrated approaches to predation control.
- Remain informed on area programs and industry research and development to ensure best practice and a proactive approach.
- Research, investigate and run cost analysis on potential efficiencies to ensure they are achievable and suitable to the enterprise.

"Stop and breath. Be heathy. Be around your friends and family.
Be there for someone and let someone be there for you.
Be bold. Just be for a minute."
Richard Branson

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Plain English Compendium Summary

Project Title:	**Diversification in Western NSW Wool Enterprises:** • **Multi-species livestock mix** • **Utilisation of natural resource base** • **Managing livestock predation** • **Improving efficiencies**
Nuffield Australia Project No.:	1717
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Objectives	To investigate ways that wool growers in the Rangelands of the Western Division of New South Wales can: • Run a multispecies enterprise. • Investigate utilising available resources. • Establish how to manage predation issues. • Explore possibilities for improving efficiencies on property, that help decrease costs and streamline the day-to-day running of the business.
Background	In the Western Division of NSW, the rainfall is at times well below averages and unreliable, with stock numbers to managed on a groundcover basis, rather than rainfall totals. Management of this groundcover and the availability of water for livestock use are the main limiting factors facing pastoralists in the area. This low rainfall also means that the available pasture needs to be managed and utilised in the most appropriate manner. Recent resurgences of Wild Dog numbers are also of growing concern to pastoralists across NSW.
Research	Multispecies livestock enterprises consisting of sheep and other mixes, predation control and methods; infrastructure; alternative income sources. Research was conducted in Brazil, USA, South Africa, New Zealand and Australia using a combination of farm visits, interviews, and personal study.
Outcomes	Multispecies livestock mixes are viable when consideration into infrastructure and suitability of available feed sources and climate is taken. Market availability and access are also important considerations. An integrated and proactive stand point will help reduce and at times prevent predation occurring.
Implications	This report imparts to readers that there are many options when investigating running multispecies enterprises, along with many considerations that need to be researched prior to commitment. Various opportunities are available when looking to utilise present resources that can be adjusted to suit country and location dependent on market access.