Department of
Primary Industries and
Regional Development

GOVERNMENT OF
WESTERN AUSTRALIA

Sheep Industry Business Innovation (SIBI) Scholarships

Scholarship project summaries 2019

SIBI Scholarships Program

Program overview

This initiative was part of the Department of Primary Industries and Regional Development's Sheep Industry Business Innovation (SIBI) project, which aimed to support the sheep industry to capitalise on growing markets for sheep products.

SIBI assisted the industry to build capacity to supply new markets for sheep meat and live exports, particularly in nearby Asia and the Middle East, generating flow on benefits to producers, industry, the regions, communities and the state economy.

The project recognised the value in supporting individuals to help solve industry relevant issues across the sheep supply chain through academic research. In addition the intention was to expose and excite students to choose a career in the agrifood supply chain demonstrating the value of postgraduate trained personnel to entities within the sheep industry, with the view to their long term employment.

The SIBI Scholarships program offers funding for students to carry out a research project as a vocational or internship, honours, masters or PhD.

Key funding sources may also include Meat & Livestock Australia Donor Company, Australian Wool Education Trust and University Australian Postgraduate Awards.

Objective of the program

The WA sheep industry scholarship program is designed to support and encourage individuals who wish to pursue further study by addressing key industry questions relevant to the sheep industry supply chain in WA.

Overall the program is about building capacity and giving the student an appreciation and awareness of the industry. Any immediate industry-ready outcome from any research study is not essential.

Program priorities

Scholarship applications need to be aligned to at least one of the SIBI outcomes and are assessed on their own merit.

- To support the establishment of dedicated export supply chains that offer the level and consistency of returns needed to restore confidence in the industry.
- To increase the on-farm productivity of market-preferred products, through better genetic selection and higher stocking and reproductive rates.
- To improve business performance by improving farm business and production skills.
- To increase access to investment, both from within and outside of the industry, as a result of increased confidence among investors and more attractive business models.
- To establish the human and physical resources needed to research, develop and demonstrate the elements required to achieve success in the industry and the means of sustaining those resources into the future.

Further information about the SIBI Scholarships program, including guidelines and application process can be found at www.agric.wa.gov.au/sibischolarships

SIBI Scholarship recipients

Student Name	University	Scholarship	Project title
Alison Walsh	University of Western Australia	Honours	Are native shrubs an economic solution to greenhouse gas emissions from Australian agriculture?
Andre Boer	University of Western Australia	Internship	Overview of potential electronics-based solutions for the early detection of flystrike in West Australian sheep
Chris Telfser	University of Western Australia	Internship	Overview of potential electronics-based solutions for the early detection of flystrike in West Australian sheep
Eliott Reed	University of Western Australia	Honours	Environmental factors which increase phytoestrogens in subterranean clover
Elise Bowen	Murdoch University	PhD	Improving reproductive efficiency by reducing mortality and reproductive wastage in young ewes
Lucas Smith	University of Western Australia	Masters	Fit for purpose biochar to improve rumen fermentation efficiency and reduce methane production
Michael Young	University of Western Australia	Internship	Effectiveness of a supply chain on out-of-season lamb production
Michael Young	University of Western Australia	Honours	An economic analysis of sheep flock structure for broadacre farm businesses
Rebecca May	Murdoch University	Honours	Sire differences in feed efficiency and temperament in Merino wethers
Renier Bootha	Curtin University	Honours	Evaluating the effectiveness and accuracy of current innovative sensor technologies to estimate crop biomass in order to improve the management of crop grazing
Sanabel Abu Jwade	University of Western Australia	Internship	Sheep multi-lane auto drafting management app
Sanabel Abu Jwade	University of Western Australia	Honours	Automatic sheep breed classification using deep learning
Thomas Clune	Murdoch University	PhD	Investigating the magnitude, timing and causes of foetal loss in young ewes
Timothy Edwards	University of Western Australia	Honours	Optimisation of the integrated sheep auto-drafting system mechanical aspects
Travis Allington	Murdoch University	PhD	Managing fecund flocks to improve the survival of triplet dams and their lambs
Victoria Rawlings	Murdoch University	Honours	The role of dam water as a source of veterinary and zoonotic infections of importance to the WA sheep meat industry
Xin Hong	University of Western Australia	Internship	Assessing nutrient content available in dry pasture field
To be determined	Curtin University	PhD	Sustaining the Australian sheep industry through unprecedented change

Alison Walsh

Project title: Are native shrubs an economic solution to greenhouse gas emissions from Australian agriculture?	
Type of scholarship: Honours	
Supervisors: Ben White and Phil Vercoe	
Project start: February 2019	Project end: October 2019

The global human population is predicted to rise to nine billion by 2050 and feeding this population in changing climatic conditions will be a major challenge for the future. Natural and anthropogenic greenhouse gas (GHG) emissions are causing climate change globally.

In 2010, agriculture accounted for 10-12% of global anthropogenic GHG emissions. In 2016, agriculture in Australia accounted for 12.6% of Australia's GHG emissions, with 71% of agricultural emissions stemming from enteric fermentation (DoEE 2018*)*. Enteric fermentation occurs in the rumen of ruminants, such as cows and sheep, where plant feed is fermented by a microbial community.

Methanogenic potential is the amount of methane produced for every gram of dry matter ingested. Some species of Australian native shrubs have low methanogenic potentials (e.g. *Cullen australasicum, Enchylaena tomentose* and *Eremophila longifolia)*. Integrating these shrubs in the feed supply to ruminants is a possible GHG abatement strategy.

In Australia, changes in climate are being observed. Within the wheatbelt region, annual rainfall has declined since the 1970s, while summer rainfall is increasing. This trend is predicted to continue with the risk of drought also predicted to increase (IPCC 2014). These climatic trends have an impact on agricultural production as well as natural resource management issues such as salinity. Increasing drought resilience, managing salinity, and risk management are some of the benefits of an abatement strategy in which Australian native shrubs are used as feed for sheep.

For an emission policy to be effective, the financial incentive of abatement needs to be greater than the cost of abatement. The net present value of the shrubs needs to be greater than the costs for adoption shrubs on-farm. Understanding the cost of emissions abatement through the introduction of native shrubs as feed is necessary for future implementation of effective agricultural emission abatement policy.

This research aims to analyse the role and value of anti-methanogenic native shrubs as a feed source for sheep in Australia's mixed enterprise farming systems. The study will encompass measuring how GHG emissions from sheep production, and the entire farming system, could be affected by the introduction of these shrubs. The financial costs and benefits associated with their introduction will also be reported. The research will establish if these shrubs constitute a cost-effective abatement strategy for these farm businesses, considering current carbon prices as well as the alternative policy whereby a tax on GHG emissions is introduced.

Andre Boer

Project title: Overview of potential electronics-based solutions for the early detection of flystrike in West Australian sheep	
Type of scholarship: Internship	
Supervisors: Dilusha Silva and Gino Putrino	
Project start: December 2017	Project end: February 2018

Overview of flystrike in Australia

- Flystrike is one of the most financially damaging diseases facing the sheep industry in Australia, costing Australia an estimated $280 million annually.
- The fly breed L. Cuprina lays eggs on sheep where after 12-24 hours they hatch. After 1-2 days they start to cause skin damage and after 6-8 days of larval infestation the sheep can die.

Aim

- Identify electronic methods of detecting flystruck sheep as early as possible.
- Since most strikes occur on the breech area of ewes this should be the main area of focus.

Potential Electronics-based Detection Methods

Infrared Imaging of Body Temperature

- A sheep's body temperature can rise by up to 2°C with acute flystrike infection. Using a thermal Imaging camera, the sheep's temperature can be measured by using its facial temperature as a proxy.
- This method would detect flystrike when symptoms are already apparent in the sheep's behaviour, meaning detection would likely be too late.

Area-Specific Infrared Imaging

- The localised flystrike wound can reach a temperature of 53 °C.
- Thermal imaging focussed on the breach.
- Wound is initially under wool, making thermal imaging difficult, meaning the detection would, again, likely be too late.

Accelerometers

- Attempt to detect the fidgety behaviour of struck sheep by fastening an accelerometer to each sheep.
- Could detect a range of ailments as well as behaviours that could imply under-grazing.
- Previous studies on a small number of sheep have attempted to classify behaviours with promising results, although none focus on flystrike.
- The hurdles are (1) creating a robust and cheap sensor that can, (2) effectively transmit data over the large paddocks, (3) that incorporates an accurate detection program.

Electronic Nose

- An electronic nose uses multiple odour sensors and a complex algorithm to detect specific odours.
- Learns to identify flystrike odour by being trained on it (exposed to it).
- An in-vitro study has been done in Queensland to detect flystrike with positive results. The e-nose gave an "accurate [and prompt] discrimination of strike" in all cases.

Reliability of Electronic Noses

- Another study examined the long-term variability of one of the most prominent gas sensor manufacturers (Figaro) and reported that the sensors had large drift and sensor-to-sensor variability.
- This implies that each e-nose must be individually trained on the target odour. There is a possibility to create an artificial flystrike odour which would make training simpler, though this hasn't been attempted to our knowledge.

Conclusion

Accelerometers and e-noses show the most promise out of electronic-based solutions. Further research is required regarding the viability and practicality of these potential solutions.

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Eliott Reed

Project title: Environmental factors which increase phytoestrogens in subterranean clover	
Type of scholarship: Honours	
Supervisors: Dr Megan Ryan, Dr Kevin Foster and Daniel Kidd	
Project start: July 2019	Project end: June 2020

Many forage legumes contain phytoestrogens, compounds known to have oestrogenic activity that can cause infertility and other reproductive disorders in grazing animals. Some out-dated cultivars of subclover contain high levels of the oestrogenic compound formononetin. In the 1970s and 1980s new clover cultivars with low concentrations of formononetin were selected as part of national breeding programs and released to industry. Additionally, improved phosphate status of many soils, and a decrease in clover pastures, resulted in a reduction of oestrogenic pastures, making the problem rarer (Cocks and Phillips 1979; Collins and Cox 1985). Also, the negative impacts of livestock reproduction on high oestrogen subterranean clovers was promoted over those decades by State Agricultural Departments and Universities. However, over the last 15-20 years the problem was assumed to be resolved and extension diminished. At the same time, there has been a strong shift from wool to lamb meat production meaning there is a greater need for higher lambing percentages. Recent work by UWA has shown that cultivars of subterranean clover high in oestrogens are widespread in pastures in the moderate to high rainfall areas of southern Australia and a recent Meat and Livestock Australia report (MS.009) stated that the number of sheep likely affected within the national flock by high oestrogenic clover was estimated in excess of 10 million.

This forgotten problem has created knowledge gaps in the production system allowing highly oestrogenic subterranean clover cultivars to again make up a significant proportion of Australian pastures. Despite the current problem, there are few recent producer guidelines on how to avoid the effects of immediate or long term cumulative infertility.

Environmental factors may exacerbate the problem of cultivars high in oestrogen such as:

1. Low phosphorus status in soil
2. Time of season
3. Waterlogging

Complete restoration of pastures to replace cultivars of subterranean clover high in oestrogens with safer, newer, cultivars is costly. Therefore, one of the aims of this study is to identify good management practices that may decrease the prevalence of oestrogenic compounds and thereby delay or remove the need for farmers to renovate their pastures.

This study's research approach will include:

Field work in collaboration with a local farmer in Albany to assess the effects of fertiliser application and seasonal variation in phytoestrogens in green shoots and in senesced shoots over summer. Glasshouse trial to investigate the interaction of waterlogging and P application level and cultivar on levels of phytoestrogens.

Projected supported by DPIRD and AW Howard Memorial Trust Inc.

Elise Bowen

Project title: Improving reproductive efficiency by reducing mortality and reproductive wastage in young ewes	
Type of scholarship: PhD	
Supervisor/s: Dr Caroline Jacobson, Dr Serina Hancock, Associate Professor Andrew Thompson, Professor Michael Friend	
Project start: May 2018	Project end: April 2021

This project will identify factors that impact reproductive wastage and mortalities in young ewes for contemporary Australian maternal sheep genetics managed commercially in a Mediterranean environment and identify opportunities for improvement. The project will explicitly address research gaps related to the impact of genetics, growth path/body condition profile and management of ewe lambs to improve reproductive rate by reducing mortalities of ewe lambs and their offspring. The findings will also underpin financial modelling to address issues of costs for achieving growth targets.

Key research questions addressed in the project include:

1. What are the benchmarks for reproductive rate in maiden ewes (both ewe lambs and hoggets), and where are the opportunities to improve?
2. What are the risk factors for mortalities of ewes joined as lambs, and for their offspring?
3. What is the optimum growth path to optimise reproductive rate for ewe lambs with contemporary Australian maternal genetics managed under commercial conditions in a Mediterranean environment?
4. What are the financial implications for joining ewe lambs? What are the cost-benefits for interventions to reduce mortalities and reproductive wastage?

This project will have four key activities:

1. Industry benchmarking – surveying reproductive wastage from scanning to marking from maiden ewes compared to adults in commercial flocks across breeds and regions of Australia
2. Analysis of historical data – quantify risk factors for ewe and lamb wastage from scanning to marking, using 2014-2018 data provided by Maternal studs
3. Observational studies - impact of growth path and genetics on reproductive wastage for ewe lambs from 2019 foetal loss sites and Maternal stud flocks
4. Experiment to explore two key risk factors for ewe and lamb mortalities – the interaction of genetics and nutrition during pregnancy on reproductive wastage

This project is also supported by additional operating funds from the Meat and Livestock Australia project “Reducing foetal and lamb losses in young ewes” (B.AHE.0318).

Lucas Smith

Project title: Fit for purpose biochar to improve rumen fermentation efficiency and reduce methane production	
Type of scholarship: Masters	
Supervisors: Professor Phil Vercoe and Dr Zoey Durmic	
Project start: February 2019	Project end: December 2019

The purpose of this project is to examine a range of biochars as a feed additive for ruminants, in particular at their potential to reduce enteric methane production and improve rumen fermentation.

Biochar is a product made from heating organic matter with little to no oxygen, to produce a high carbon product with a large surface area to size ratio. Biochar is generally made of waste by -products from agricultural and industrial production. Properties of biochar can be manipulated, and depending on the source material, methods of manufacturing and manipulation, biochar can exhibit a wide variety of both physical and chemical traits.

Initially, biochar applications were in industry and water treatment as a filter and absorbent of unwanted and toxic residues. More recently, it has been investigated as a soil improver due to its high carbon content and its interactions with microorganisms in soil and on the plant roots. Due to all these properties, the use in animal is gaining interest. So far, the use in animals is limited to individual farms and some anecdotal, but encouraging evidence of some positive effects in ruminant production.

There is a range of biochars on the market that are already being advertised as feed additives, with little to no systematic research or reports on the effectiveness of biochar in a rumen system or the mechanisms of how biochar would work in the rumen. It is unknown which of biochars are better than the others, and which the properties would render more desirable outcomes in the rumen, and therefore should be manipulated to create 'fit-for-purpose' biochar.

In my project I am planning to use a systematic approach to create and identify those properties in biochar that will reduce methane production and enhance fermentation of rumen microorganisms, using both commercial and custom-made biochars.

Testing will be conducted through two 24h batch culture tests, followed by a long-term artificial rumen (RUSITEC) test. The batch tests will allow quick screening of a range of biochars to narrow down candidates. These will then be tested in a dose-response manner to reveal which level of inclusion may result in optimal fermernation pattern. Selected combination of biochars and doses will then be tested in RUSITEC. This system is a continuous non-static system that closely replicate live animal conditions, and identify effects that may be expressed over longer time periods.

These results will be the preliminary findings in this field and act as the standing for further research *in vivo* as well as further study into the mechanisms behind biochars interactions. By integrating biochar as an animal feed we can have an interconnected system that utilises waste, improves animal production efficiency while lowering emissions, and through animal waste act as a soil improver.

I would like to acknowledge both University of Western Australia and Meat and Livestock Australia for providing funding and support for this project.

Michael Young

Project title: Effectiveness of a supply chain on out-of-season lamb production	
Type of scholarship: Internship	
Supervisor: John Young	
Project start: June 2018	Project end: October 2018

As part of the “Supplying Out-of-Season Lambs to the World” project, John Young completed an economic analysis of the breakeven prices required for farmers to produce out of season lambs. Part of that analysis looked at the use of a supply chain to maximise feed utilisation and reduce the break-even price. The conclusion showed that it was most profitable to produce store lambs in the great southern and background and finish in the wheatbelt.

This project aimed to build on the previous analysis by:

1) Further investigating the effects of crop grazing and chaff pile technology.
2) Analysing feed allocation for different sheep groups to identify feed profile characteristics that increase the suitability of properties for being part of a supply chain.
3) Quantify the impact of grazing pressure on farm profit, to understand how seasonal variation may affect properties in a supply chain.

The economic analysis was undertaken using MIDAS to evaluate the profitability of the supply chain under different conditions. Two existing MIDAS models were used in this analysis. The first represents a mixed farm in the 550-600mm rainfall zone in the western great southern and the second represents a farm in the 350-400mm rainfall zone in the central wheatbelt.

Complementing the supply chain with crop grazing and chaff piles proved to be very profitable. In the wheat-belt, high-quality feed provided by green crops significantly reduce the need for supplementary feeding and allows a higher stocking rate, providing added value of up to $100 000. Chaff piles provide a feed source that is easily accessible by sheep, has a lower deterioration rate than normal stubble and can be utilised as a deferred feed source, this adds value of up to $30 000. In the great-southern, crop grazing is utilised by both twin ewes and finishing lambs, reducing the supplement feed per dse (dry sheep equivalent), this adds value of up to $25 000. Chaff piles have similar benefits to the wheatbelt and provide up to $10 000 added value. Although in both regions chaff piles are most economical if they also provide value to the cropping enterprise.

Breeding and selling store lambs in the great southern and backgrounding and finishing in the wheatbelt is the most effective supply chain method. This result is different to John Young’s initial analysis which is due to the re-calibration of the stubble and chaff pile modules in MIDAS, using some new data from a trial by AgPro Management. Compared to the previous representation in MIDAS, stubble and chaff piles are higher quality initially but reduce quicker as consumed. This made it more profitable to background in the wheatbelt due to the large amount of available stubble.

The great southern system runs a self-replacing flock where ewes and ewe hoggets both consume chaff piles throughout summer and into the beginning of autumn.

For the remainder of autumn, they are fed supplements, graze dry pasture and consume deferred low-quality chaff. By this time there is green feed available which ewes also compliment with crop grazing to maintain condition in late pregnancy. The central wheatbelt system run no ewes and a higher cropping area, the purchased wethers are backgrounded using chaff piles and supplements, then finished on green crop.

Seasonal variation has a similar effect on all out-of-season lamb production systems and hence won't affect farmers decisions about buying or selling time. This can provide confidence that the supply will remain consistent over time.

Full report can be found here: https://youngmr44.wixsite.com/website/economic-reports

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Michael Young

Project title: An economic analysis of sheep flock structure for broadacre farm businesses	
Type of scholarship: Honours	
Supervisors: Ross Kingwell and Phil Vercoe	
Project start: February 2019	Project end: November 2019

Farm systems and their management can be complex (Price and Goode 2009; Kingwell 2011), meaning farm management is a difficult and lengthy process requiring intimate knowledge of a range of factors that influence the farm system. In the face of this complexity, and noting time-pressures on farmers, most farmers tend to devote their time and energies to current issues rather than evaluating strategic directions for their farm business.

This project aims to aid farmers with their farm management decisions by evaluating the effect of different sheep flock structures on whole farm profitability and crop management. The analysis will be completed using MIDAS, a profit maximising whole farm linear programming model with a joint emphasis on biology and economics. For this project MIDAS will be calibrated to represent a case study farm in Williams, Western Australia. This is the first time MIDAS has been tailored to a particular farm, and to accurately portray the farm business, certain model updates are required along with detailed farm data which the owners and managers of the case study farm are willing to supply.

Using the updated version of MIDAS the following questions will be addressed:

i. How do different flock structures and size of the sheep enterprise influence whole farm profit and does this affect crop management?
ii. What is the optimal flock structure and size, and crop management that maximises whole farm profit?
iii. What factors affect optimum flock structure?
iv. What is the value of MIDAS modelling on an individual basis?

Significance and outcomes:

The development of MIDAS to allow utilisation on individual farms could increase its applicability and lead to broader application as a consulting tool, benefiting the industry.

The analysis will provide a detailed evaluation of a range of different flock structures available to farmers and outline the impact each has on the whole farm profit. Factors that influence the choice of flock structure will also be examined. This will potentially aid other farmers grappling with this same issue: what is the ‘best’ flock structure and size of sheep enterprise for their farm business? By providing a list of factors to consider when choosing a sheep structure.

Additionally, the project will outline the optimal enterprise structure for this case study farm. This information will be highly relevant to this particular business, but may also generate useful information for other farmers in the same region.

Rebecca May

Project title: Sire differences in feed efficiency and temperament in Merino wethers	
Type of scholarship: Honours	
Supervisors: Dr Andrew Thompson, Sarah Blumer and Dr Colin Byrne	
Project start: January 2019	Project end: August 2019

The aim of my project is to determine whether there is a sire group correlation between temperament and feed conversion efficiency in sheep; I would like to know if sheep that are more docile have a better feed conversion efficiency than sheep who display more anxious/agitated behaviours and whether there is a genetic relationship between the traits and to apply these traits to increase feed efficiency in sheep.

The profitability of sheep farming operations in Western Australia are driven by the costs of production versus the amount and value of the products sold. The amount of feed that an individual sheep consumes represents a large proportion of the cost in sheep production systems, approximately 65 – 70% of the total costs (Zhang et al., 2017). The cost is real and recognised within all farm modelling systems but has increased relevance and emphasis in farming scenarios where feed quantity and quality can be limiting such as on farms in Western Australia. Feed efficiency is a heritable trait (Paganoni et al. 2017), and potential exists to select more efficient animals to increase stocking rates and or reduce the feed costs per animal and therefore the costs of production. Historically, genetic improvement of sheep has focused on increasing the amount and value of wool or meat, with comparatively little emphasis on genetic selection of traits which would result in cost reduction.

The biological determinants of animal-to-animal variation in feed efficiency are still far from being fully understood, especially in adult compared to young growing animals. In young growing animals previous research indicates that no single mechanism is responsible for determining animal feed efficiency (Herd et al., 2004). It has been suggested that temperament might have an influence of the feed efficiency of sheep. Temperament is reflective of a sheep's response to stressful environments, that response being to increase its metabolic rate (Dodd et al; 2012). When a sheep's metabolic rate increases there is a subsequent increase in energy expenditure and as a result there is a reduction in weight gain, as the energy is re-directed away from growth to sustain the stress response (Knott et al; 2007). By selecting for a more docile temperament, we can select for sheep that exhibit a lower stress response when presented with an adverse situation, meaning energy is not diverted from production resulting in more feed efficient sheep (Blache & Ferguson; 2005).

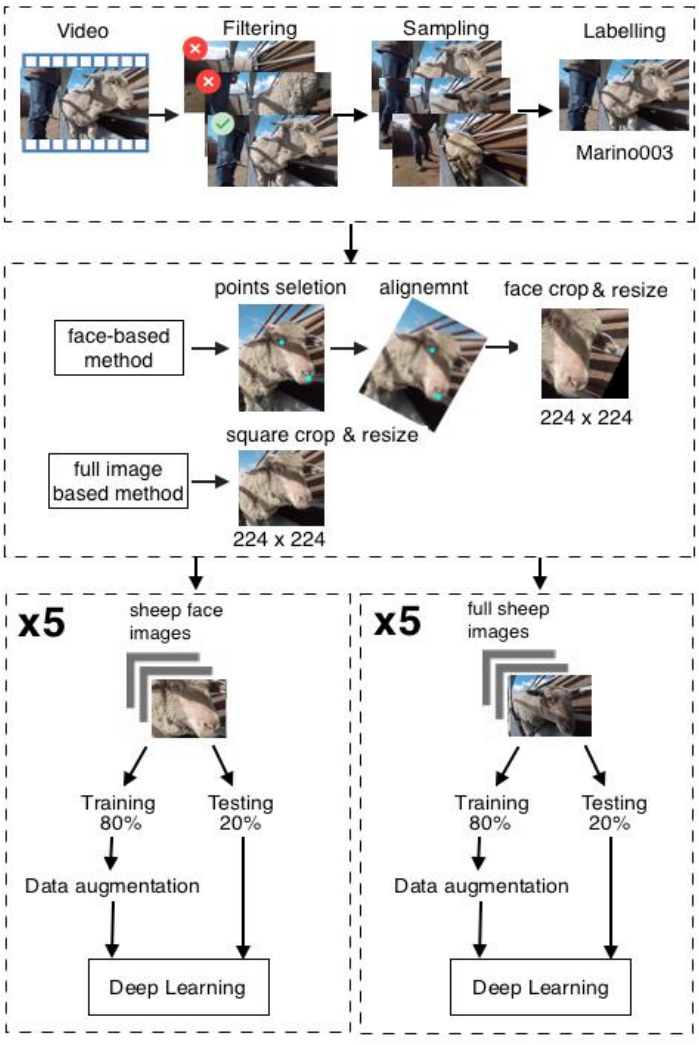
The expected outcomes from this project will include an increased understanding of sire differences in feed intake, efficiency and temperament and the biological basis for these differences. This will lead to a greater understanding of the role of these traits in genetic selection programs and productivity per hectare. Ultimately, this will encourage and assist ram breeders in adjusting their breeding directions and positively alter how commercial growers select their rams.

I would like to thank the Department of Primary Industries Research and Development for awarding me the Sheep Industry Business Innovation scholarship and the Australian Wool Education Trust for awarding me the Undergraduate Project Scholarship and Australian Wool Innovation for funding this project.

Sanabel Abu Jwade

Project title: Automatic sheep breed classification using deep learning	
Type of scholarship: Internship and honours	
Supervisors: Dr Andrew Guzzomi and Prof. Ajmal Mian	
Project start: February 2018	Project end: November 2018

Automatic identification of breeds of sheep can be valuable to the sheep industry. Sheep producers need to identify different breeds of sheep to estimate the commercial value of their flock. In many situations however, farmers find it challenging to identify the breeds of sheep without a great deal of experience. DNA testing is an alternative method for breed identification. However, it is not practical for real time assessment of large quantities of sheep in a production environment. Hence, tools that could accurately and efficiently differentiate between breeds are considered useful. Autonomous methods that can replicate the identification ability of a sheep breed expert, while operating in a farm environment are beneficial to the industry. Our original contributions in this field include: setting up a prototype computer vision system in a sheep farm, building a database compromising 1,642 sheep images of four breeds captured on a farm and labelled by an expert with its breed, and training a sheep breed classifier using machine learning and computer vision to achieve an average accuracy of 95.8\% with 1.7 standard deviation. This classifier could assist sheep farmers to accurately and efficiently differentiate between breeds and allow more accurate estimation of meat yield and cost management.



Thomas Clune

Project title: Investigating the magnitude, timing and causes of foetal loss in young ewes	
Type of scholarship: PhD	
Supervisors: Dr Caroline Jacobson, Dr Serina Hancock, Dr Sue Beetson, Prof. Andrew Thompson	
Project start: January 2018	Project end: December 2020

Maiden ewes generally have lower reproductive performance compared to multiparous ewes. Reproductive wastage represents a potential limitation in achieving optimal maiden ewe reproductive performance, however the extent and timing of which this occurs in not well quantified.

This project is currently underway and involves monitoring maiden ewes on 30 sheep farms across WA, SA and VIC between 2018 and 2020. At each farm, at least 200 young ewes (mated at 8-18 months of age) will be monitored from joining until lambs are 2-6 weeks old. Pregnancy ultrasounds will be used to monitor foetal numbers and viability. Blood samples collected from the ewes will be tested to assess the pattern of exposure to diseases to determine if there is evidence that disease exposure is associated with abortion or birth of weak lambs.

Project Objectives:

- To determine which diseases are implicated as causes of lamb losses (abortion, stillbirth or weak lambs) for Australian sheep
- To determine if abortion is a significant contributor to overall reproductive wastage from young ewes, and if so, what time these losses occur and whether there is an association with infectious disease
- To determine if management and nutrition of young ewes impact the susceptibility to diseases associated with abortion and lamb losses for offspring of young ewes

In 2018, sampling and data collection was piloted on four farms in Western Australia. In utero losses were identified in maiden ewe lambs (joined 7-9 months) but not for maiden hoggets (joined 18-20 months). Apparent in utero wastage (scanning-birth) represented over 40% overall wastage in ewe lambs. Post mortem examination of collected dead lambs identified dystocia, starvation-mismothering-exposure and still birth as the most common causes of perinatal death between birth and marking. Perinatal death was the most significant source of reproductive wastage in maiden ewes, consistent with previous observations for mature ewes, with a similar proportion of cases in each cause-of-death category.

Preliminary results suggest that mid and late gestational foetal loss may be an important contributor to overall wastage for ewes bred at 7-9 months of age on Australian farms. This project is being expanded in 2019-2020 to better determine the timing and extent of reproductive wastage for young ewes, and determine if infectious disease has an involvement.

Acknowledgements:

This project is funded by Meat and Livestock Australia and led out of Murdoch University in collaboration with Melbourne University, University of Adelaide and Livestock Logic, Hamilton.

Travis Allington

Project title: Managing fecund flocks to improve the survival of triplet dams and their lambs	
Type of scholarship: PhD	
Supervisors: Assoc. Prof. Andrew Thompson and Prof. Paul Kenyon	
Project start: April 2018	Project end: April 2021

There has been a significant increase in scanning rates, which has led to an increase in the percentage of triplet bearing ewes. Triplet bearing ewes and their lambs are at higher risk of mortality and other animal welfare issues. Although only about 5% of ewes are currently scanned for triplet foetuses the precise magnitude of the risk associated with excessive mortality of triplet bearing ewes and lambs is unknown. The project is seen as an important step for the industry in order to mitigate risks associated with this cohort of animals.

Stage 1 of the project was to undertake a producer needs analysis, this included an extensive literature review, 5 focus groups in Australia and New Zealand, 16 in-depth interviews and 87 benchmarking surveys from both farmers whom separate and differentially manage triplet bearing ewes and those who don't normally manage triplet bearing ewes separately (figure 1). Key research priorities were ascertained during every stage of the process. The findings from this process were presented at 5 regional forums and 1 webinar, again key research priorities were gathered from farmers. The top 5 research priorities, as identified by farmers are condition score at lambing, feed on offer (FOO), mob size, mineral supplementation and mixed versus managed. In 2019 and 2020, 75 on-farm research sites will be conducted across WA, NSW, Victoria, SA and Tasmania. This will include 20 collaborating with farmers across Western Australia. We would like to thank all farmers that have been involved in the project along with farmers that will continue to be involved in project.

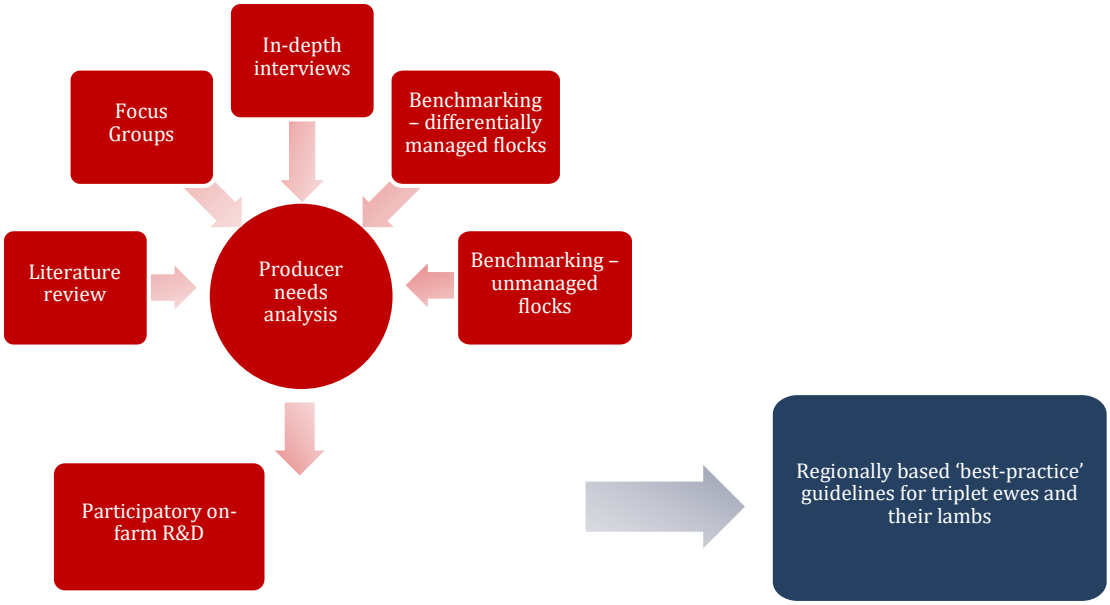


Figure 1- Summary of producer needs analysis

The project is funded by MLA project and is led by Murdoch University, in collaboration with DPIVic, DPINSW, SARDI, JT Agri-source and Massey University.

Student – To be determined

Project title: Sustaining the Australian sheep industry through unprecedented change	
Type of scholarship: PhD	
Supervisors: Dr Elizabeth Jackson and Dr Robin Jacob	
Project start: To be determined	Project end: To be determined

This project aims to investigate sheep producers' attitudes and behaviours, and corresponding community values, regarding industry changes born primarily from social and political pressures, which are a new form of disruption to global sheep supply chains. An innovative behavioural model will be developed using the theories of social license and planned behaviour. Expected outcomes of the project include enhanced understanding of how Australia's sheep producers are adapting to changes and how governments should innovate and allocate resources so that disruptions are not amplified through the supply chain. This project is of utmost importance as the sheep industry contributes over $6 billion a year in exports to the Australian economy.

Using a mixed method approach, we will conduct the project in three phases. Phase 1 will be dedicated to understanding producers' attitudes and behaviours towards changes in the sheep industry, Phase 2 will be about understanding community values towards changes in the sheep industry and in Phase 3 we will develop and test the sheep industry change management adaptation model (created from Phases 1 & 2). These phases will be achieved through focus groups and large-scale survey.

This project will benefit Australian sheep producers by developing their adaptability and resilience in the face of unprecedented change. Through increased knowledge and practical recommendations, sheep producers will be able to effectively respond to external forces affecting their production and supply chain. They can hence plan to minimise disruptions and develop an efficient global supply chain. This will result in increased exports thus benefiting Australia's economy directly. This project will see the world-class training of a PhD student and develop long-term research alliances between Curtin University, The Royal Veterinary College (UK), the University of Liverpool, our industry partner (DPIRD) and industry end-users (SPA and MLA).

Copyright and disclaimer

Important disclaimer
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