

REPORT



NSW WOOL INDUSTRY & FUTURE OPPORTUNITIES

A report to the NSW Department of Primary Industries from Miracle Dog, Poimena Analysis, Scott Williams Consulting and DAFWA



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Primary Industries

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NSW Wool Industry and Future Opportunities

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Authors:

Russell Pattinson (Miracle Dog)

Chris Wilcox (Poimena Analysis)

Scott Williams (Scott Williams Consulting)

Kimbal Curtis (Department of Agriculture and Food Western Australia)

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About this report

The NSW Government (Department of Primary Industries) commissioned this review to provide some insights into future directions, challenges and opportunities for the State's wool industry. The review identifies both the potential opportunities and the challenges for the industry over the next ten years, the implications of these, and then makes recommendations for how New South Wales (NSW) producers, industry and NSW Government may wish to respond to embrace the opportunities and address the challenges identified.

This review was developed by undertaking a relatively brief situation analysis which examined a range of key wool industry parameters – including supply and demand, flock demographics, producer age profiles, productivity and profitability levels – and exploring a range of key industry influences such as animal health and welfare, climate variability, conservation and environmental attitudes, the carbon economy and predation. Potential trends and implications were then developed along with a series of four short scenarios, or illustrations of how the NSW wool industry might look in 2025. It is important to note that the scenarios presented **do not represent the authors' views of the future of the wool industry in NSW**. Instead, they were provided to more closely look at some of the key trends identified in the situation analysis and to stimulate discussion.

A consultation paper was prepared and sent to 17 experienced industry participants who were subsequently interviewed in confidence and their responses collected. This consultation was highly influential in developing the key findings and recommendations within this report.

Acknowledgments

The project team would like to thank and acknowledge the support and input they received during the preparation of this report. The generous allocation of time and the frank and insightful views provided by industry members on the current state of, and future directions for, the wool industry is greatly appreciated. This input had a significant impact on the recommendations developed in this report. The team also extends their thanks to the project Steering Committee (Ian Rogan [Chairman], Joe Sullivan, Alex Russell and Ashley White) for their guidance, advice and comments on the drafts of the various papers, including this final report. The report was enhanced immeasurably as a result of their feedback.

Situation analysis

Comprehensive desk-top research was undertaken to develop a situation analysis for key elements of the wool industry in NSW. Five background papers were prepared:

- Wool supply and demand
- Industry demographics
- The wool pipeline and selling system in NSW
- Wool productivity and profitability
- Animal health and welfare, the environment and societal expectations

A review of a previous scenario planning exercise for the wool industry was also undertaken.

The five papers are made available with this report and, as noted above, were compiled into a consultation paper which was provided to interviewees.

This section presents a short summary of the key points arising from the situation analysis and the implications arising from it.

A snapshot

The following is a brief summary ('snapshot') of the current status of the wool industry in the world and Australia generally, and NSW specifically. More detail is provided in Appendix 1 (as indicated by the page number against each point) and in the background papers.

Wool's place as a world textile

- Australian (and therefore NSW) wool competes against an increasing volume of other fibres used in apparel. (p 22)
- Wool production globally and in Australia has been falling due to low prices and perceived higher profitability of other enterprises, notably cropping and lamb production. (p 23)
- NSW has the largest sheep population and is the largest wool-producing Australian state. If it were a country it would be the world's fourth-largest supplier. (p 24)
- The Australian (and NSW) wool clip has been trending genetically finer since the early 1990s which, combined with the influence of drought and dry conditions in 2012 and 2013, has led to an over-supply of and a reduction in the premium for superfine¹ wool. (p 25)
- Over the last two decades, China has become the dominant buyer of Australian greasy wool. (p 27)
- China now dominates global exports of wool textiles with the US, UK, Japan and Italy being the largest importers. (p 28)
- Based on global trade data, knitwear and men's suits, jackets and trousers provide a solid foundation for wool use, while wool's volume and share in most women's wovenwear has been eroded by price competition and a trend to 'fast fashion' retailing. (p 28)
- Casualisation might erode sales of traditional high-value woven wool wear, although wool knitwear could benefit. (p 28)

¹ Superfine wool is defined as being 18.5 micron and finer.

- Global growth in textile demand (especially wool products) is driven by population and incomes. (p 29)
- With little prospect for growth in wool supply, the opportunity lies in increased value demand for wool products, including benefiting from wool's advantage as a natural, sustainably-grown fibre. (p 30)
- Casualisation and active leisure wear are a natural fit for Australia's growing superfine wool component. (p 31)
- Despite tougher environmental regulations and rising labour costs, China is expected to remain the main processor of Australian wool and the China Australia Free Trade Agreement (FTA) will (marginally) assist this relationship. (p 31)
- Increasing global demand for food is expected to constrain expansion of wool production in NSW and Australia. (p 32)

Flock size, production and producers

- In 2014 the NSW flock comprised 27 million sheep, including 15 million breeding ewes, producing 125 million kg of greasy shorn wool in 2013/14. (p 33)
- Breeding ewes and lambs have increased as a proportion of the flock at the expense of wethers as sheep meat rises in importance. (p 33)
- Between 1991 and 2000, the number of specialist sheep producers declined as they quit sheep or moved into cropping, and then from 2000, mixed enterprise producers aggregated farms without increasing flock size. (p 34)
- Lamb production has replaced mutton turn-off resulting in an increase in product quality (and value). (p 35)
- Low wool prices have provided an incentive for producers to go finer, or to expand their area under crop. (p 35)
- Recently there have been depressed premiums for superfine wool as the supply of superfine wool has exceeded demand. (p 36)
- The transition from a wool-driven sheep industry to a dual-product wool plus lamb industry is reflected in the converging value of each commodity to NSW. (p 37)
- Despite the increased importance of lamb production, Merino ewes remain the core of the flock. (p 38)
- Recent increases in marking rates support the production of lamb and are driving an increase in flock efficiency. (p 38)
- The sheep industry is highly export-dependent with two-thirds of sheep meat production exported and most wool exported. (p 39)
- Over three decades to 2011, the number of farmers in Australia declined 40% while the median age increased by nine years to 53. (p 39)
- The factors driving the decline in the number of young farmers are farm aggregation, declining participation of young people, and increased entry / decreased exit of older workers. (p 40)
- Between the collapse of the Reserve Price Scheme and the disposal of the stockpile, the number of young entrants halved and subsequent sheep industry performance has failed to reverse this pattern. (p 41)
- There is a significant change continuing in the provision of support services (especially extension and advice) for farmers – moving from the public to the private sector. (p 42)

Supply chain and selling system

- Apart from compliance with government regulation, the wool supply chain, including the selling system, is totally driven by commercial imperatives. (p 42)
- Eighty-five to 90% of Australia's wool is sold at auction, with NSW wool predominantly sold at auction centres either in Yennora (Sydney) or in Melbourne. (p 44)
- Cotton is sold very differently to wool as a result of the vastly greater financial risk facing cotton producers. (p 44)
- There were 23 auction brokers selling to 37 buyers in NSW in 2013/14, although 15 buyers accounted for 85% of wool sold. (p 44)
- The number of bales sold through Sydney was equivalent to two-thirds of the sales through Melbourne in 2013/14. (p 45)

Enterprise productivity and profitability

- Many broadacre farms, including sheep enterprises, have on average experienced low or negative profitability over the last decade. (p 46)
- Wool tends to be only a component of a broadacre enterprise and often a small proportion of farm receipts. (p 47)
- Terms of trade for broadacre farms are falling and are likely to continue doing so. (p 47)
- Wool industry productivity gains have, on average, been lower than those of other broadacre enterprises, making the impact on terms of trade even more pronounced. (p 48)
- The industry needs to better manage its declining terms of trade by increasing productivity and / or increasing the value of the product. (p 48)
- Relative profitability between broadacre enterprises depends on commodity prices and seasonal conditions – wool may not be the most profitable enterprise but returns from wool do tend to be less volatile over time. (p 49)
- There is big variation in profitability between wool enterprises, with some wool producers achieving good profitability. (p 52)
- Since the 1990s, broadacre producers in the sheep / cereal zone and even high rainfall zone have shifted away from sheep to more cropping. (p 50)
- Sheep may have a greater role in the relatively higher-risk, lower-rainfall, mixed farming areas. (p 52)
- ABARES predicts that future wool price trends will be outstripped by increases in prices for lamb and mutton, on par with beef, but better than wheat. (p 52)
- Information and investment are required to grow production levels and quality. (p 53)

Animal health and welfare, the environment and societal expectations

- Increasingly, society expects food and fibre production to meet its ethical standards, not just those adopted to meet the supply chain's requirements. (p 53)
- Animal health management remains a significant cost to livestock production and this is expected to continue despite incremental improvements in treatments. (p 53)
- Animal health has the potential to throw up particularly disruptive events such as exotic disease outbreaks or food safety scares. (p 54)
- Predation by wild dogs is a growing threat with serious productivity, social and environmental impacts in affected regions. (p 55)

- The world is gradually changing its attitudes about how animals should be treated by humans. (p 55)
- Animal welfare regulations are becoming more based upon welfare science than 'accepted industry practice'. (p 56)
- Retailers market to the consumer's desire for ethical animal production and may impose production standards on producers with little consultation. (p 57)
- The wool industry continues to invest in improving production practices to meet community expectations. (p 57)
- Chemicals are important inputs for wool production but chemical use is under constant scrutiny. (p 58)
- Climate change has the potential to affect productivity but the impact is unlikely to be uniform across geographical regions. (p 58)
- Adaptation options may mitigate some of the impacts of climate change, but some of these mitigation options are already 'factored in' to address declining terms of trade as they are current best-practice. (p 59)
- Government policy responses to climate change in coming years will also affect the wool industry. (p 60)
- Society will continue to demand 'environmental services' from farmers, but may have to contribute to the cost of these. (p 60)

Key implications

There are a number of key implications from the situation analysis for NSW wool producers, the NSW wool industry and the NSW Government:

Global economic conditions and incomes are the major driver of demand prospects...

The long term prospects for the demand for Australian and NSW wool will hinge most on global economic conditions and income growth, and less on the relative volume of wool production compared with the production of other textile fibres or on the relative price of wool compared with these other fibres.

...which means consumer requirements, clothing styles and retail trends will be crucial for the type of wool used...

The consumer requirements for wool include quality garments at moderate price levels for the upper-middle retail market and luxury garments at higher price points. There is no clear-cut evidence that demand for worsted men's suits and jackets and trousers has waned in recent years in spite of the casualisation trend. Demand for this business wear should therefore continue to be a mainstay of demand for Australian wool. This means there should still be solid demand for fine Merino fleece wool of around 85 mm length with good tensile strength.

There is likely to be increased demand for active leisurewear (next-to-skin wear) and casual garments (knitwear and unstructured jackets and trousers). Wool that is best placed to capitalise on the growth in active leisurewear is fine wool of 19 microns and finer, and preferably 18 microns or even less (superfine wool). The wool used for these products requires good strength and length, so the preference is mainly for fleece wool. Fine wool is also favoured for lightweight knitwear, and yarn used for this market requires raw wool that has moderate tensile strength with an average Hauteur in the top of 58-65mm. This means the raw wool purchased can be a blend of fleece and pieces / bellies and prem shorn.

The development of the ‘fast fashion’ retail sector (exemplified by retailers such as Zara, H&M and Uniqlo) has contributed to a steady decline in wool use in most women’s wear, with the exception of overcoats for colder weather. This has not taken hold in men’s wear to the same degree, although the risk is that it may do so in the future.

...and demand for superfine wool has risen due to these requirements.

Superfine wool premiums have been low, largely due to a sharp increase in production of superfine wool, not because of a collapse in demand. Demand for most categories of superfine wool has actually increased. The premium for superfine wool is likely to return towards the 10-year average once the short-term, drought-induced aspect of the increased superfine wool production wanes, although the long-term trend towards finer wool will mean higher production relative to a decade ago. The increased demand for superfine wool and the potential growth in demand for garments which use superfine wool (such as active leisurewear) justifies a continued (but not increased) emphasis on producing sound superfine wool. This may not be traditional Australian superfine wool (‘spinners’ style) but more general ‘good topmaking’ styles.

In contrast, the very low level of production of wool of 21 to 24 microns has been the reason for the better prices across this range. Demand for this wool does not appear to have increased. As well, this wool faces the most competition from man-made fibres (as it can be substituted for this wool in blends). A significant increase in production of this wool is likely to result in markedly lower prices.

Consumers are more demanding of environmentally sustainable products.

The rising consumer interest in the environmental and animal welfare impacts of products will influence both the direct demand for wool products and government regulation. Consumers will put the provenance of garments under the microscope, wanting to know the source of the raw fibre to ensure that it is produced sustainably with low environmental impact and minimal impact on the welfare of animals. Products which can prove their environmental and welfare credentials will see the strongest demand.

Some retailers are responding to this demand by developing accreditation throughout the supply chain back to the raw wool, and this trend is expected to grow in the next ten years. The wool industry will need to strengthen existing systems (such as the mulesing status declaration on the National Wool Declaration) or develop and adopt new systems.

Governments may also respond through increased regulatory requirements on all involved in the supply chain, from producers to garment makers and retailers.

China will remain the major processor of Australian wool...

China will remain the major processor of wool and manufacturer of wool products over the next ten years, in spite of some challenges in the near term, notably from new environmental controls and tighter credit availability. It is highly unlikely that early stage processing will return to Australia in any significant way, in part because of the size of China’s industry and in part due to new early stage processing plants which have been established in the past 2-3 years elsewhere, such as Egypt and Malaysia.

...and will further develop as a major consumer market for wool.

In the longer term, the transition of China’s economy to a more mature one – based more on consumer demand, branded and higher quality products and the services industry – will potentially be a major benefit for wool with growth in the purchases of wool products by Chinese consumers. However, this growth is more likely to be for more casual styles of clothing, including

business casual wear, rather than formal wear. There will still be some demand for formal business attire, but not for everyday office wear.

Australia and NSW wool production, which has fallen in the past two decades, has a major influence on the world wool market...

Developments in Australia and NSW have a major influence on world supply and price of wool, due to their size and importance in the global production of apparel wool.

Wool production in both Australia and NSW has fallen over the past two decades to 90 year lows due in part to the poor profitability of wool enterprises compared with other agricultural enterprises. Recently this has been most notable for superfine wool where micron price premiums have reduced dramatically. As well, productivity increases for the sheep and wool industry have been poor in the past, although some turn-around may be evident more recently. It is important to note, however, that over the last two decades, improvement in wool production has focussed on improving product quality (principally by reducing fibre diameter) rather than quantity.

Furthermore, sheep producers have increasingly shifted their focus from wool to meat production – not abandoning wool but moving from a sole wool focus to mixed farming enterprises, with wool being just one of their diversified product lines.

...and production is likely to remain at historically low levels...

The real price of wool is likely to remain flat or decrease over the longer term although ABARES predicts that prices in real terms will increase by 3% out to 2018/19. It is unlikely, therefore, that wool production will rebound significantly in the next ten years either in Australia or in NSW. Nor is it likely to decline further, although the increase in production of superfine wool seen in the past ten years may be halted or reversed as a result of the recent low price premiums for superfine wool compared with medium Merino and broader wool.

...unless there are productivity improvements...

As the terms of trade for wool producers and other broadacre enterprises will most likely continue to decline, it will be crucial that producers seek to increase productivity. If wool industry productivity does not improve, there could be further falls in wool production with a shift to either lamb production or out of sheep altogether. It appears that there are opportunities for significant increases in animal productivity within the sheep and wool industry, with improvements possible in all components of production – pasture, animals (meat and wool quality and quantity) and labour efficiency.

To put the impact of productivity growth into perspective, a recent analysis suggests that had productivity growth for the wool industry kept pace with that of cropping over the last 25 years, the current financial performance of a wool enterprise would be the equivalent of having an Eastern Market Indicator of 1804 cents (compared to 1140 cents at the time of the analysis).

Wool producers will need to focus on improving their value of production through genetic improvement and animal management, improving product quality to meet market requirements and reducing costs.

...or significant improvements in profitability.

A substantial lift in the relative profitability of wool production (compared with other competing enterprises) will, of course, encourage increased sheep numbers and wool production. As well,

past evidence suggests that while the profitability of wool production is often on average lower than competing enterprises, it is more reliable and stable, notably compared with cropping.

Producers are fewer, older and getting information from different sources.

Over three decades to 2011, the number of farmers in Australia declined by 40% while the median age has increased by nine years to 53. There are a number of reasons for this, some quite expected - for example the large capital barrier to entry which favours older producers. More concerning, the number of young farmers (<35 years old) fell by 75% over the same period. A further issue in relation to the future capability of the industry relates to how readily the next generation of R&D practitioners, advisers, animal health and biosecurity professionals will appear. In the past there has been a flow of practitioners graduating from tertiary study through to employment in either the public or private sector. As industry profitability has stalled and as the public sector draws back from many regional services, especially extension, new approaches will be needed to provide future producers/farm managers with access to the professional services they will need.

Wool production remains an option for risk mitigation in regions with more variable seasons.

Wool production is likely to continue to play an important role in NSW agriculture, but its role may vary between regions.

In regions with short, variable or unreliable seasons (e.g. western parts of the sheep / wheat zone), sheep, particularly Merinos, will likely remain the risk minimising production system of choice. In these regions, while average returns from cropping are higher, financial stress in poor or failed seasons can be crippling, particularly if equity is low. Sheep enterprises and especially wool production are more resilient to poor seasonal conditions than cropping or beef production, and may provide an important risk management strategy in the future, especially if more variable climates eventuate as expected. Increased herbicide resistance in cropping regions may further foster a bigger role for livestock. There will nevertheless need to be a compelling financial (or management) incentive for producers to build sheep numbers, particularly if it is at the expense of crop area.

Wool production in pastoral areas face challenges.

Wool production increases in pastoral areas may be challenged because of availability of labour and, in particular, increasing predation pressures.

Fine wool production may remain competitive once supply and demand return to balance.

In regions with more reliable seasons (higher rainfall) and perhaps less arable land, high quality fine and superfine wool production may remain competitive against other enterprises over the long term depending on fine wool premiums and the relative price of lamb and sheep-meats. However, some loss of wool production may be expected on current trends.

Information and investment are required to grow the flock, the size of the clip and its quality.

In all cases, there is a need for wider publication of information to help producers make comparisons of broadacre enterprise profitability to inform enterprise choice. Such analysis should also consider the prospect of greater inter-year seasonal volatility brought about by climate change.

As well, investment is needed if the flock is to grow and will also be important for productivity improvements. This might come about through existing producers forgoing cash flow (e.g. to retain ewe lambs), or it might come from external investors moving into the industry. These new external investors may also come from overseas.

Increased compliance burden will be a hindrance for production increases...

With the rise in societal interest in animal welfare and environmental stewardship and sustainability, there are likely to be increased calls for government regulation. With regard to animal welfare, this will extend beyond the issue of mulesing to other practices, including lamb survival rates, castration and tail-docking, shearing, road transport and abattoir practices. With regard to environmental sustainability, this includes water use, carbon (notably methane) emissions, native vegetation management and use of chemicals. New government regulations are likely to impose a significant compliance burden on sheep and wool producers, as well as potentially restricting practices and even production activity in certain locations.

Given the need to improve farmer profitability, all efforts to reduce the burden of compliance should be made. This is not to say that all regulation is undesirable. Given the nature of these issues, a combination of market-driven and regulatory action is probably the best course of action. This will both provide the appropriate market signals to producers and demonstrate to the populace and society that the industry is responding to their concerns. Enforcement of regulation protects the majority of industry, who 'do the right thing', from the destructive actions of a small minority.

In many cases, industry / farmers may be well advised to closely examine the development of their own stewardship / sustainability programs, rather than have these imposed by government or customers.

...and some new ways of thinking will be needed.

In addition, there is likely to be ongoing pressure for sheep graziers and other landholders to provide other environmental services such as biodiversity protection. Again, government will need to provide a compliance monitoring role in respect to relevant legislation. Importantly, though, there will need to be consideration of how the cost of environmental services should be spread between the private landholder and the Australian and NSW taxpayer. Environmental stewardship will also need to form part of an industry QA system.

New government regulation may not be restricted to those introduced by the Australian or NSW Governments, but may include regulations imposed by foreign governments that affect trade in Australian wool, either in raw or in processed form (including finished garments).

Climate variability likely to have a mixed impact.

Increased variability in climate as a result of climate change will have a mixed impact on the wool industry in NSW. It is likely to mean a greater spread of sheep across the state as producers introduce sheep to manage year-to-year variation in crop harvests and specific negative impacts such as increased frost damage. But this increased spread will likely be at a lower stocking rate than currently achieved in regions where rainfall amount and reliability diminish and temperature increases.

High standards of biosecurity will continue to be important...

Animal health will continue to be important in the wool industry. Producers will have to take primary responsibility for the biosecurity of their own flocks. There are important roles to be played by government, though, to protect the majority of industry from the small number of

producers whose actions endanger the health of others' flocks or the health status of the Australian sheep industry. Monitoring diseases and protecting against emerging or exotic diseases is also a critical function. Meat processors can also play an important role in providing feedback to producers on health issues detected at slaughter.

...and the protection of flocks from predation is a particular priority.

Stopping predation in sheep flocks is critical for reasons of productivity but also social and environmental wellbeing. Government has a responsibility to manage feral animals on Crown land and can also facilitate farmers' access to controls such as baits, as well as coordinating regional control programs.

Changes in wool selling systems are possible.

The wool selling arrangements in NSW and Australia are likely to come under pressure if wool production volumes remain low. One particular pressure will be on the continuation of three selling centres across the country and, in particular, the presence of two selling centres on the East Coast, the feasibility of which was investigated by an industry-funded study in 2009. If the wool selling centre in Sydney was closed and wool auctions on the East Coast were conducted only in Melbourne, there would be implications for NSW woolgrowers. In the first instance, the industry cost savings would flow to growers, at least to some extent in the form of lower broker and purchasing costs. The downside would be more difficulty attending auctions in person, as a small number of growers still do now. It may also bring significant change to those wool broking companies whose business is focused on selling through Sydney. This may affect growers who are long-standing clients of these broking businesses. As well, there are some who are concerned that closure of one centre would result in reduced competition, and possibly increased risk if that one selling centre was, for whatever reason, closed temporarily.

Future changes to selling systems such as the successful introduction of sale by description for some wool may eliminate the need for transporting and displaying grab samples, thereby introducing further handling efficiencies. It may also encourage further development of electronic trading of wool, which could bring further efficiencies and industry cost savings. The introduction of a system of electronic identification of wool bales would bring significant benefits to the whole industry. While wool brokers and handlers would be the initial major beneficiaries, benefits would eventually flow back to wool producers through competition between brokers.

It should be noted that AWI has commissioned a review of wool selling systems that is due to report in October 2015. The structure and arrangements for the selling of wool in Australia are a matter entirely for industry and commercial decisions, and not a matter for government involvement or intervention.

Findings

The following key findings have been drawn from the situation analysis and industry consultations.

- i. The NSW wool industry is, and should consider itself to be, a component of the NSW sheep industry. The sheep industry comprises lamb, wool and mutton production.
- ii. There is a lack of a clear and shared vision / direction for the NSW wool / sheep industry. This is likely to inhibit confidence and investment.
- iii. The wool industry is perceived by many to be 'unattractive' (old-fashioned, low tech, hard work, non-dynamic), discouraging people from investing or working in it.
- iv. There is a need to make the industry more satisfying and profitable, especially for young people. The average age of Australian farmers, including wool producers, is increasing so the industry would benefit from the adoption of good succession planning practices, both for individual businesses and for industry organisations. It will be important to make the industry more 'tech savvy' to both attract young entrants and enhance profitability.
- v. Aggregated industry statistics indicate low productivity growth and low profitability.
- vi. However, there are many individual wool enterprises that are productive and profitable. This story is not well known and needs to be told. Greater use of benchmarking information (or practical case studies) would be beneficial.
- vii. Sheep and especially wool production is perceived by many as a good risk management tool in broadacre production. This benefit needs to be quantified and incorporated with advice on the complementary benefits of sheep in a mixed farming enterprise.
- viii. There is an undue reliance or expectation that the price of wool will increase ('the market will save us'). However, there are many external factors (exchange rates, global economic conditions, competitive fibre price, fashion trends) that influence the price of wool in Australia and that are beyond the control of anyone in the industry or government.
- ix. As a result, producers and other participants in the wool supply chain need to take responsibility for the profitability of their own enterprises.
- x. Despite the 'average' low productivity gains in the industry there are technologies (genetics, labour-saving etc.) and information packages (such as Prograze, Lifetime Ewe Management, Bred Well Fed Well, Ram Select, Managing Scanned Ewes and wether trial analyses) available to turn this around – and many producers are using these.
- xi. The use of these technologies and information packages (genetics, business planning, agronomy, marketing etc.) will require the attainment of or access to new skills by many industry participants.

- xii. Over recent decades there has been a reduction in government-funded extension services to agriculture generally, including the wool industry. As a result there is a transition from the public sector to the private sector for the provision of advice. The capacity of the private sector and its use by producers needs to be further encouraged.
- xiii. Delivery of advice to producers is not limited to agribusiness consultants but is also sought from other service providers such as wool brokers, agribusiness bankers, stock agents, and accountants. Professional development of all providers should be encouraged.
- xiv. Margins in broadacre industries, including wool, are and will continue to be tight. This situation in combination with increased variability in climatic conditions and market prices will require producers to maximise their flexibility and maintain resilience.
- xv. There is ongoing disjoint of the wool supply chain between the production and processing / manufacturing sectors. This is more evident in wool than other agricultural products. This disjoint reduces clarity of market information and the understanding of what wool goes into what products.
- xvi. There remain a number of key challenges for which solutions need to be found. These include ongoing improvements in the sophistication and adoption of genetic technologies, better harvesting techniques, reduced reliance on mulesing, management of predation from feral pests, enhanced animal health and welfare and obtaining higher pasture production per millimetre of rainfall. Ongoing innovation² in these areas is critical.
- xvii. The industry remains vulnerable to many external factors including exotic diseases, environmental legislation and climate change. These need to be taken into consideration.

² 'Innovation' refers to all activities along the research, development and adoption continuum, from 'blue sky' research through applied R&D to producer-driven demonstration sites, learning groups, formal training and other activities.

Recommendations for producers, industry and government

What might the NSW wool industry look like in 2025, and how should producers, industry and NSW Government respond to address challenges and embrace opportunities?

Industries can be profoundly altered even over ten years. However, signals from the future can be discerned, some with reasonable confidence. (William Gibson noted, 'The future is already here – it's just not evenly distributed'.)

This review has analysed the wool industry of 2014/2015 and the trends and forces that will buffet the industry over the next decade. This analysis strongly suggests that in 2025 the wool industry will be shaped by the following key forces:

- Price pressures from retail back to the producer will remain intense – that is, producers' terms of trade will continue to tighten
- Production conditions will be more variable as climate change takes hold
- The trend towards casualisation in consumer markets will continue, shifting demand away from some of wool's traditional market segments and towards active-leisure wear
- Product quality, provenance and sustainability will assume increasing importance, as will animal welfare and ethical production practices, which will be required to maintain industry's social licence³ to operate
- Demand for sheep-meat will continue to grow, particularly from export markets

In these conditions, it is likely that the successful wool producer of 2025 will:

- Determine the optimum balance between sheep and other enterprises on their farm, and between wool, sheep meat and livestock trading, based on a considered well-informed and objective long-term view of the respective industries, resource capability and personal preferences
- Understand the target product segment for their annual wool production, such as the active-leisure knitwear sector, and structure their wool production and husbandry practices to produce wool with the specifications required by that main product segment
- Conduct annual production and financial analyses to monitor progress against business plans, adjusting as needed
- 'Know what they need to know' to successfully run their business – and source these skills either by their own professional development, or by retaining expert advisers where needed
- Have in place a sheep genetic improvement program optimised to the enterprise mix of the business and target market segment(s)
- Adopt a continuous improvement mindset where productivity improvements are vigorously and relentlessly pursued
- Participate in, and meet the standards of, an Australian wool industry provenance / sustainability scheme which has credibility in the eyes of customers in their target market for wool
- Actively manage production and price risk through flock structure, stocking rate, feed conservation / fodder purchases and use of price risk management tools

³ Social licence is defined as "The privilege of operating with minimal formalized restrictions (legislation, regulation, or market requirements) based on maintaining public trust by doing what's right. ['Public trust' is a belief that activities are consistent with social expectations and the values of the community and other stakeholders]" (Arnot 2011)

- Have sourced and structured the financial capacity required to put their plans into practice
- Have developed and adopted a clear succession plan in conjunction with their family and / or business partners

To help address these challenges and embrace opportunities the following recommendations are made:

Overarching recommendation for all stakeholders:

1. Develop a strategic plan for the NSW sheep industry to 2025 or beyond

Of overarching importance is the need to develop a preferred future for the NSW sheep industry, one that is owned and shared by industry, providing confidence to both current stakeholders and future investors. To that end, the NSW sheep industry should develop a strategic plan to guide the decisions of all stakeholders (producers, input suppliers, buyers, brokers, processors, industry service bodies, NSW Government, etc.) over the next decade and beyond. The choice of the term 'NSW sheep industry' is deliberate and recognises that wool no longer stands on its own, but is part of a three-product industry – wool, lamb, sheep.

The plan must be owned by industry – that is, its development must be driven by an industry group and involve widespread consultation. The plan should draw on this report and set out a vision, key objectives (for example, gross value of production targets), and strategies to achieve these targets and responsibilities. NSW DPI is the body most suitably placed to initiate the process of developing a plan. A good example, for reference, is WA's 'Sheep Industry Strategic Plan 2025+'. The plan itself, the process followed and possibly the governance model might all serve as templates for the development and custodianship of an equivalent NSW plan.

What the review heard⁴:

Wool industry lacks direction and transparency. Industry doesn't have growth or a growth strategy.

Wool is a competitive industry with a real image problem. Data says it is profitable but the industry is seen as poor and always whingeing about price and issues.

The most important change for wool is that it is no longer a stand-alone industry. It is an important component of the sheep industry that produces lamb, wool and mutton.

Wool producers should:

2. Develop an understanding of the product market segments in which they wish to operate

Traditionally, wool producers – except those at the traditional superfine end – have had little understanding of the form in which their wool is finally consumed (for example knitwear, woven fabrics, outerwear, next to skin). In an era when substitutes exist for almost every

⁴ The statements presented here and in subsequent boxes reflect the interviewer's summary of what an interviewee said during the course of an interview. They have not been attributed to individuals because the interviews were conducted on a confidential basis. The statements have been selected to illustrate the input giving rise to the respective recommendation.

product, not least textile fibres, it is critical that whole supply chains focus on producing the right product for their chosen market. Producers should at least understand the raw product specifications of the market segments they are targeting: micron, staple length and strength, style and so on. Without knowing what the customer wants, it is very difficult to make decisions that improve the business.

What the review heard:

Need to know more about the types of products that different wools go into. Need to make a connection to the buyers and get some feedback.

The industry should identify new apparel products and then say what wool producers need to produce to meet that market.

3. Set long-term goals and actively plan and manage their business accordingly

Producers have a high degree of control over their own production systems and virtually no control over commodity prices. Each producer must focus their efforts on running their business as effectively as they can. As with any business, this means developing a plan that identifies what market the business is engaged in, what the business's long term goals are, how the business will meet those goals and how it will manage the various risks along the way.

What the review heard:

The sheep enterprise (wool and meat as co-products) should be part of a balanced portfolio of enterprises on each farm, with the enterprises reflecting those best suited to the geography and climate of each farm.

4. Attain the necessary skills to plan and operate their business

Woolgrowing is an increasingly complex endeavour and, most commonly, it will be part of a multi-enterprise business. Successful woolgrowers have strong skills in areas away from the paddock – such as business planning, information technology, production and price risk management. There is also a wealth of new animal management programs (e.g. Ram Select, Prograze, Stockplan, Lifetime Ewe Management) which offer producers real opportunities to improve their performance. It may not be possible for one person or family to acquire all of these skills. Producers should understand what skills they need to be successful, which of these skills can be acquired through professional development such as training, and which ones should be bought in from consultants and other sources of advice.

What the review heard:

Efficient management of a three-product sheep business is a high-tech job and not enough 'wool producers' have grasped this point.

There is a need to recognise that skills development is needed – sheep management is a professional job – when done well it is both satisfying and profitable.

5. Relentlessly pursue productivity gains through the adoption of best management practices suitable to their geography, climate and business structure

The success of the industry will be strongly driven by how well individual enterprises, and the industry as a whole, achieve productivity increases. Production and financial analyses consistently show a wide range in performance of woolgrowing enterprises. The difference between the most profitable farms and the rest is the adoption of proven practices and technologies. Producers must actively seek, trial and adopt best practices in all facets of their business, from breeding and selection to pasture management and sheep husbandry to risk management. With the progressive withdrawal of free extension services, responsibility for identification and adoption of best practices rests squarely with the individual producer.

What the review heard:

Sheep producers have a differing mentality between lambs and wool. For lamb many are very active and innovative – they focus on outcomes. Is it because contact with buyer is closer?

The industry has totally failed to increase productivity. Industry thinks price will save them – it won't.

6. Include a succession plan as an important element of the farm business plan

Succession is a vexed issue in agriculture generally. Farm land is expensive and financial returns are often insufficient to attract younger generations back to the property, especially when siblings must be bought out to maintain the requisite scale of the business. Many farm owners simply ignore the issue until it is too late. A thorough succession plan, developed with the guidance of financial and legal advisers, allows farming businesses to be run in a way that serves each individual's best interests.

What the review heard:

The number of younger people in rural areas has fallen, which makes it difficult to attract young people into the wool and service industries. This is a major challenge for the NSW wool industry. More needs to be done to bring young people in and train them.

Need more on succession planning ... it is a big issue across the board – farms, industry leadership, extension, R&D etc.

Wool industry⁵ should:

7. Facilitate grower understanding of specific market requirements by providing easy-to-follow information

The industry can assist producers to pursue Recommendation 2 by packaging and providing information on the specific raw wool requirements for each end use of wool. This might take the form of a market specification matrix identifying the preferred range for key specifications including micron, staple length and strength, vegetable matter, colour and style for each identifiable end use. The matrix would be analogous to the grids available to meat producers, possibly with additional information on the estimated volume of each market segment, major consuming countries, processing technology involved and so on.

What the review heard:

More education and information is required, and industry and government can be involved in this, for wool producers, stud breeders and wool brokers about ... what types of wool are required for these different products (micron, length, strength, etc).

8. Continue to provide packages of information to producers on best practice sheep production

The industry can assist producers to pursue Recommendations 4 and 5 by continuing to package information on best practice sheep production. 'Raw' R&D outputs usually require translation to a systems context, and where this does not occur, adoption and thus productivity improvements may be sub-optimal. Best practice packages should, where appropriate, address wool production as part of a multi-enterprise (wool, meat, cropping) farming system. Where possible, packages should be developed, demonstrated and delivered at a regional level.

What the review heard:

If wool production gets too hard, people will walk away ... mulesing, worms, dogs, harvest, other animal welfare issues like lamb mortality, castration.

Everyone blames producers for being slow but they won't adopt if they don't see the value.

9. Continue to drive innovation for the industry's leading edge through R&D

The industry must continue to drive the R&D needed to enable it to become more competitive over time. All of wool's competitor fibres are continually becoming cheaper to produce and of higher quality and wool cannot afford to fall behind. Cost pressures are immense and it is really only Australia (and NZ) who will invest in this area. This review reinforced the huge opportunities offered by genetic technologies and also the need for R&D

⁵ For the purposes of this paper, 'industry' comprises all of those organisations and individuals that participate in the wool industry, including (but not exclusively) seedstock producers, input suppliers, consultants, brokers, stock agents, test houses, R&D and marketing bodies and peak bodies

to reduce labour in sheep enterprises, improve animal welfare (especially through alternatives to mulesing) and optimise farming systems. These challenges may require brave research investments to find paradigm-changing solutions – but the above examples are not an exhaustive list of the areas in which R&D funding could provide a high return on investment.

What the review heard:

Core business of industry should be research ... when info comes out it must be evidence-based – not opinions.

Genetics is the crucial factor. It is the driver of productivity improvement, disease management ... best practice genetics is needed to compete with declining terms of trade.

Must concentrate on developing R&D especially for productivity – and the big ticket items that may take 10 to 15 years to address – genetics, harvesting, parasites, new wool products.

10. Continue to support the development and recognition of young leaders in the industry

The wool industry is perceived by many as unattractive, for reasons (true or otherwise) that include low profitability and productivity, technological backwardness and a lack of vision. Industry has an interest in maintaining a critical mass of industry participants for both human resource and investment reasons. The industry needs to continue to identify, support the development of and celebrate a new generation of leaders who will act as role models for others.

What the review heard:

The age profile of farmers is a concern. More must be done to encourage and support young farmers in the industry because the older ones find it difficult to break out of the cycle of doing what has always been done in the past.

11. Facilitate the transition to a private farm advisory sector to encourage adoption of best practice by producers

State departments of agriculture across Australia are inexorably moving away from the provision of free extension services to agricultural producers. Other service providers (for example, consultants, agribusiness bankers, accountants, stock agents, brokers) are filling the void, which raises issues of independence and quality of advice and the willingness of producers to pay for services. Industry (and the NSW Government) can play a valuable role facilitating the transition of advisory services to a private service provider sector through initiatives such as free or subsidised provision of ‘wholesale’ information to ‘retail’ advisers, training, accreditation schemes and registration for specific skills. Recent reviews of this area and the experiences of other states should be taken into consideration when determining responses to this recommendation.

What the review heard:

Skills development and support of private sector service providers and consultants is vital.

The rise of private advisers may fill the void created by the reduction in DPI advisers, but doubt growers will pay for sheep advisers like they will for agronomists – growers are too traditional, and sheep are a lower cost system compared to cropping. But there are good advisers around and people are probably making money using them.

12. Critically consider the feasibility of an industry-wide provenance / sustainability scheme for wool

Consumers are increasingly looking for ethical production attributes in their purchases. Some products, notably food but also some garments, now allow purchasers to learn about the farm and the production system from which the product was derived (that is, its provenance). One of the competitive advantages for wool is its clean, green image. Wool's capacity to exploit this edge would be enhanced by an industry-wide system to describe and capture the provenance of individual wool lots.

What the review heard:

Consumers want to know provenance of the products they are buying but how do you get that message to them about wool being natural etc. as opposed to oil-based synthetics?

Accreditation through the supply chain is a worthy objective.

Australian wool has good possibilities and needs to build on its sustainability credentials covering its clean and green elements.

NSW Department of Primary Industries should:

13. Continue to provide biosecurity, animal health and welfare and related services, where these have industry or public good outcomes, to help industry maintain its productivity and its acceptance by society

DPI has a critical role to play in protecting individual producers from the negligent actions of other producers or members of the broader public because the private sector will never adequately discharge these functions. The introduction of an exotic disease like foot-and-mouth, for example, would have a devastating impact on the livestock industries and the economy at large. DPI has prime responsibility for surveillance to detect any such incursion. Similarly, DPI should be vigorous in supporting the prosecution of deliberate or negligent animal welfare transgressions because one well-publicised incident such as a mass mortality could harm the entire industry.

What the review heard:

Quarantine / biosecurity must not be neglected.

Biosecurity is a major issue, and Australia is dropping the ball on it.

Quarantine and biosecurity cannot be eroded – they must be better resourced.

14. Continue to make all reasonable efforts to reduce the impact of predation on NSW sheep flocks

Predation by wild dogs in particular has major impacts on sheep production (and the mental health of owners) in certain areas of the State. Several NSW Government agencies (for example, National Parks and Wildlife Service, Local Land Services) bear responsibilities in managing the wild dog problem. NSW DPI should advocate collaboration among these bodies and private landholders, community and industry groups for their full and vigorous fulfilment of wild dog control responsibilities.

What the review heard:

There should be more focus on the rangelands as it covers a third of the state. If sheep fail there, what's next? Predation should be examined continuously.

15. Facilitate the provision of benchmarking data on productivity and profitability for a range of broadacre enterprises at a regional level

Producers and agri-business investors require reliable, independent information on which to base enterprise investment decisions. DPI can play an important role in facilitating the gathering, analysis and / or extension of data on the performance of sheepmeat, wool, beef and cropping enterprises in particular regions – although this must be done in such a way as to promote rather than cut across the activities of private consultants, some of whom are already active in this area. These analyses should include modelling under differing future climatic scenarios.

What the review heard:

Private sector needs greater encouragement. Not enough consultants. People should have access to good data to help them make decisions, but then it is up to them.

What's missing is the analysis of 'what is a profitable sheep'. Finer, more weight? Who knows??

16. Continue to support industry-specific R&D as recommended for industry and evolving from the proposed strategy development

DPI has been a strong provider of R&D services to the sheep industry for many years and is a national leader in particular areas such as genetics. It should continue to co-invest with industry in priority R&D in partnership with industry, as set out in Recommendations 7 through 12 for industry, along with the priorities identified by the industry strategic planning process of Recommendation 1.



What the review heard:

Satisfaction comes from making a profit but also from enjoying farming. Farmers need 'smarts' to help with sheep management. Currently they have to employ people to help and they don't like that.

There should be more funding for DPI from Government. They have some excellent people and knowledge but they are constrained.

17. Commit to the employment and professional development of the next generation of R&D professionals / practitioners to enable industry R&D capacity to be maintained

The successful wool industry of the future will be more technologically sophisticated. To support Recommendations 9 and 16, DPI should play a lead role in providing opportunities for 'innovation' professionals to contribute to the industry.

What the review heard:

No other country will solve our sheep issues like worms, lice etc. We will have to develop our own R&D resources.

18. Support the sheep industry by facilitating, wherever possible, reductions in red tape

DPI should support the sheep industry by advocating, among other State and also Commonwealth agencies, for the removal of undue regulatory burdens wherever this is possible. The recent review of biodiversity legislation in NSW provides one example of how this may occur.

What the review heard:

The best approach is to make farmers as profitable as possible so they will take control. Currently they are just incurring a whole lot of costs. We need to reduce burdens wherever possible.

The role of State Government is to 'simplify and enable' – make it easier to be a sustainable producer – and prove it.

Appendix 1: Situation analysis

1. Trends and drivers for the global and Australian wool industry

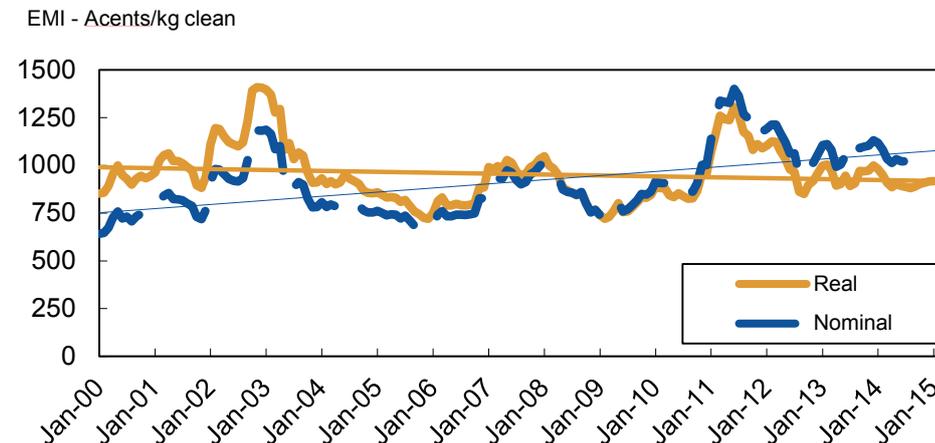
1.1 The place of wool in world fibre production

Total world fibre consumption has risen steadily in the past fifty years and more, largely on the back of a massive rise in production of man-made fibres, mainly oil-based synthetics⁶. However global wool production has declined, notably in the past 20 years.

Australian (and therefore NSW) wool competes against an increasing volume of other fibres used in apparel.

Australian (and NSW) wool, used mostly for apparel, is in direct competition with synthetic staple fibres (polyester staple and acrylic), cotton and cellulose (also known as viscose), all of which have seen increases in production over the same period.

Australian wool prices in nominal terms have been on a rising trend since 2000 but have fallen slightly in real terms over the same period (Figure 1)⁷.



Source: AWEX and Reserve Bank of Australia

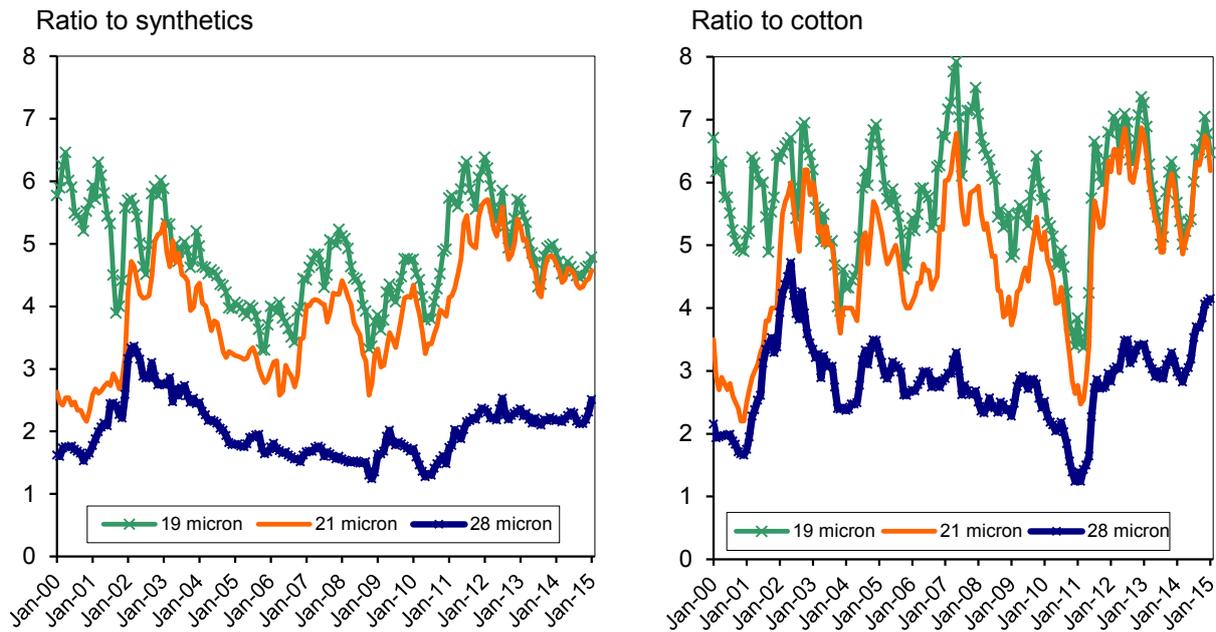
Figure 1 Australian wool prices in real and nominal terms

Over the last decade wool prices have performed relatively better than prices for synthetic fibres and cotton, however wool remains expensive relative to these fibres (figure 2)⁸.

⁶ International Wool Textile Organisation (2014), *Market Information Report 2014*. (Published in December 2014)

⁷ AWEX and Reserve Bank of Australia

⁸ National Council of Wool Selling Brokers (2014), *Weekly Newsletter*, 2014/36, 26th September 2014



Source: AWEX, Cotlook, PCI Fibres, Poimena Analysis

Figure 2 Ratio of wool price to price of synthetics and cotton

Wool production globally and in Australia has been falling due to low prices and perceived higher profitability of other enterprises, notably cropping and lamb production.

World wool production has fallen significantly in the past 20 years or more, as a result of a fall in and then low wool prices during the 1990s, as well as competition from other agricultural enterprises. For example, cropping and, more recently, lamb production has been the major influence on sheep numbers (and hence wool production) in Australia, together with seasonal conditions⁹.

Australia is the world's largest wool producing country, with a share of 23%¹⁰. In terms of wool for apparel, Australia accounts for 46%, with China accounting for 12%. For Merino wool, Australia's share is even higher with an estimated 80% of the world's wool production of 20 microns and finer.

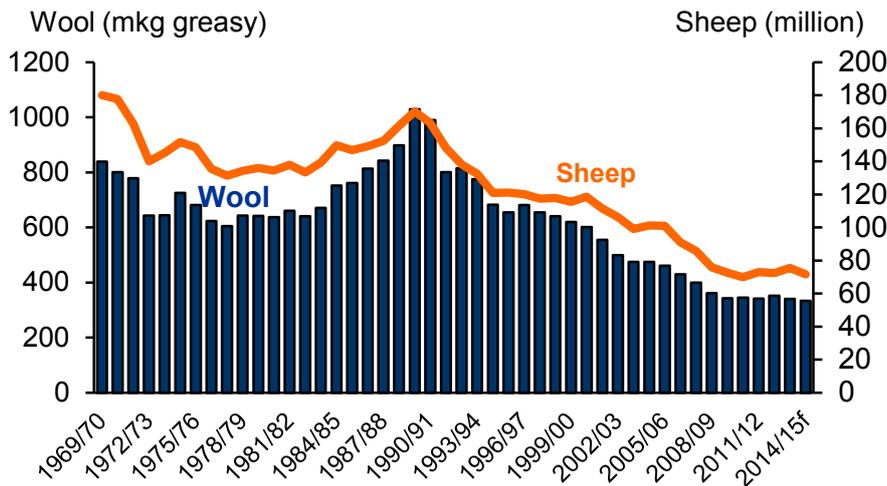
This high share for Australia of apparel wool and, in particular, of Merino wool has some important implications. First and foremost, world Merino wool prices are in essence determined in A\$ terms, which is unlike any other agricultural commodity. This means that increases in Australian wool production will have a dampening effect on prices, while falls in Australian wool production will support prices. By implication, efforts to boost wool production and productivity in Australia will dampen prices. On the other side of the supply-demand equation, lifting demand for Merino wool at the consumer stage will mainly benefit Australian wool growers because of Australia's dominant position.

⁹ Woods, A (2014), *Season and price relativities the key drivers of Aussie flock size*, Mecardo website (www.mecardo.com.au), 16th January 2014.

¹⁰ IWTO (2014), *Market Information Report 2014*. (published in December 2014)

1.2 Australian wool production

Australian wool production has fallen substantially in the past two decades¹¹ (see figure 3) driven by a combination of production declining in the mixed cropping-livestock regions of Australia (due to better returns from cropping)^{12,13}, a shift to a greater emphasis on lamb production in other regions, drought or dry seasonal conditions in several years since 2000, and a retreat from sheep and wool production in other regions due to wild dog predation.



Source: AWPFC

Figure 3 Australian wool production and sheep numbers

NSW has the largest sheep population and is the largest wool-producing Australian state. If it were a country, it would be the world's fourth-largest supplier.

NSW is currently Australia's largest wool-producing state. NSW produces 9% of world wool production¹⁴. If it were a country on its own, NSW would be the world's fourth largest wool producing country, after China, the rest of Australia and New Zealand. Production in NSW has also been declining steadily, as shown in figure 4¹⁵.

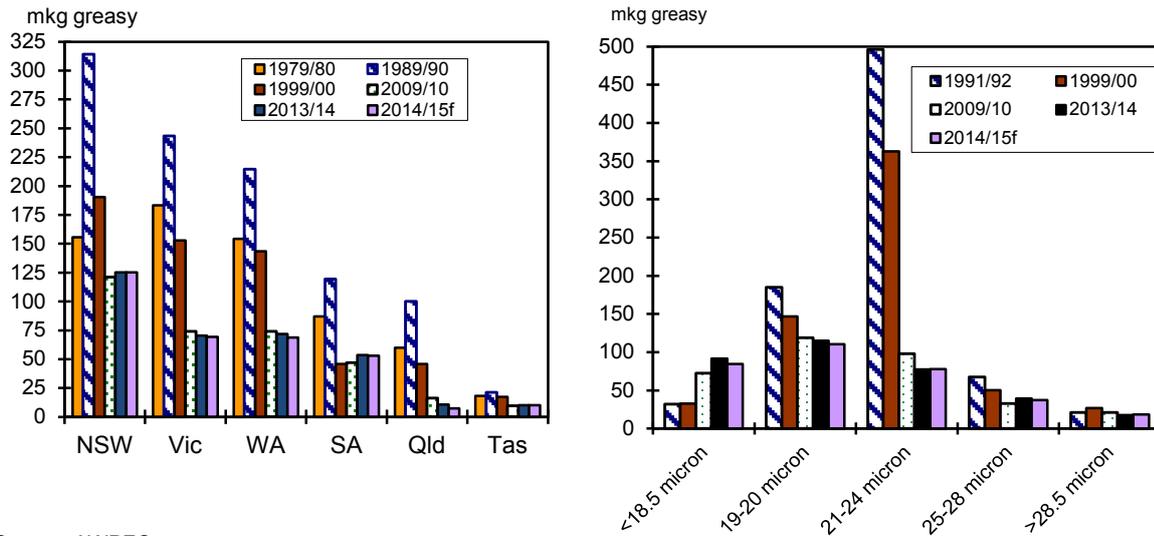
¹¹ National Council of Wool Selling Brokers, *Weekly Newsletter*, 2014/33, 29th August 2014

¹² Woods, A (2014), *Season and price relativities the key drivers of Aussie flock size*, Mecardo website (www.mecardo.com.au), 16th January 2014.

¹³ Woods, A (2014) *The battle of the spare paddock*, Mecardo website (www.mecardo.com.au), 27th November 2014.

¹⁴ Michell, *Wool Whispers*, October 2013. Updated with data from the Australian Wool Production Forecasting Committee and others.

¹⁵ This is shorn wool production based on data from the Australian Wool Production Forecasting Committee, and excludes production of other wool such as slipe wool

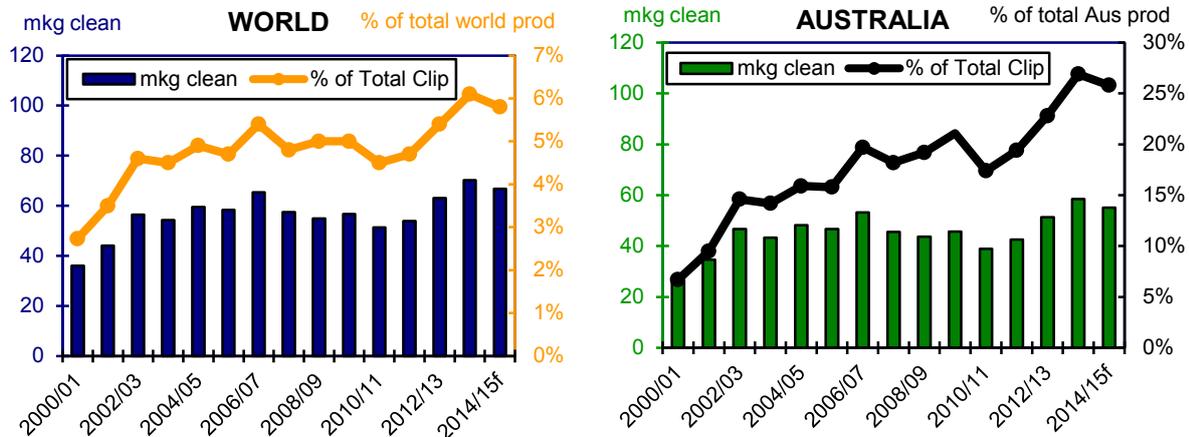


Source: AWPFC

Figure 4 Australian wool production by state and micron

The Australian (and NSW) wool clip has been trending genetically finer since the early 1990s which, combined with the influence of drought and dry conditions in 2012 and 2013, has led to an over-supply of and a reduction in the premium for superfine wool.

One well-known feature of production trends in Australia has been the rise in production of superfine wool (18.5 micron and finer) in the past decade, even while total production in Australia has declined (figure 5). Australian production of superfine wool reached a peak in 2013/14 at 90 mkg greasy (59 mkg clean). This compares with production of 40 mkg greasy (27 mkg clean) in 2000/01. Superfine wool also reached a record share of the total clip at 26.8%¹⁶. Australia dominates world production of superfine wool. The increase in production has been due to a combination of breeding decisions taken by stud breeders and producers in the past two decades.



Source: IWTO, AWPFC, AWTA, Poimena Analysis

Figure 5 World and Australian production of superfine wool

¹⁶ Michell, *Wool Whispers*, October 2012. Updated with data from the Australian Wool Production Forecasting Committee and others.

As is well known, seasonal conditions also influence fibre diameter, with drought and dry conditions causing an increase in fine and superfine wool volumes. Figure 6 shows this influence, using rainfall as a measure of seasonal conditions, and the change in average fibre diameter¹⁷, with the long-term decline in average micron due to breeding decisions having been removed. This chart is for the whole of Australia, although it is relevant to NSW. The drop in rainfall beginning in late 2011 through to 2013 led to a decline in the average micron over these years.

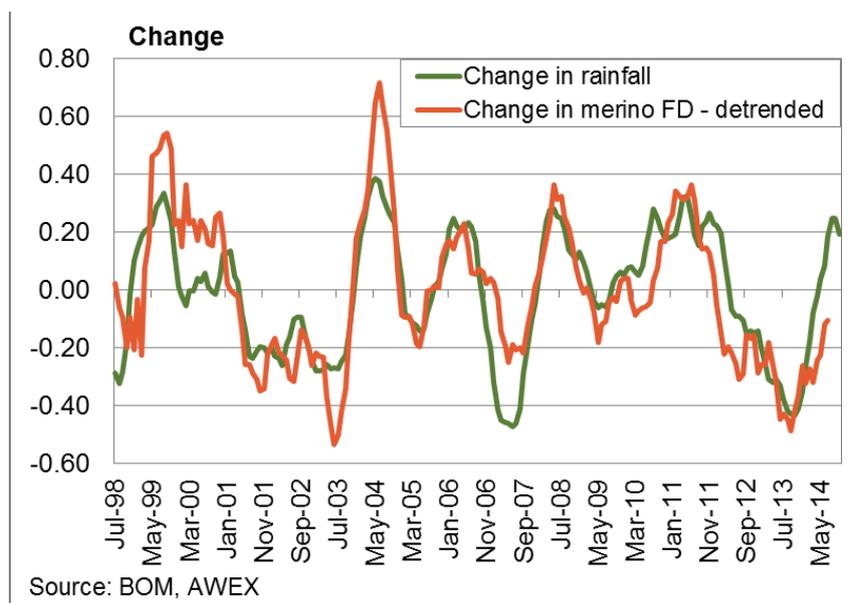


Figure 6 Seasonal effects on Merino micron

Rainfall improved in the first half of 2014, which suggests that the average micron would increase in 2014/15. This has been realised in the first half of the current 2014/15 season. Wool test data from the Australian Wool Testing Authority for the 2014/15 season between July and January shows that the production of superfine wool (18.5 micron and finer) for Australia fell by 5.4% after increases of 13.4% and 22.0% over the same seven months in 2012/13 and 2013/14.

The breeding decisions by growers was in response to both the “get fine” message promoted by industry organisations in the 1980s and 1990s and large price premiums for superfine wool that were prevalent through the 1990s and the early 2000s¹⁸.

The other, lesser covered, feature of production trends of the past 25 years has been that producers drastically cut back production of wool in the 21 to 24 micron categories. As a result, the supply of wool in the 21 to 24 micron category is now a fraction of what it was in the 1990s.

The higher production of superfine wool combined with the large decline in 21 to 24 micron wool has, inevitably, led to much lower premiums for superfine wool (table 1). The lower price premiums for superfine wool do not indicate, however, that demand for superfine wool has declined or that demand for 21 to 24 micron wool has increased. The trend in the value of Australian wool exports by micron category is evidence that demand for superfine wool has actually increased.

¹⁷ Woods, A (2014), Presentation to the Mecardo Wool Market Webinar, September 2014.

¹⁸ Woods, A (2014), *What drove the ‘get fine’ message?* Mecardo website (www.mecardo.com.au), 18th November 2014.

While the current premiums for fine and superfine wool are low compared with the 10 year average, prices for this wool are still higher than for 21 to 23 micron wool and could therefore be more profitable if good fleece weights can be achieved. As noted above, the increased production of superfine wool in the previous two seasons is partly due to dry seasonal conditions, and this increase could be retraced when more typical seasonal conditions return (as has happened to some extent in 2014/15 to date). In that case, the premiums for superfine wool are likely to move back towards the long term average.

Table 1 Micron price differentials (% relative to 21 micron wool)

Month and year	18 micron	19 micron	23 micron	26 micron	28 micron
July 1999	+125%	+88%	-22%	-29%	-29%
July 2001	+194%	+85%	-3%	-19%	-19%
July 2005	+30%	+18%	-3%	-25%	-38%
July 2009	+39%	+22%	-3%	-19%	-38%
July 2014	+4%	+1%	+0.2%	-28%	-41%
January 2015	+11%	+5%	-2%	-27%	-33%
10 year average	+30%	+16%	-5%	-32%	-46%

Source: AWEX

1.3 Australian wool exports

Over the last two decades, China has become the dominant buyer of Australian greasy wool.

Seventy three per cent of Australia's wool exports went to China in 2013/14, compared with 12% in 1991/92. The second largest country destination was India, with a share of 8%. Exports to Western Europe accounted for 10% of Australia's exports, down from 39% in 1991/92¹⁹.

An additional change in Australia's wool exports has been the large decline in the share of semi-processed wool that is exported. The rise to dominance of China and its preference for greasy wool rather than semi-processed wool resulted in a decline in demand for semi-processed wool from Australia, and caused the closure and relocation of much of Australia's scouring and carbonising capacity, and all of its wool combing plants.

¹⁹ Australian Bureau of Statistics, Australian Wool Industries Secretariat, *Exports of Australian Wool* monthly reports, and NCWSBA 2013/14 Season Wall Chart.

1.4 World wool textile industry – location, trade, products, shifts and drivers

China now dominates global exports of wool textiles with the US, UK, Japan and Italy being the largest importers.

Over the past two decades China has risen to be the world's leading producer of man-made fibres, processor of textile fibres and manufacturer and exporter of textiles, clothing and interior textiles. This rise was the result of the market liberalisation of China's economy and access to a huge pool of cheap labour²⁰.

China now dominates the world wool textile industry, particularly for wool clothing. In addition to its position as the world's major exporter of finished wool products, China is also the leading exporter of wool top, yarn and fabric, accounting for 27%, 18% and 32% of world exports respectively²¹.

The US was the major wool clothing import country in 2013 with 18% of world imports of wool clothing²². However, it was only the fourth-largest importer of wool knitwear, behind the UK, Japan and Italy.

Based on global trade data, knitwear and men's suits, jackets and trousers provide a solid foundation for wool use while wool's volume and share in women's wovenwear has been eroded by price competition and a trend to 'fast fashion' retailing.

Knitwear and men's wovenwear products dominate the global trade, although women's wool overcoats features as one of the major products. Men's suits remain a solid foundation of global wool use in apparel, as do men's jackets and trousers. Global trade in men's wool suits fell in 2007, but the decline appears to have moderated in more recent years. Trade in the other major woven wool products has remained relatively stable²³.

Global trade in women's wovenwear wool products, other than coats, has declined in importance over the past 20 years due to intense competition from products made of other fibres, powerful price competition at retail and a trend to higher turnover of women's wardrobes. The latter point has been fed by 'fast fashion' retail chains which feature high changeover of fashion lines and very competitive price points.

Casualisation might erode sales of traditional high-value woven wool wear, although wool knitwear could benefit.

One trend that has been identified and discussed within the wool industry is casualisation of clothing. This trend was identified by the wool industry over a decade ago and casualisation remains a key determinant of AWI's strategy, informing their product development and marketing efforts²⁴. In theory, casualisation means that demand for more formal wear (such as men's suits) could diminish, replaced by greater emphasis on separates, such as jeans, trousers and jackets (with jackets likely to be less "structured" than in the past). It is thought that casualisation is also likely to bring increased demand for knitwear, both traditional flat-bed knitwear and circular knits used in the active leisurewear market.

²⁰ Wang, A (2014), *The effect of increasing labour cost on the wool processing industry*. Presentation to the IWTO 2014 Congress, Cape Town.

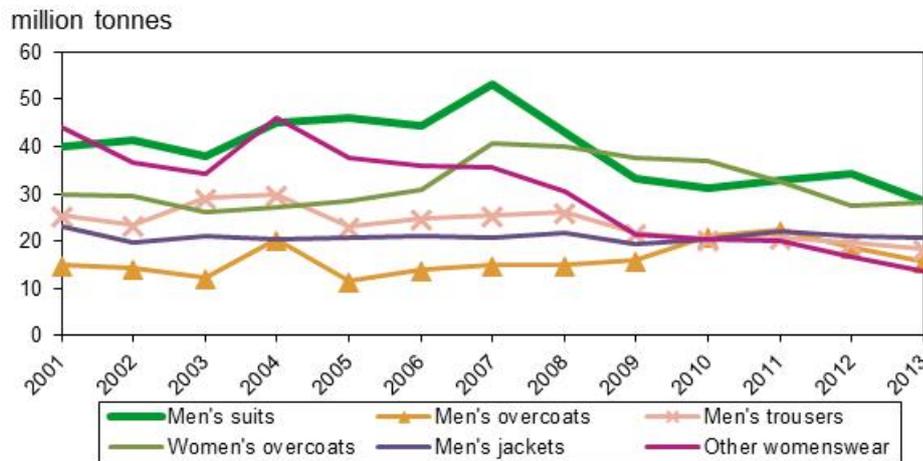
²¹ International Wool Textile Organisation (2014), *Market Information Report 2014*. (Published in December 2014)

²² International Wool Textile Organisation (2014), *Market Information Report 2014*. (Published in December 2014).

²³ Wang, A (2014), *The effect of increasing labour cost on the wool processing industry*. Presentation to the IWTO 2014 Congress, Cape Town.

²⁴ Swan, P (2013), *Opportunities to grow demand for wool*. Presentation to the Nanjing Wool Market Conference. September 2013.

However, the statistical evidence of the impact of casualisation on wool products and, in particular, the decline of the suit is mixed. Rabobank, in a recent report on the fine wool industry²⁵, presents data showing that global trade in wovenwear of all fibres has slipped in value terms in the past two years, while knitwear (all fibres) has been rising since 2009. However, global data for wool products suggest that the decline in the volume of trade in men’s wool suits has, to some extent, moderated since the GFC. This view is supported by recent US trade data²⁶. Imports of knitwear (which includes sweaters and knitted shirts) and men’s separates (jackets and trousers) have been relatively stable after recovering from a dip in 2009. In contrast, the most significant decline in recent times has been in woven wool womenswear. This highlights the competitive pressure facing wool in womenswear, which has been present for the past two decades (see figure 7 – note that knitwear is not shown).



Source: www.trademap.org

Figure 7 World trade in wool wovenwear

In terms of the location of consumer demand, the major wool consuming markets at retail in 2011 were (in descending order) China / Hong Kong, the US / Americas, Japan, Italy, India, Russia / Belarus / Ukraine, Germany, the UK, South Korea and France.

1.5 Likely trends

Global growth in textile demand (especially wool products) is driven by population and incomes.

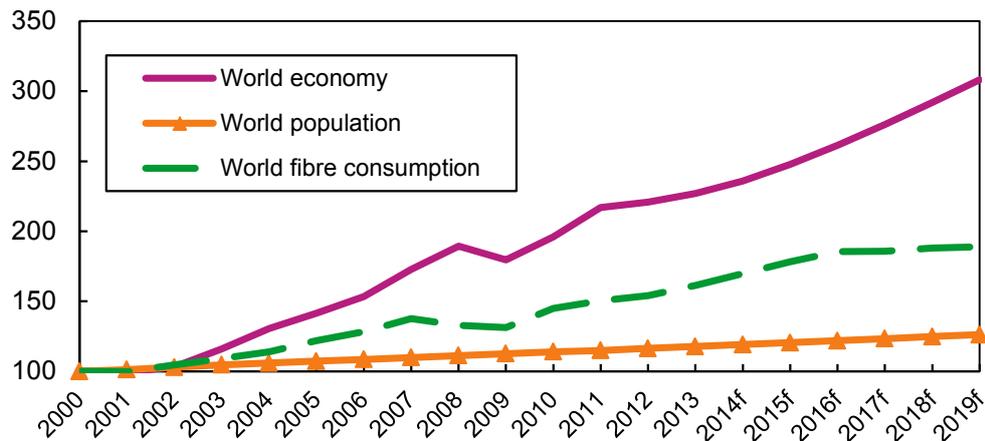
Global demand for textile fibres to 2025 and beyond will, in the first instance, be driven by population and incomes. World fibre consumption has tracked the rise in world Gross Domestic Product (as a proxy for incomes) and population²⁷. Given the projections for GDP and population (and particularly GDP) out to 2019, further strong growth in consumption of textile fibres can be expected (figure 8). While the forecasts from the International Monetary Fund are only available to 2019, it can be assumed that further growth in GDP, at least, will be seen out to 2025.

²⁵ Rabobank International (2014), *Walking a Fine Line: Strategic Blunder or Just Bad timing? The Fine Wool Dilemma*. Rabobank Industry Note #461. November 2014.

²⁶ Office of Textiles and Apparel, US Department of Commerce (2014). <http://otexa.ita.doc.gov/>. Data downloaded on 26th November 2014

²⁷ Wilcox, C (2012), *The Global Wool Market: Short Term Pain, Long Term Gain*, presentation to the 2012 Nanjing Wool Market Conference, September 2012. Updated data.

Index: 2000 =100



Source: CIRFS and International Monetary Fund

Figure 8 Growth in world economy, population and fibre consumption

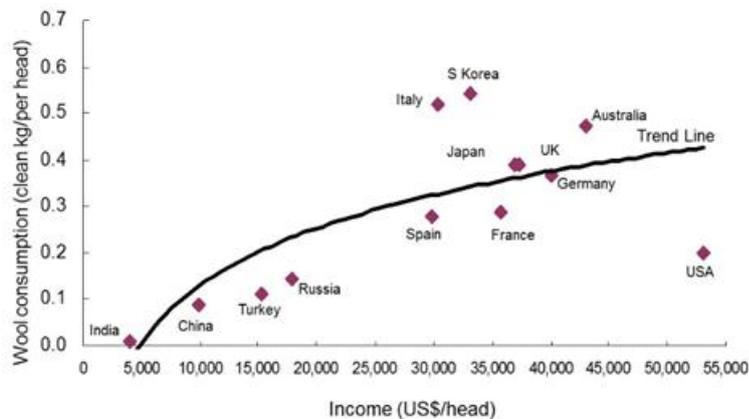
With little prospect for growth in wool supply, the opportunity lies in increased value demand for wool products, including benefiting from wool's advantage as a natural, sustainably-grown fibre.

While world textile fibre consumption will grow, this increased volume of demand will be met mainly by man-made fibres²⁸. For wool, future volume consumption will be constrained by slow or no growth in wool production. This is an opportunity if the gap can be translated into increased value demand (as wool production is not expected to increase and certainly cannot match the growth rate in production of other fibres).

There is a strong relationship between per capita income and apparel wool consumption per head²⁹ (figure 9). For the countries that Australian Wool Innovation have identified as the strongest potential growth countries for clothing (China, India, Brazil and Russia), per capita wool consumption is low. It is hoped that as incomes increase in these countries, per capita wool consumption will follow the expansion path indicated by the per capita consumption in Europe, Japan and Australia, and not the path indicated by the US.

²⁸ Morris, D (2012) European Synthetic Fibre Association (CIRFS), reported by Chris Wilcox in a presentation to the WA Sheep Leaders Forum, October 2012.

²⁹ Wilcox, C (2012) *Wool Market Drivers to 2025*. Presentation to the WA Sheep Industry Leaders Forum, October 2012. Updated.



Source: International Monetary Fund, IWTO and Poimena Analysis

Figure 9 Per capita apparel wool consumption vs income

Wool has a marked advantage over man-made fibres for being a naturally, sustainably grown fibre³⁰. The International Wool Textile Organisation sees this as a significant opportunity and, together with Australian Wool Innovation, has developed a strategy and is conducting research and development to support marketing of this feature.

Increased urbanisation in countries such as China and India will provide opportunities for wool, both in the traditional suiting market and in active leisurewear³¹.

Casualisation and active leisure wear are a natural fit for Australia's growing superfine wool component.

The casualisation trend and the trend to active leisure wear will no doubt continue. This provides opportunities for wool in knitwear, next to skin wear and fabrics suited to casual wear. Fine and superfine wool is well suited to next-to-skin wear, which is typically used in active wear, and this is a growing market segment³².

Despite tougher environmental regulations and rising labour costs, China is expected to remain the main processor of Australian wool and the China Australia FTA will (marginally) assist this relationship.

Environmental regulations were introduced in China in 2013 and even tougher regulations will come into force in January 2015. These regulations are likely to induce the closure of older, less efficient wool scourers and combers. Nevertheless, it seems very likely that China will remain the major wool processor (from scouring to end garment) and the major export destination for Australia's raw wool over the next ten years, unless there is a significant political or economic event to disrupt this scenario. This sovereign risk is the major issue with China's dominance of Australia's exports of raw wool.

³⁰ Wilcox, C (2009). *Implications of decreasing Merino wool production for the supply and demand of apparel wool*. Report prepared for the CRC for Sheep Industry Innovation. September 2009.

³¹ The Woolmark Company (2005). *The China Consumer Market: The Challenging Frontier for Australian Wool*. Report to Australian Wool Innovation. April 2005.

³² Swan, P (2013), Australian Wool Innovation. *Challenges and Opportunities: Strategic Market Outlook*. Presentation to the IWTO 2013 Congress, Biella.

The importance of China will be sustained by the recent signing of the China-Australia Free Trade Agreement (ChAFTA). Under the Agreement, Australia will be granted a Country Specific Quota of 30 mkg clean which will be free of import duties (above the 30 mkg the import duty is 1%). This compares with China's wool imports of around 180 mkg clean in 2013 from Australia. This quota will increase by 5% per year for eight years to 46 mkg³³. This access is considerably better than for wool exported to India, for example, which has higher import and other duties. While ChAFTA will help sustain the importance of China, its immediate impact and long term benefit will be very modest.

On the production side, it is difficult to envisage a solid increase in sheep numbers or, in particular, wool production over the next decade. One of the key factors that will constrain a sizeable increase in sheep numbers and wool production is the rising demand for food³⁴.

Increasing global demand for food is expected to constrain expansion of wool production in NSW and Australia.

The FAO predicts that global food production will rise by around 50% over the next 40 years, and a significant part of that growth will be in developing countries. However, this growth is much smaller than the growth seen in the previous 40 years and may not match the increased demand. This will mean that there is likely to be long-term upward pressure on food prices, which will encourage increased grain production but would be a disincentive for fibre production, such as wool.

This competition for land-use will probably hold back wool production. Meat and Livestock Australia, in its latest projections released in early February 2015, projects that sheep numbers in Australia will increase very slowly to 73.85 million head by 2019 (from 71.63 million head in 2014). This very slow rise in sheep numbers, if correct, will also mean only very slow growth in Australian wool production, particularly as there will continue to be competition from sheep and lamb meat to wool production.

One likely trend is that production of superfine wool will pull back from the recent highs. This will be achieved in part assuming that seasonal conditions return to normal (as opposed to the dry conditions seen in 2012 and 2013). As well, the recent relatively low prices for superfine wool may result in fewer superfine sheep and subsequently lower superfine wool production.

2. Sheep and wool – an industry in transition

2.1 Demographics

The NSW sheep industry is a significant contributor to the NSW economy with a gross value of agricultural commodities produced (GVACP) of \$816 million from wool and \$640 million from sheep and lambs³⁵. These account for 32% and 24% of the national totals for these commodities, respectively.

³³ National Council of Wool Selling Brokers of Australia, *Weekly Newsletter*, 2014/44, 21st November 2014

³⁴ Australian Wool Industries Secretariat *Exports of Australian Wool* monthly reports (August 2014).

³⁵ ABS 75010. abs.gov.au Catalogue number 75010DO001_201314 Value of Principal Agricultural Commodities Produced, Australia, Preliminary, 2013-14. Released 21-January-2015.

In 2014, the NSW flock comprised 27 million sheep, including 15 million breeding ewes, producing 125 million kg of greasy shorn wool in 2013/14.

Between 1991 and 2014, the NSW sheep population declined from 59.8 million to 26.7 million, an overall decline of 55% (figure 10). Over the same period, the total number of breeding ewes declined from 25.7 (1991) to 15.0 million (2013), a decline of 42% (figure 10).

Wool production in NSW declined from 377 million kilograms (mkg) in 1990-91 to 125 mkg in 2013-14³⁶. This 67% decline in wool production is greater than the decline in the number of sheep partly due to a shift in the breed mix (more non wool sheep) and partly due to the change in the composition of the flock (more ewes and lambs, fewer wethers) (figure 11).

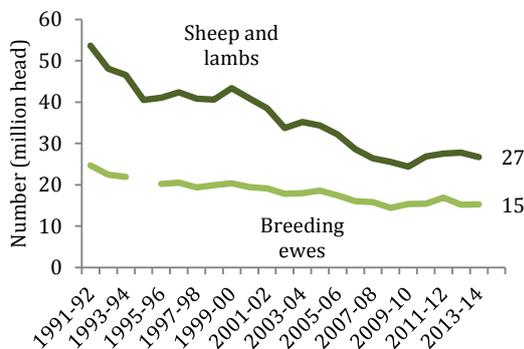


Figure 10 Number of sheep and lambs (millions), and number of breeding ewes (millions) in NSW (Based on ABS data)

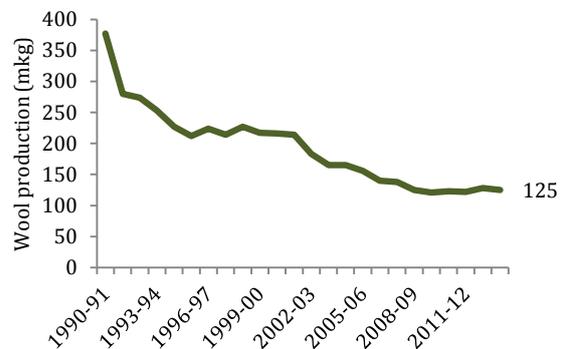


Figure 11 Annual wool production (million kg) as reported by the AWI wool production forecasting committee (AWPFC).

NSW wool production accounts for 38% of the national total, according to the AWPFC. The NSW Government³⁷ estimates that 83% of NSW-produced wool is delivered to warehouses within NSW, while 17% is transported interstate, mainly to Victoria from southern parts of NSW.

The extent of the decline in sheep number varies between regions from 40% in the Southern Tablelands (1991 to 2011) to a decline of 67% in the northern part of the Western Division. The most severe drop in sheep number, triggered by the discontinuation of the Wool Reserve Price Scheme and the consequent drop in the wool price, occurred in the first five years (1991-1996) and was most noticeable across the Slopes and Plains³⁸.

Breeding ewes and lambs have increased as a proportion of the flock at the expense of wethers as sheep meat rises in importance.

The ewe component as a percentage of the NSW flock has risen from 48% in 1990-91 to 63% in 2009-10, before slipping slightly following the ending of the millennium drought (2006-2009) (figure 12)³⁹. Wethers for wool production have declined from 29% of the flock in 1990-91 to just

³⁶ Australian Wool Production Forecasting Committee.

³⁷ NSW Government (2012) Transport for NSW. *NSW Freight and Ports Strategy*. November.

³⁸ DAFWA analysis of ABS agricultural census small area data.

³⁹ ABARES Farm survey data for the beef, slaughter lambs and sheep industries. <http://apps.daff.gov.au/MLA/> accessed November 2014.

9% in 2009-10. The lamb component has also increased due to the higher proportion of breeding ewes, and to a lesser extent higher marking rates from better management and an increase in non-Merino matings. The increase in the proportion of breeding ewes in the flock reflects a swing away from a strong reliance on wool to a dual product (wool and sheep meat) industry.

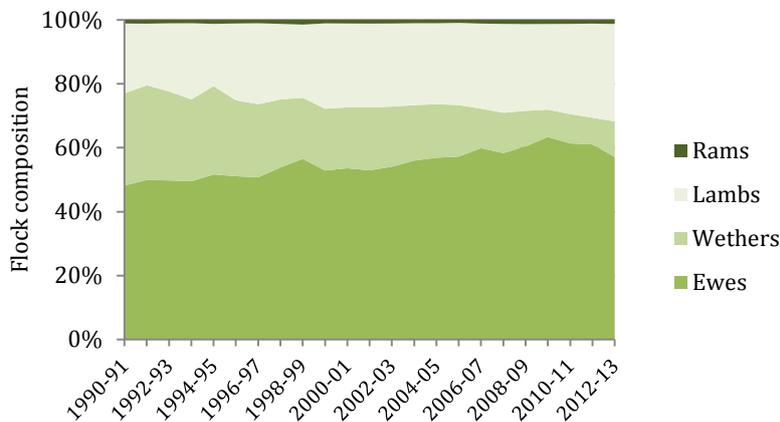


Figure 12 Change in composition of the NSW flock (Based on ABARES data⁴⁰)

Between 1991 and 2000, the number of specialist sheep producers declined as they quit sheep or moved into cropping, and then from 2000, mixed enterprise producers aggregated farms without increasing flock size.

Between 1991 and 2000 there was a small increase in the number of mixed enterprise sheep farms while the number of specialist sheep farms decreased by close to 50% (figure 13)⁴⁰. Then from around 2000, the number of mixed enterprise sheep farms declined while the number of specialised sheep farms remained flat.

⁴⁰ ABARES Farm survey data for the beef, slaughter lambs and sheep industries. <http://apps.daff.gov.au/MLA/> accessed November 2014.

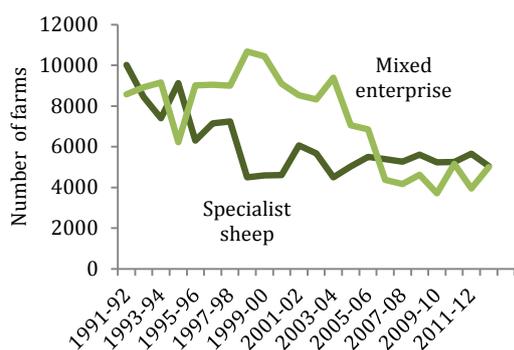


Figure 13 Number of specialist and mixed enterprise sheep farms in NSW (Based on ABARES data⁴⁰)

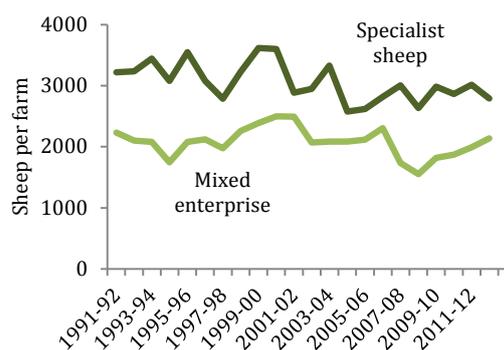


Figure 14 Number of sheep per farm for specialist and mixed enterprise sheep farms in NSW (Based on ABARES data⁴⁰)

Compared to the changes in the number of specialist and mixed enterprise sheep farms, the flock sizes on each have only changed slightly (figure 14). Over the period 1991 to 2013, specialist sheep farm flocks have declined in size from an average of 3,400 to an average of 2,760, while mixed enterprise sheep flocks have declined from an average of 2,180 to an average of 1,980 sheep and lambs. Specialist sheep producers have reduced their average flock size faster than have mixed enterprise sheep producers (though excluding those producers who have de-stocked completely).

2.2 Structural change

Lamb production has replaced mutton turn-off resulting in an increase in product quality (and value).

During the last two decades the NSW sheep meat industry has changed from producing mutton as a by-product of the wool industry toward a focus on quality lamb production. Lamb slaughter has risen to overtake sheep slaughter in 2003-04⁴¹. Since 2003-04, sheep slaughter has continued to decline and lamb slaughter has risen to just under five million head in 2013-14.

During this same period, carcass weights for both lambs and mutton have increased by about five kilograms and three kilograms respectively. Whereas mutton carcasses averaged three kilograms heavier than lamb carcasses between 1991-92 and 1995-96, since 2011-12, the difference is just one kilogram in favour of the older sheep.

Low wool prices have provided an incentive for producers to go finer, or to expand their area under crop.

As wool prices declined, and even as sheep meat demand (and prices) rose, producers responded by reducing their flock size in favour of other enterprises (largely cropping across the slopes and plains), and / or by driving the fibre diameter of their clip finer. The fining of the clip occurred to varying extents in all regions of NSW. While the decline in diameter across the state over the 20+ years averaged a little over 1 μm , individual regions within NSW declined by between 0.5 μm (Central Tablelands) and 2.1 μm (Northern Tablelands).

⁴¹ DAFWA analysis based on ABS data (ABS 72180. abs.gov.au Catalogue number 7218.0.55.001 Livestock and Meat, Australia. Table 5. Livestock Slaughtered - Sheep. Table 6. Livestock Slaughtered - Lambs. Released 7-November-2014.)

Between 1988 and 2013, the main peak of the fibre diameter distribution moved from 22 μm (1988-93) to between 19 and 20 μm (2008-13) (figure 15). Across 1988-1993, fine wool of 19.5 μm or less accounted for 11% of the wool offer, but by 2008-13, this had increased to 40%⁴².

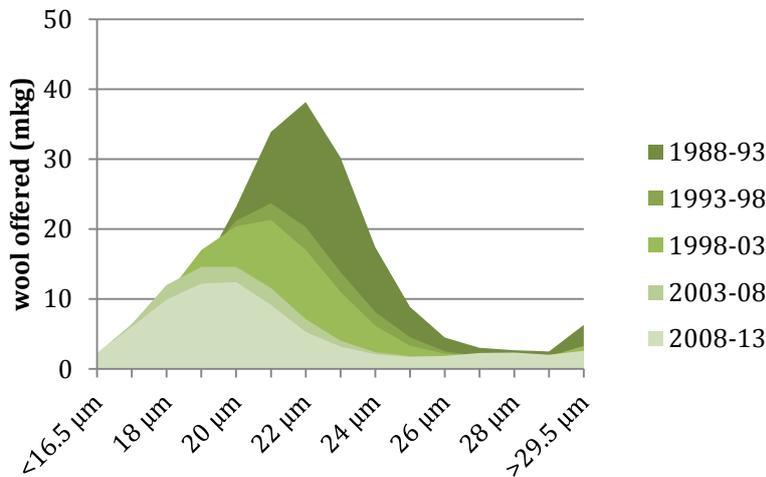


Figure 15 Change in fibre diameter distribution of NSW wool presented for auction, averaged over five year periods. (Based on AWEX auction data. DAFWA analysis)

Broad wool over 25 μm , while only a small part of the clip, increased its share from 10% to 15% as the middle micron wool (22-25 μm) plummeted from 50% to just 16% across the same period.

Recently there have been depressed premiums for fine wool as the supply of superfine wool has exceeded demand.

By 2008-13, in excess of 50% of the wool from the Northern and Southern Tablelands, Northern Slopes and wool statistical area N23 (WSA-N23)⁴³ had a fibre diameter of 19.5 μm or finer (figure 16)⁴². This is in marked contrast to 1988-93 when less than 20% of the wool from any region, except the Northern Tablelands (39%), was less than 19.5 μm .

⁴² DAFWA analysis of AWEX auction catalogue data by wool statistical area.

⁴³ Wool statistical area N23 includes the shires (as defined in 1991) of Boorowa, Crookwell, Goulburn, Gunning, Harden, Mulwaree, Tallaganda, Yarrowlumla, Yass, Young. This area is reported separately because it is spread across Tablelands and Slopes.

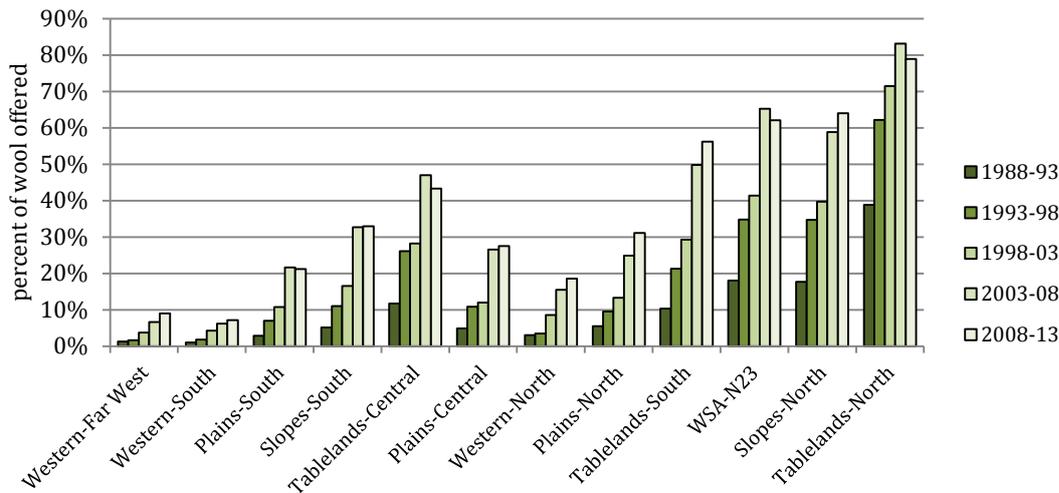


Figure 16 Change in the proportion of wool offered for auction that measured 19.5 µm or finer (Based on AWEX auction data. DAFWA analysis)

The transition from a wool-driven sheep industry to a dual-product wool plus lamb industry is reflected in the converging value of each commodity to NSW.

The final proof of the transition to a dual product industry can be seen in figure 17. This shows the convergence of the gross value of agricultural commodities produced (GVACP) for wool and sheep meat in nominal dollars⁴⁴. Prior to 1995, the GVACP from wool was in excess of five times that from sheep meat. Since 2008-09, the GVACP ratio has averaged just 1.3 in favour of wool.

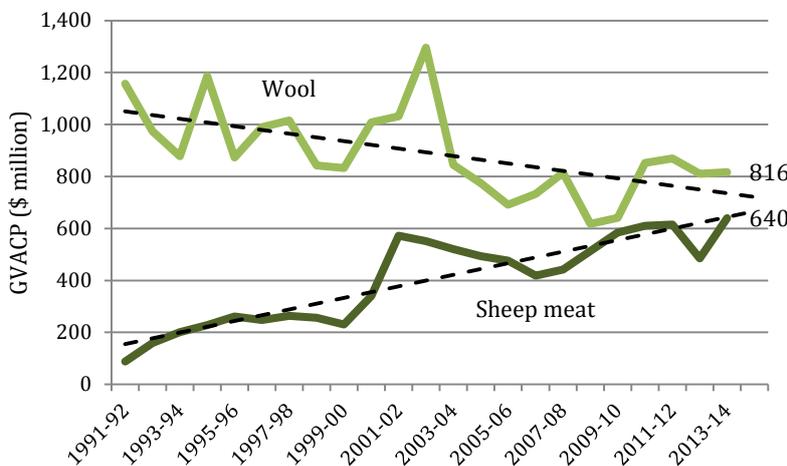


Figure 17 Converging contributions from wool and sheep meat to the gross value of agricultural commodities produced (GVACP) in NSW. Amounts are in nominal dollars (Based on ABS data. DAFWA analysis)

⁴⁴ Based on annual releases of ABS 75030. abs.gov.au Catalogue number 75030DO001_201213 Value of Agricultural Commodities Produced, Australia, 2012-13. Preliminary data for 2013-14.

2.3 Current snapshot of production

There were an estimated 26.8 million sheep and lambs in NSW being run by 15,800 businesses (farms with sheep) in 2011. The largest 27% of farms (those with more than 2000 sheep and lambs) carried 71% of the total NSW sheep and lamb population⁴⁵.

Of the 15.4 million breeding ewes in mid-2011, 72% were Merino, and these were being run on 10,500 farms⁴⁵. Based on the type of lambs produced, farms were divided into those that produced Merino lambs only, produced Merino and other breed (including first cross) lambs, those that only produced other breed lambs, and those that did not mate any ewes. The proportion of ewes mated, of all sheep and lambs, and of all farms in each category is shown in table 2.

Despite the increased importance of lamb production, Merino ewes remain the core of the flock.

Table 2 The percentage of (a) ewes mated, (b) sheep and lambs on farms, and (c) farms in NSW that, in 2010-11, produced either Merino lambs only, both Merino and other breed lambs, only other breed lambs, or did not mate ewes⁴⁵

Farm type based on lamb types produced	Percent of all ewes mated	Percent of all sheep and lambs	Percent of all farms
Merino lambs only	22 Merino	24	17
Both Merino and other breed lambs	24 Merino, 16 Other	37	21
Other breed lambs only	39 Other	35	49
No ewes mated	–	4	13

From table 2:

- Almost half (46%) of all ewes mated were mated to produce pure-bred Merino lambs;
- 17% of farms, carrying 24% of the sheep and lambs and 22% of the breeding ewes in NSW, produced only pure-bred Merino lambs; and
- 13% of farms, running 4% of the sheep and lambs in NSW, did not mate ewes in 2010-11. These are more likely to be wether only flocks rather than farms running dry ewes as 2010-11 was a good season with good growth of paddock feed.

Recent increases in marking rates support the production of lamb and are driving an increase in flock efficiency.

Average marking rates in NSW have risen to 90% in 2010-11 and 2011-12 from an average of 81% in the previous decade⁴⁵. Marking rates for pure-bred Merino lambs were 8% to 12% lower. However, there is a wide spread of marking rates reported for individual farms. Of the farms that marked lambs in 2010-11, there was an average of 7% of all breeding ewes on farms reporting marking rates of less than 50%, while 11% of breeding ewes were on farms reporting marking rates in excess of 110%.

⁴⁵ Curtis, Kimbal (2014) Stocktake of the Australian sheep flock. Meat & Livestock Australia Limited. Project B.LSM.0055, ISBN 9781740362153.

Since the 2011 census, the NSW flock is reported to have increased to 27.81 million 2013⁴⁶ but is expected to decline in 2013-14 as drought and strong sheep meat demand drive increased turn-off. Wool production is expected to decline in-line with falling numbers shorn and drought reduced wool cut per head.

The sheep industry is highly export-dependent with two-thirds of sheep meat production exported and most wool exported.

A detailed break-down of wool and sheep meat exports is given in appendix 4⁴⁷. It shows that around two thirds of the sheep meat produced is exported with the main markets in 2013-14 being China, USA and Japan (on a value basis). For wool, China dominates with 74% on a value basis, followed by Italy, Czech Republic and India.

2.4 Producers and their age

Data limitations make any detailed analysis of the age distribution of farmers, let alone NSW wool (and sheep) producers, problematic. Barr (2014)⁴⁸ states the sheep industry data is weakened by undocumented coding issues during the 1990s.

Over three decades to 2011, the number of farmers in Australia declined 40% while the median age increased by nine years to 53.

Recognising these limitations, the most recent ABS population and agricultural census collections were each conducted in 2011. The 2011 census found a total of 157,000 farmers, a drop of 40% over the three decades, 1981 to 2011 (ABS 4102.0, 2012)⁴⁹. Figure 18 compares the 1981 and 2011 age distributions of Australian farmers. This figure clearly shows the big decline in farmer numbers and the reduction in the proportion of farmers under 55 years of age.

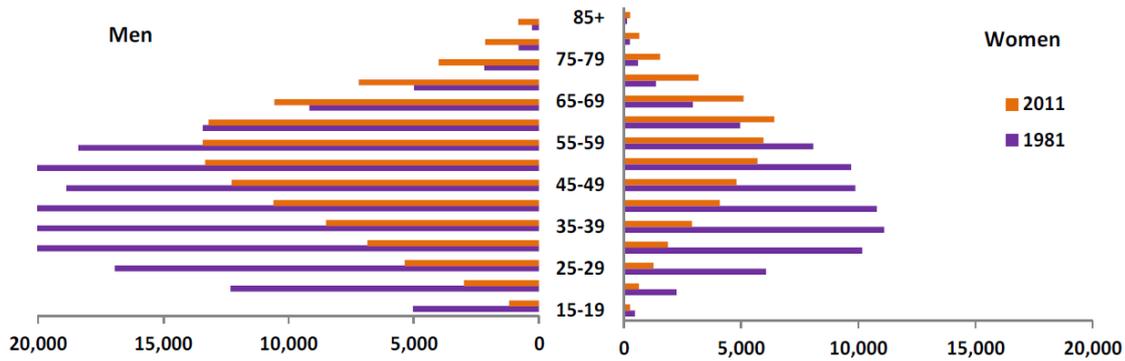
The median age of farmers in 2011 was 53 years compared to a median age of 40 for people in other occupations. For farmers, this is an increase of nine years in three decades compared with a six year increase in other occupations. Barr (2014) suggests that due to the rise in the median age of other occupations, much of the rise in the median age of farmers may be due to factors in common with the rest of the country's workforce.

⁴⁶ ABS 71210. abs.gov.au Catalogue number 71210DO001_20122013 Agricultural Commodities, Australia, 2012-2013. Released 30-May-2014.

⁴⁷ DAFWA analysis based on ABS data. Slaughter data from Catalogue number 7218.0.55.001, wool receivals from Catalogue number 7215.0, and export data from ABS customised report (trade data – exports).

⁴⁸ Barr, Neil (2014) New entrants to Australian agricultural industries –Where are the young farmers? Rural Industries Research and Development Corporation. Publication No. 14/003. RIRDC Project No. PRJ-008875.

⁴⁹ ABS 4102.0 (2012) Australian farming and farmers. ISSN 1321-1781.



Source: ABS Census of Population and Housing

Figure 18 Age profile of Australian farmers – 1981 and 2011. (ABS 4102.0, 2012)

Interestingly, the Australian Farm Institute⁵⁰ suggests that the age profile of farmers compared with other occupations can be somewhat misleading in that:

- The ABS data includes many 'farmers' which run very small enterprises and are 'not strictly farm "businesses" – most relying almost entirely on non-farm income' (e.g. tree-changers).
- Farming has a significant 'capital' barrier to entry which favours entry of older farmers.

Decline in young farmers

The factors driving the decline in the number of young farmers are farm aggregation, declining participation of young people, and increased entry / decreased exit of older workers.

The number of young farmers (<35 year old) fell from 71,200 to 17,700 between 1981 and 2011, a decline of 75%. Barr points out that farm aggregation has resulted in a 51% decline in the number of farms thus accounting for about 68% of the decline in the number of young farmers. The remaining 32% fall is attributed to a range of factors including declining attractiveness (real or perceived) of farming as an occupation. The relative contribution of each factor is shown in figure 19.

⁵⁰ Australian Farm Institute (2014) http://www.farminstitute.org.au/_blog/Ag_Forum/post/farmers-are-getting-older-but-its-not-a-problem/

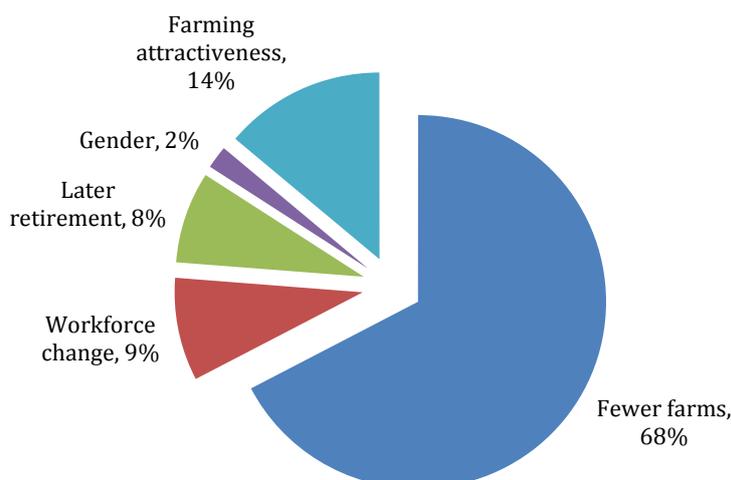


Figure 19 Relative contribution of demographic factors to the decline in the population of younger farmers between 1981 and 2011. (after Barr, 2014)

Sheep industry demographics

Barr (2014) chose the wool and sheep meat industries as a case study.

Between the collapse of the Reserve Price Scheme and the disposal of the stockpile, the number of young entrants halved and subsequent sheep industry performance has failed to reverse this pattern.

Barr concludes that the shock caused by the collapse of the RPS led to changes in the entry and exit behaviour resulting in a reduction in the proportion of under 35s in the sheep industry, and that subsequent performance of the sheep industry has failed to shift the industry to its previous demographic structure.

Implications of an ageing sheep industry workforce

Concerns over the ageing of the workforce seem to be raised out of concern about whether this will be the last generation of wool producers. Barr (2014)⁵¹ points out that:

- The exit of a farmer does not generally lead to the loss of production of that farm. Generally the farm will be purchased by a new entrant or incorporated into another farm by a farmer seeking to increase scale i.e. farm aggregation.
- For food production, the smallest 50% of farms produce just 10% of the value of agricultural production. These smaller farms tend to be operated by older farmers.

Implications of farm aggregation

As farms get larger in order to remain viable, there is an inevitable decline in population, and in the capital cost for new entrants. This has implications for the local community and the services it can offer which in turn impact on the attractiveness of the area as a place to live and to do

⁵¹ Barr, Neil (2014) New entrants to Australian agricultural industries –Where are the young farmers? Rural Industries Research and Development Corporation. Publication No. 14/003. RIRDC Project No. PRJ-008875

business. Regions without a history of aggregation continue to support many small operators and as they retire they are replaced by mid-career entrants (Barr, 2014) thus perpetuating the older age structure.

Future skills and capabilities

There is a significant change continuing in the provision of support services (especially extension and advice) for farmers – moving from the public to the private sector.

A further issue in relation to the future capability of the industry relates to how readily the next generation of R&D practitioners, advisers, animal health and biosecurity professionals will appear? In the past there has been a flow of practitioners graduating from tertiary study through to employment in either the public or private sector. As industry profitability has stalled and as the public sector draws back from many regional services, especially extension services⁵² how easily will future producers / farm managers have access to the formal tertiary, business and practical skills training that will surely be needed.

3. Wool supply chain

3.1 Overview

Apart from compliance with government regulation, the wool supply chain, including the selling system, is totally driven by commercial imperatives.

The wool supply chain and wool selling system in NSW is entirely driven by commercial imperatives of the free market. As with all industries, there are some government regulations, such as road transport limits and work health and safety requirements, but there is no direct government involvement at either the Federal or state level that affects the commercial operation of the wool supply chain and selling system in NSW.

The wool selling system is illustrated in Figure 20. The vast majority of wool flows via Route 1 (around 90%⁵³).

⁵² RMCiC (2014) Sheep and Beef Extension – a vision and framework for future investment. Draft Discussion Paper – Version 2. August

⁵³ Wool Selling Systems Review. Review Panel Issues Paper. December 2014

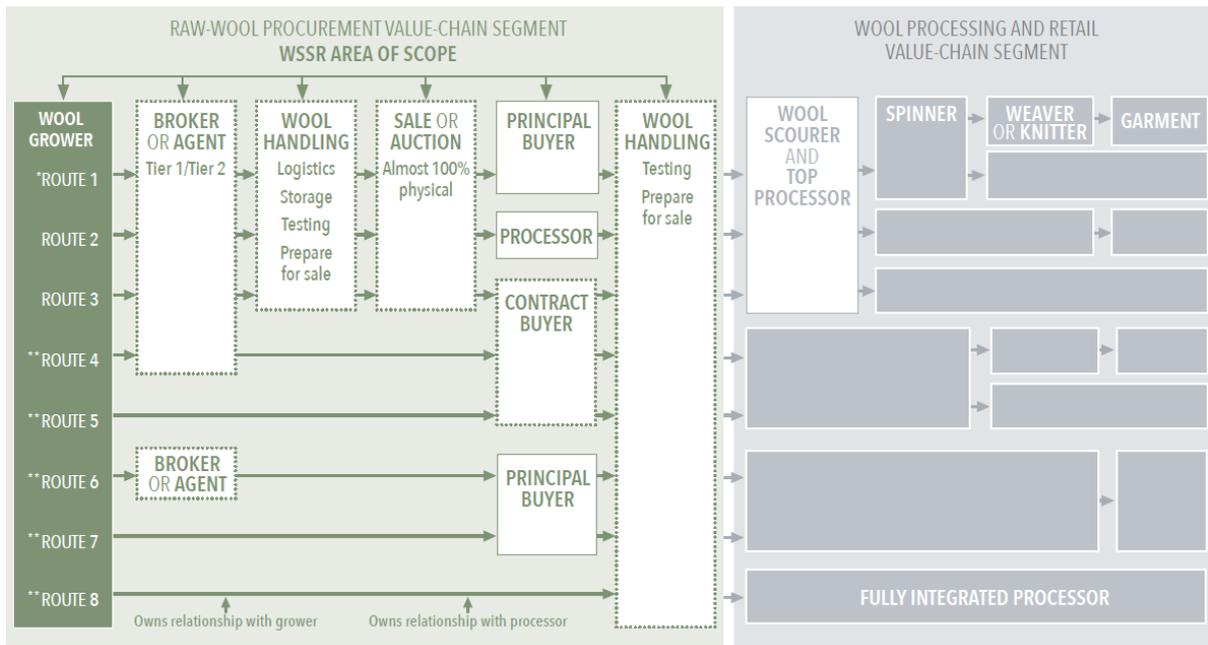


Figure 20 Wool supply chain from Australian growers to overseas processors⁵⁴

The wool supply chain and actual volume flows in NSW is illustrated in figure 21, which is sourced from a NSW Government reference group report and shows data for 2010/11⁵⁵. It is unlikely that the picture has changed substantially since then.

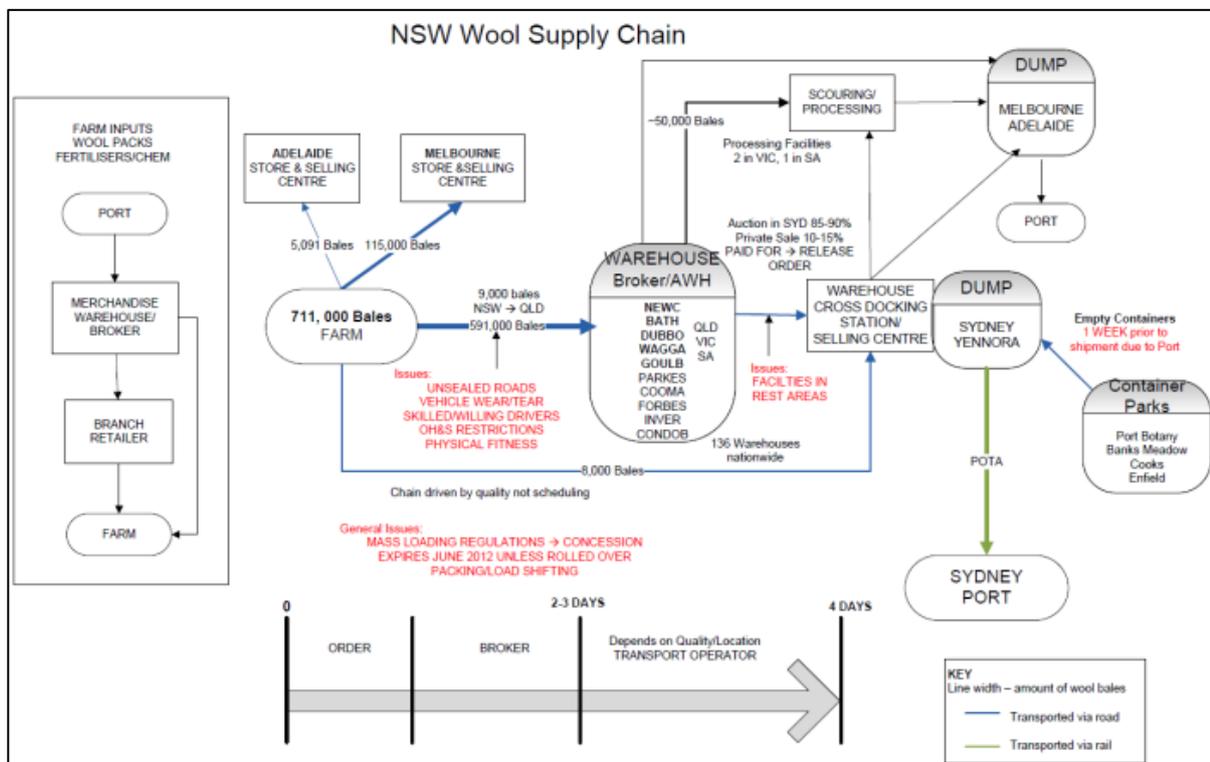


Figure 21 NSW wool supply chain

⁵⁴ Wool Selling Systems Review. Review Panel Issues Paper. December 2014

⁵⁵ NSW Government, Transport for NSW. *NSW Freight and Ports Strategy*. November 2012.

3.2 Wool selling arrangements in New South Wales

The majority of NSW wool is sold at auction, either at the wool selling centre in Yennora (Sydney) or at the Melbourne wool selling centre.

Eighty-five to 90% of Australia's wool is sold at auction, with NSW wool predominantly sold at auction centres either in Yennora (Sydney) or in Melbourne.

It is estimated that 85% to 90% of Australia's wool is sold at auction⁵⁶, either by wool brokers directly from farms or after having been first sold privately. The remainder is sold privately either to a merchant who then sells direct to an exporter or processor, or directly to an exporter or processor. Some wool is sold electronically on the WoolTrade / Auctions Plus platform. This wool may be offered directly on the WoolTrade platform or be offered after having been passed in at auction.

Cotton is sold very differently to wool as a result of the vastly greater financial risk facing cotton producers.

There is a vast difference in the manner in which wool is sold compared with other agricultural products. Cotton, for example, is sold mainly on fixed forward contracts (60%) and in pools (25%)⁵⁷. These tools, however, only developed fairly recently (around 1990), with cotton being marketed prior to that in a 'seasonal pool'. Grain marketing exhibits a similar focus on forward sales. In contrast, as noted previously, wool is sold mainly on the spot market at auction. Futures, forward contracts and other risk management tools have been and are used in the wool industry, but only to a small extent.

The vast difference in financial risk is the major driver for forward sale contracts being the backbone of cotton marketing, while the spot (auction) market is the predominant selling method for wool. The Risk Management Solutions Group estimated that a 10% movement in price equates to around 15% of the land value for cotton growers while it is only 1% to 2% of land value for woolgrowers⁵⁸. In other words, woolgrowers carry vastly lower financial risk than cotton (or grain) growers, which inhibits their demand for forward sale contracts and other risk management tools, such as wool futures.

There were 23 auction brokers selling to 37 buyers in NSW in 2013/14, although 15 buyers accounted for 85% of wool sold.

There are 23 auction brokers currently operating in NSW, according to AWEX⁵⁹. These range in size and scope from large national brokers, through mid-sized brokers who operate only in the Northern Region (NSW and Queensland), mid-sized brokers who operate in NSW and Victoria, to mid-sized brokers who operate almost entirely in NSW, and finally to smaller brokers. Some of these brokers only sell wool in Sydney, while others sell NSW wool in Melbourne as well as Sydney.

There were 37 buyers who purchased wool in the Northern Region in 2013/14, although the top 15 buying companies accounted for 85% of the wool sold during the season⁶⁰. There have been

⁵⁶ Wool Selling Systems Review. *Review Panel Issues Paper*. December 2014

⁵⁷ Risk Management Solutions Group (2005), *Wool Marketing and Risk Management Scoping Study (EC470)*, Australian Wool Innovation.

⁵⁸ Risk Management Solutions Group (2005), *Wool Marketing and Risk Management Scoping Study (EC470)*, Australian Wool Innovation.

⁵⁹ AWEX. *List of Warehouse Locations used by Auction Brokers (season 2014)*.

⁶⁰ AWEX. *National Buyers List by Region*. 2013/14

significant changes to the ranks of buyers in Australia in recent years, with the departure of all of the major corporate buying companies in recent years for commercial reasons. The departure of corporate buying companies has caused some concern among the industry about availability of working capital and liquidity for purchasing, and, in particular, for taking stock positions. This might result in greater price volatility in future.

The number of bales sold through Sydney was equivalent to two-thirds of the sales through Melbourne in 2013/14.

In terms of wool offered and sold in Sydney, data from AWEX shows that there were a total of 513,812 bales offered in Sydney in 2013/14 in 111,296 lots⁶¹. This was a little more than half the number of bales offered in Melbourne in the same year. The offering volumes in Sydney in 2013/14 were about 44% lower than in 2003/04 (for the combined Sydney / Newcastle). This compares with a 17% drop for wool offered in Melbourne over the same period. It also compares with the 27% decline in wool production in NSW & Queensland over that period. At the same time, wool production in Victoria, South Australia and Tasmania fell by 23%. In other words, auction offering volumes fell much more in NSW over the ten year period than did wool production, while auction volumes in Melbourne fell by less than the decline in available production. This points to a shift in auction volumes from NSW to Victoria.

4. Farm profitability and productivity

4.1 All broadacre farms

Over the last 20 years, profitability across all broadacre farms Australia wide has been, on average, more negative than positive, especially during the prolonged drought periods in the 2000's (figure 22)⁶².

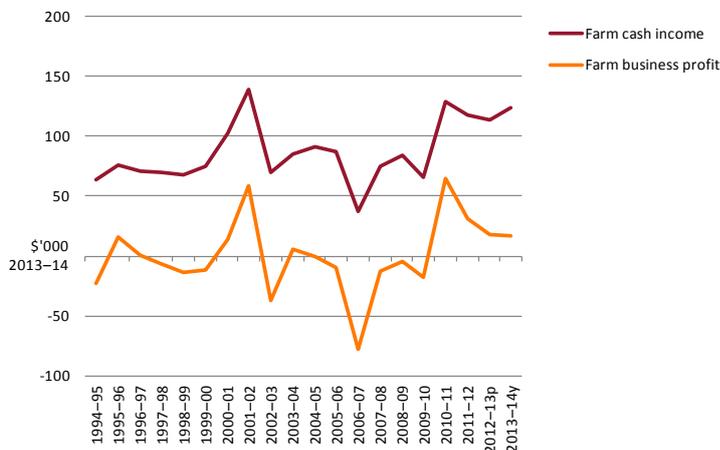


Figure 22 Financial performance, all broadacre industries (ABARES, 2014)

Rates of return on investment (ROI) for broadacre businesses have been similarly low (figure 23), with grain producers generally out-performing other sectors⁶³.

⁶¹ AWEX. Auction Statistics 2003/04 and 2013/14.

⁶² ABARES (2014). Australian farm survey results 2011-12 to 2013-14. March

⁶³ Martin, P. (2014). Personal communication

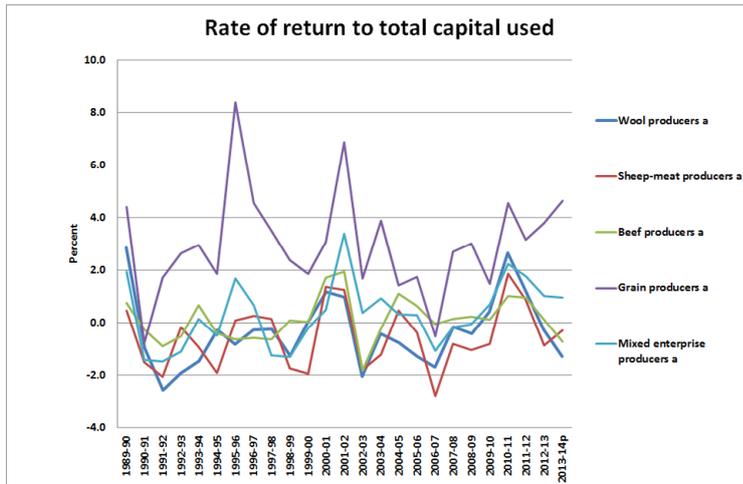


Figure 23 Financial performance, individual broadacre industries (P. Martin, 2014)

Many broadacre farms, including sheep enterprises, have on average experienced low or negative profitability, over the last decade.

In 2013/14 in NSW, 35% of all farms had negative farm cash income ('total cash receipts' – 'total cash costs'), 68% had negative farm business profit and the rate of return on all capital (excluding appreciation) was 0.5%.

The situation is similar for sheep enterprises with 23% having negative farm cash income, 62% negative farm business profit and the rate of return on all capital (excluding appreciation) of 0.2%.

Profitability across the NSW sheep industry has also been low for more than a decade, although returns have improved in the period 2010 to 2012 on the back of better seasonal conditions and improved commodity prices (wool and sheep-meat) (figure 24).

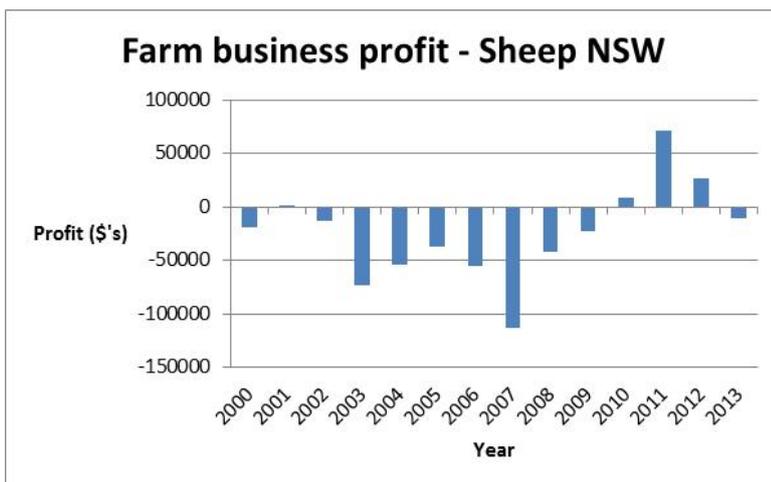


Figure 24 Farm business profit – all sheep enterprises NSW⁶⁴

⁶⁴ ABARES (2014). Selected physical and financial estimates for sheep industry farms, by state. <http://www.agriculture.gov.au/abares/surveys>

Wool tends to be only a component of a broadacre enterprise and often a small proportion of farm receipts.

Specialist sheep and wool producers account for only about 30% of Australia’s wool production with most wool and sheep meat production occurring on mixed enterprise farms, particularly on mixed livestock-crop industry farms⁶⁵.

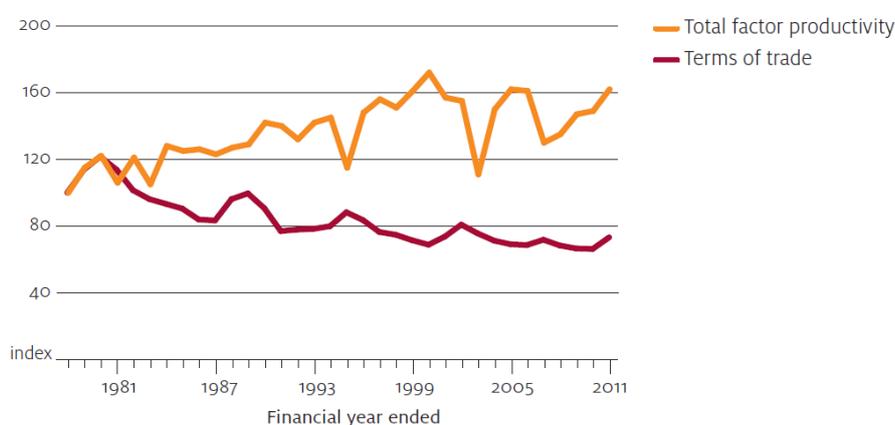
There has been no detailed analysis of the wool industry by ABARES since 2004. That analysis⁶⁶ showed that on average, even “specialist” wool producers only derive 53% of their farm receipts from wool, while a mixed farming sheep enterprise receives 19% of farm receipts from wool. While this data is now quite dated, the changing nature of broadacre farming operations over the last decade has probably further reinforced this situation (i.e. wool receipts relatively low as a proportion of total farm receipts)

4.2 Terms of trade

Terms of trade for broadacre farms are falling and are likely to continue doing so.

Data shows that the terms of trade for broadacre industries, including the wool industry, have and will continue to fall as prices paid for inputs exceed prices received for outputs, and productivity gains have been insufficient to compensate (figure 25)⁶⁷.

Broadacre total factor productivity and farmer terms of trade, 1977–78 to 2010–11



Note: Farmer terms of trade relate to all Australian agriculture; total factor productivity relates to broadacre (non-irrigated) agriculture only.

Figure 25 Broadacre TFP and Terms of Trade (1977/78 to 2010/11)

⁶⁵ ABARES (2014). Australian farm survey results 2011–12 to 2013–14. March

⁶⁶ ABARE (2004). Australian wool industry

⁶⁷ ABARES (2013). Productivity in the broadacre and dairy industries. Agricultural commodities – vol. 3 no. 1 March quarter 2013

Wool industry productivity gains have, on average, been lower than other broadacre enterprises, making the impact on terms of trade even more pronounced.

ABARES⁶⁸ data also shows productivity across broadacre industries has grown at an average rate of one per cent a year between 1977–78 and 2010–11, though the rate for the sheep industry was zero (table 3) over the period.

Table 3 Productivity growth – broadacre enterprises, 1977-78 to 2010-11 (ABARES 2013)

Broadacre industry	Total factor productivity growth (%/year)
All broadacre	1.0
Cropping	1.5
Mixed crop-livestock	0.9
Beef	0.9
Sheep	0.0

However, ABARES also notes that since the mid-1990's there has been some productivity growth in the sheep industry (1.4% per year from 1999 to 2010), coinciding with a fundamental shift in industry focus away from wool and toward slaughter lamb production (table 4).

Table 4 Average annual sheep input, output and productivity growth by period (%) (ABARES 2013)

	Productivity growth	Output growth	Input growth
1977-78 to 1987-88	-2.1	5.2	7.3
1988-89 to 1998-99	-2.9	-10.4	-7.5
1999-2000 to 2010-11	1.4	-4.5	-5.8

The industry needs to better manage its declining terms of trade by increasing productivity and / or increasing the value of the product.

Holmes, Sackett & Associates⁶⁹ argued that all commodity producers, including woolgrowers, would continue to suffer from declining terms of trade and that only productivity gains (increased efficiency) and product quality improvements could offset these declines.

The good news is that productivity gains are very achievable for wool production. An examination of genetic progress in the Australian sheep industry⁷⁰ found that genetic gain in Merino breeders participating in the MERINOSELECT program was around one-third of its potential.

⁶⁸

⁶⁹ Sackett, D. (2004), 'Will wool growing be a viable business in 2029'? A review of price and productivity trends. Holmes Sackett & Associates Report Prepared for Australian Wool Innovation and Land and Water Australia

⁷⁰ Swan, A.A. Brown, D.J. Banks, R.G (2009) Genetic improvement in the Australian sheep industry. Report to AAAGB

4.3 Relative enterprise profitability

Relative profitability between broadacre enterprises depends on commodity prices and seasonal conditions – wool may not be the most profitable but returns from wool do tend to be less volatile over time.

The relative profitability of broadacre farms varies depending on commodity prices and seasonal conditions. However, generally cropping is shown to be relatively more profitable than wool enterprises but with far greater variation. Dual purpose enterprises (wool and lamb) perform well.

One of the most comprehensive benchmarking studies of broadacre enterprises is presented by Holmes & Sackett⁷¹. The location of benchmarking participants for 2013 covered 6 states, with a predominance in NSW. Figure 26 presents a comparison of net profit (in units of \$/Ha/100mm of rainfall) across a range of enterprises for the 16 year period from 1998-2013.

The report noted that:

- Over the 16 year period, dual purpose enterprises⁷² have had the highest average enterprise profits followed by dryland cropping, and prime lamb then beef and wool
- The most recent year, 2013, cropping enterprises were easily the most profitable, followed by dual purpose, wool, then beef with prime lamb least profitable
- There is a large range in average enterprise profits within a sector between years, especially cropping.

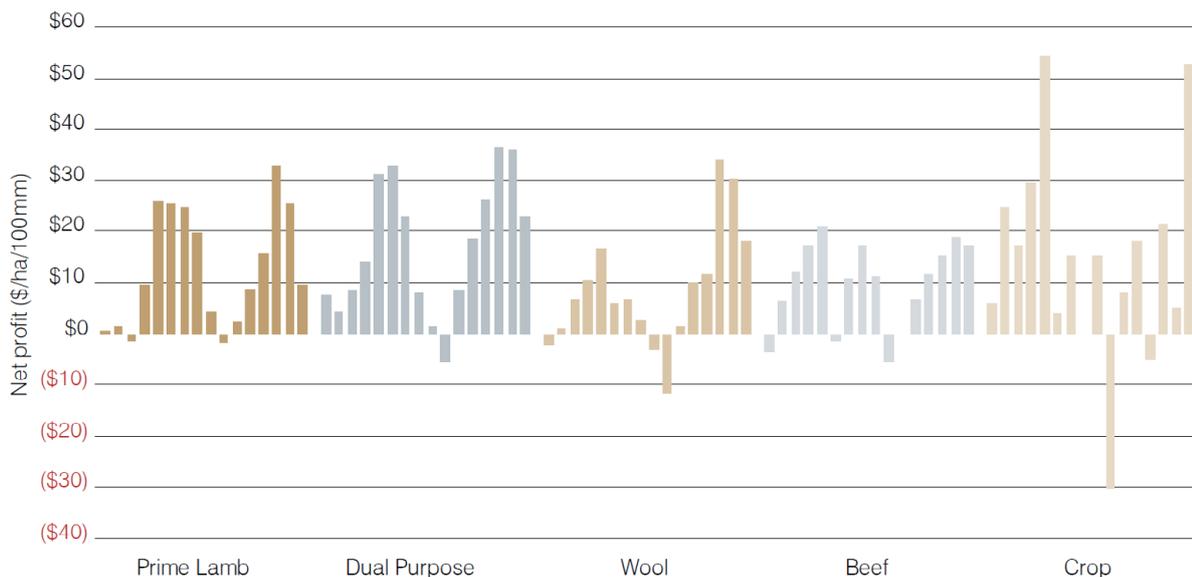


Figure 26 Gross margin (\$/Ha/100mm annual average rainfall) by broadacre enterprise (1998 – 2013)

The AgInsights report also presented data on enterprise profitability across three rainfall zones (low <500mm long term average, medium 500 – 650 mm, and high >650mm). Averages across five years (2008-2013) showed:

⁷¹ Holmes & Sackett (2014). AgInsights Vol 16

⁷² AgInsights notes that a dual purpose enterprise consists mostly of Merino ewes joined to terminal or maternal sires, often run alongside a self-replacing Merino flock.

- In the low-rainfall zone cropping was most profitable followed by dual purpose and wool
- In the medium-rainfall zone, dual purpose was most profitable followed by wool and cropping
- In the high rainfall zone, there was little difference between prime lamb, wool and dual purpose

There is big variation in profitability between wool enterprises, with some wool producers achieving good profitability.

The AgInsights report also notes that there was significant variation in profitability even between wool producers in the benchmarking study. In 2013, the range in net profit across enterprises was over \$30 per DSE.

Modelling undertaken by NSW DPI⁷³ examined the relative profit (\$/Ha) for key sheep enterprises using relevant market prices for a well fertilised environment at Yass, NSW (figure 27).

The results show considerable variation in relative profits between enterprises and between years, most likely as a result of price relativities between sheep, wool and lamb / sheep meat. For wool enterprises, relative profitability was greatly influenced by micron premiums (in this example between 18 and 20 micron where micron premiums were much higher in 2010 to 2011 than 2013 and 2014).

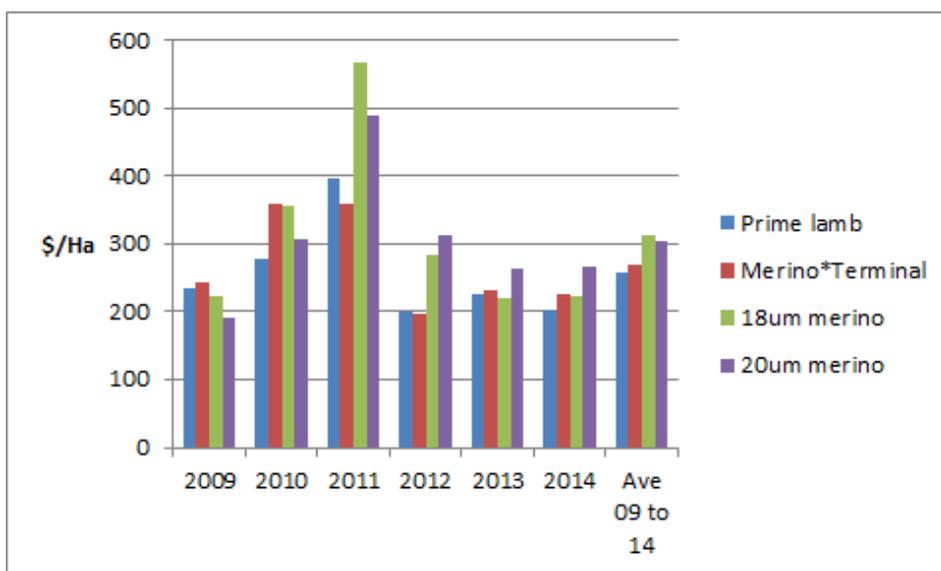


Figure 27 Profitability across sheep enterprises at Yass NSW (2009-2014)

The modelling performed by NSW DPI⁷⁴ also included an analysis of different sheep enterprise profitability across locations in NSW (figure 28) which showed some variation, especially in lamb-focussed enterprises.

⁷³ Graham, P. (2014). Personal communication

⁷⁴ Graham, P. (2014). Changes in profit between sheep enterprise over time. Merinolink newsletter, November

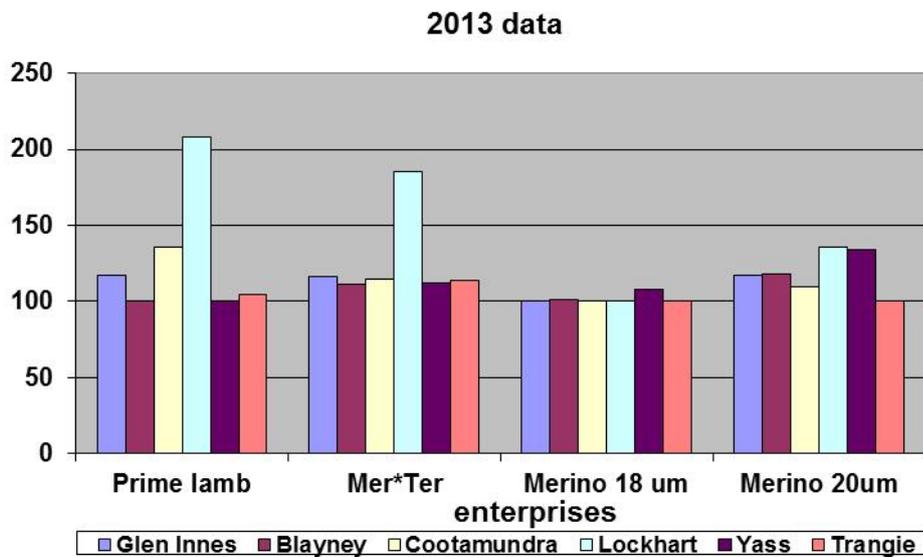


Figure 28 Profitability of sheep enterprises across locations in 2013

Since the 1990s, broadacre producers in the sheep / cereal zone and even high rainfall zone have shifted away from sheep to more cropping.

Since the 1990’s, large amounts of land that had run livestock, especially sheep, was converted into crop production. Figure 29 (Woods⁷⁵) shows that transition from the mid-1990s. There is some evidence that trend may have run its course, and Woods contends that ‘since 2007, the link between sheep numbers and crop area looks to have changed, supporting a view that the Australian flock may have reached base level’..

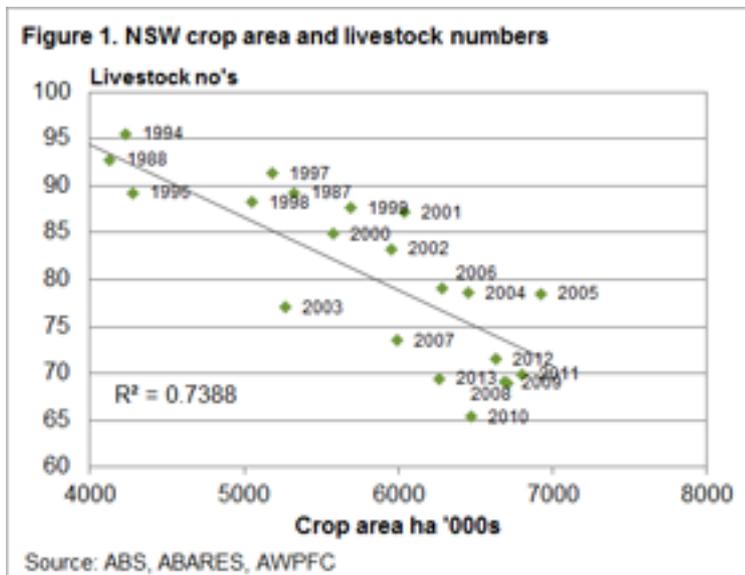


Figure 29 NSW crop area and annual number of livestock units⁷⁶

⁷⁵ Woods, A (2014), “The battle of the spare paddock”. Reported in www.mecardo.com.au 26 November. Independent Commodity Services

⁷⁶ Woods, A (2014), “The battle of the spare paddock”. Reported in www.mecardo.com.au 26 November. Independent Commodity Services

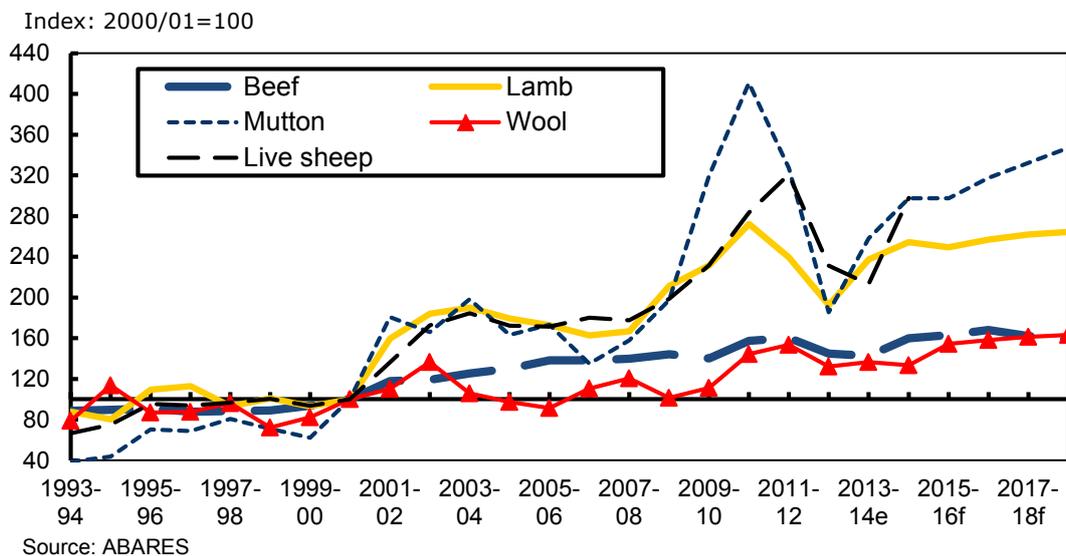
Sheep may have a greater role in the relatively higher-risk, lower-rainfall, mixed farming areas.

A study by Hutchings⁷⁷ suggested that the role of sheep in the mixed farming enterprise in south-eastern Australia is to reduce the exposure of the business to the relatively high risk of financial losses with dryland cropping. The analysis found that in all districts sheep have a cost of production about half that of cropping (as well as a large investment in machinery), and crop yields are more sensitive to rainfall variability. Hutchings considered that ‘sheep therefore reduce the risk of loss when compared with continuous cropping. In broad terms cropping needs a wheat price above \$220/tonne, and a drought frequency of less than one in three years to break even’. As a result Hutchings concluded that there may be a greater role for sheep in the relatively higher risk, low rainfall, mixed farming areas of eastern Australia than is currently the case.

4.4 Future prices?

ABARES predicts that future wool price trends will be outstripped by increases in the prices for lamb and mutton, on par with beef, but better than wheat.

ABARES⁷⁸ predicts that wool prices will rise in nominal terms (actual) by around 16% between 2013/14 and 2018/19. In real terms, however, ABARES projects that wool prices will increase (adjusted for inflation etc.) by just 3% over this period. As Figure 30 shows, this nominal increase will be outstripped by increases in the price for lamb and mutton, but is on par with the projected increases in prices for beef. It is better than the ABARES projection of the trends for wheat prices.



Source: ABARES
Figure 30 Prices for Australian livestock products

⁷⁷ Hutchings, T. (2009) A financial analysis of the effect of the mix of crop and sheep enterprises on the risk profile of dryland farms in south-eastern Australia

⁷⁸ ABARES (2014), *Agricultural Commodities*, March Quarter 2014.

But price alone is not the full story. To put the impact of productivity growth into perspective, a recent analysis by Sackett (2014)⁷⁹ suggested that had productivity growth for the wool industry kept pace with that of cropping over the last 25 years, the current financial performance of a wool enterprise would be the equivalent of having an Eastern Market Indicator of 1804 cents (compared to 1140 cents at the time).

Information and investment are required to grow production levels and quality.

In all cases, there is a need for wider publication of available information to enable producers to make relevant comparisons of broadacre enterprise profitability so as to enhance future decision making. Such analysis should also consider the prospect of greater inter-year seasonal volatility brought about by climate change.

As well, investment is needed if the flock is to grow and will also be important for the industry to invest in productivity improvements. This might come about through existing producers forgoing cash flow (e.g. to retain ewe lambs), or it might come from external investors moving into the industry. These external investors may also come from overseas.

5. Animal health and welfare, the environment and societal expectations

Increasingly, society expects food and fibre production to meet its ethical standards, not just those adopted to meet the supply chain's requirements.

Societal attitudes to the environment, chemical use, food safety and animal welfare have evolved significantly in recent decades, in Australia and around the world. These attitudinal changes have in turn changed customer behaviours, including those of retailers and other intermediaries, and also the political / regulatory environment. As a result farmers are no longer free to operate purely as they wish but must respect the social licence under which they operate.

These pressures affect different agricultural enterprises in different ways. Wool production requires extensive areas of land⁸⁰, the stewardship of animals and significant reliance on chemicals. The industry has already experienced the debate on mulesing, to give one example, and it does not appear that public pressure on the way woolgrowers operate will ease over time.

5.1 Animal health & welfare

Animal health

Animal health management remains a cost to livestock production and this is expected to continue despite incremental improvements in treatments.

Animal diseases represent a significant source of loss to sheep producers, both from the upfront prevention or treatment costs and from losses in production including deaths. A report for Meat & Livestock Australia (MLA) and Australian Wool Innovation (AWI) by Sackett et al (2006)^{81,82} concluded that the most economically-important diseases affecting the sheep industry in Australia are:

⁷⁹ Sackett, D (2014). 'Key decisions for the future. What will drive our profitability?' MerinoLink – March 2014

⁸⁰ Except shedded sheep operations, of course, which have their own welfare challenges.

⁸¹ Sackett D, Holmes P, Abbott K, Jephcott S and Barber M 2006, *Assessing the economic cost of endemic disease on the profitability of Australian beef cattle and sheep producers*, MLA project AHW.087 Final Report, April.

⁸² An update and expansion of this study is currently being carried out under MLA funding but the report is not yet available

- Internal parasites;
- Flystrike;
- Lice;
- Post weaning mortality;
- Perennial ryegrass toxicity (PRGT); and
- Perinatal mortality.

There is no reason to believe that the ranking for NSW specifically would differ from the national profile (except possibly in the relative ranking of PRGT). Internal parasites and flystrike dominate.

Animal health costs are already built into wool business models, so the important question for future scenarios is whether animal health will become a relatively bigger or smaller issue than it is now. Key observations in this respect would be:

- A major challenge is increasing drench resistance of gastrointestinal worms. New classes of drench are launched periodically which, combined with a suite of other control options including the combining of drenches is generally keeping the resistance problem at a manageable level.
- Industry-funded R&D programs seeking improved disease diagnostics, treatments, prevention and control strategies, including breeding for disease resistance, produce regular incremental innovations but no particular breakthroughs are anticipated.
- Commercial animal health companies also produce a regular stream of new products, the most significant of which for sheep are usually new worm drenches. Conventional wisdom is that multinational animal health companies are progressively reducing their investments in sheep-related new product development in favour of more lucrative pig and poultry industries, but new parasiticide products have been released in recent years.
- Health management makes sheep a relatively labour-intensive enterprise – apart from shearing, the main husbandry procedures such as crutching, drenching, dipping and jetting, mulesing / tail docking and vaccinating are all health-related. These provide a major disincentive to running sheep and there is little prospect of these procedures being made redundant in the near future.

Animal health has the potential to throw up particularly disruptive events such as exotic disease outbreaks or food safety scares.

Aside from these ‘steady-as-she-goes’ trends, two wildcards relating to animal health can be imagined:

- Ovine Johne’s disease (OJD) has been a highly controversial disease in NSW. The OJD debate has been less heated since recent changes placed responsibility for control very much back on producers and an effective vaccine has been progressively taken up. However, there remain lingering questions about a possible link between the OJD organism and Crohn’s disease in humans. Were a link to be definitively established and accepted, sales of sheepmeat (with knock-on effects on wool profitability) and beef as well as dairy products could be adversely affected. Establishment of such a link seems unlikely but not out of the question.
- An exotic or emergent disease such as foot-and-mouth or sheep and goat pox could affect flocks in NSW or elsewhere in Australia with sudden dramatic effects on market access for wool and sheepmeat nationally. Bluetongue has already been found in sheep

in Australia and there is a concern that the virus will spread south as the territory for its *Culicoides* vectors expands with climate change. A future emergency animal disease outbreak is a very real possibility.

Predation

Predation by wild dogs is a growing threat with serious productivity, social and environmental impacts in affected regions.

Dingoes and feral dogs (usually termed, collectively, 'wild dogs'), foxes and pigs are all predators of sheep across Australia. Dogs, however, have become a particular problem in recent years. Allen & West (2013)⁸³ argue that despite better methods of trapping and baiting, the sheep industry in the pastoral zone is shrinking due to predation by dogs, for two reasons: a reduction in the farm labour force, leaving fewer people to detect and manage dogs; and the reduced use of netting fences.

Dogs cause more than just losses of livestock, although these losses can be very large; they also cause considerable stress and upset for flock owners.

In NSW, wild dogs are found mostly in the north-west of the state as well as along the Great Dividing Range and coastal hinterlands. The State has a Management Strategy⁸⁴ that emphasises coordinated planning and management starting with a 'nil-tenure' approach – that is, working across a broad landscape that ignores land titles and boundaries and focuses instead on the population dynamics of the dogs themselves.

International perspectives on animal welfare

The world is gradually changing its attitudes about how animals should be treated by humans.

The way people think about animal welfare is changing. Whereas animals have historically been regarded as the property of humans, and subject to protection only to the extent that an owner could reasonably afford it, they are increasingly being regarded as sentient beings with the right to enjoy 'five freedoms' (freedom from hunger and thirst; discomfort; pain, injury or disease; to express normal behaviour; and from fear and distress).

Examples of how the growing international concern for animal welfare is being manifested are:

- The growing involvement of the World Organisation for Animal Health (OIE) in developing and promulgating international animal welfare standards;
- The increasingly stringent animal welfare standards of European countries in particular, for example the requirement in Switzerland and other countries that castration of lambs or calves must be carried out using anaesthetic, at any age; and
- The rapid rise in offering of animal law subjects in law schools around the world (figure 31 – which may significantly underestimate the present number, as there are 14 Universities teaching animal law in Australia alone⁸⁵).

⁸³ Allen, BL and West, P 2013, Influence of dingoes on sheep distribution in Australia, *Australian Veterinary Journal* 91:7, pp 261-7.

⁸⁴ State of NSW 2012, *NSW Wild Dog Management Strategy 2012-2015*

⁸⁵ Voiceless 2014 (www.voiceless.org.au/animal-law/study-animal-law)

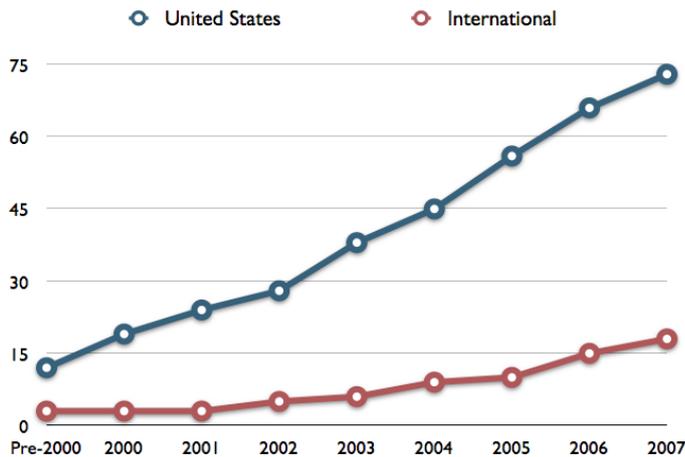


Figure 31 Rise in the number of Universities offering animal law courses between 2000 and 2007 ('international' means 'outside of the United States')⁸⁶

Regulation of animal welfare

Animal welfare regulations are becoming more based upon welfare science than 'accepted industry practice'.

In 2014, after a protracted process, the Australian Animal Welfare Standards & Guidelines (S&G) for Sheep⁸⁷ were finalised by a diverse stakeholder group and have been sent to the Agriculture Senior Officials Committee (part of the COAG framework) for endorsement. The S&G will then require the approval of the Australian Agricultural Ministers (AGMIN) before each State and Territory makes the required legislative changes to recognise the S&G as the basis for defining acceptable sheep welfare practice in their jurisdictions.

The various S&G documents replace the current Codes of Practice (CoP) for the Welfare of Animals. The aim of developing the S&G has been to provide:

- Scientific underpinning of welfare standards.
- Greater clarity of acceptable standards.
- Greater legal certainty.
- Harmonisation between jurisdictions.

There are few changes in technical provisions between the current CoP and the S&G, so the Sheep S&G should have little immediate impact on most sheep producers in NSW. However, the fact of their development signals the progressive tightening of this aspect of the regulatory environment.

⁸⁶ Sankoff, P 2008, Charting the growth of animal law in education, *Journal of Animal Law*, vol 4, p 105

⁸⁷ Animal Health Australia (AHA) 2014, Australian Animal Welfare Standards and Guidelines – Sheep, first edition, version: 1.0 May 2014 subject to government endorsement

Signals from retailers and consumers on animal welfare

Retailers market to the consumer's desire for ethical animal production and may impose production standards on producers with little consultation.

There have been several examples in recent years of food retailers unilaterally adopting particular animal welfare standards as part of their promise to consumers – for example, the HGP-free beef and sow-stall-free pork policies of Coles. Fibre is arguably less vulnerable than food to such disruptions. The domestic food retail environment is dominated by two powerful players, while the apparel trade is much more dispersed and largely overseas-based; 'eating' is a more intimate experience than 'wearing'; and the relationship between 'wool' and 'sheep' is less direct than that between 'lamb chop' and 'sheep'.

The wool industry continues to invest in improving production practices to meet community expectations.

The wool industry is not immune to welfare lobby pressure, though. The campaign against the practice of mulesing by People for the Ethical Treatment of Animals (PETA) during the early 2000s caused considerable consternation for the industry as some apparel brands and retailers expressed concern about mulesing even if they did not directly support the PETA campaign. The industry initiated a massive, urgent investment in R&D and associated activities to find alternatives to mulesing and to ensure best practice mulesing while it remained. AWI continues to invest heavily in R&D to replace mulesing with an acceptable alternative for the control of breech flystrike, and in reassuring international partners of these efforts. A renewed attack on mulesing by PETA or other groups, in the near future, is very possible.

The export of livestock is another emotive issue with a number of groups actively campaigning for its closure. For NSW, even though only 11,000 out of over two million sheep exported from Australia were attributed to NSW⁸⁸, any such ban would likely impact on the sheep industry nationally.

Other potential welfare 'vulnerabilities' (in terms of public perception) for the sheep industry are:

- Other 'bloody' procedures: tail docking, castration (pizzle dropping has now been banned in the S&G);
- On-farm mortality rates (notably pre-weaning and during extreme weather events – which are expected to increase in frequency and intensity with climate change);
- Shearing;
- Land transport; and
- Slaughterhouse practices.

It is unlikely that pressure on the industry from welfare activists, governments and consumers to improve welfare practices will abate over the medium to long term. The challenge for the sheep industry will be to: (a) actually improve welfare practices over time, for example through the replacement of aversive husbandry procedures (e.g. immunological vs physical castration) or provision of pain relief where such procedures continue to be required; and (b) gain the trust of the public that producers are adopting the best available welfare practices as they evolve.

New technologies for remote sensing / monitoring of animals to enhance productivity and animal welfare outcomes are already being evaluated and may become increasingly important. These

⁸⁸ MLA (2014)

include the use of drone technologies, walk-over-weighing systems, electronic detection of animal health problems (e.g. 'smelling' flystrike) and virtual mustering / fencing.

5.2 Chemical use

Chemicals are important inputs for wool production but chemical use is under constant scrutiny.

Veterinary chemicals continue to form the backbone of the control of sheep parasites which, as described above, are the primary sheep health problems (worms, flies, lice). Chemicals are also used by graziers to manage pastures, weeds and pasture pests.

There are pressures on chemical use in the wool industry, arising from concerns over:

- **Workplace health and safety.** Organophosphate (OP) compounds used in sheep dips and topical blowfly treatments, for example, have been implicated in episodes of ill-health in farm workers. Recently, the OP diazinon was deregistered from use on sheep except by special permit or special application methods.
- **Environment.** The industry has largely moved from saturation dips, which generate large volumes of excess fluid, to backline products which remain entirely on the sheep. However, wet dips (on-farm and mobile units) are still used. EPA regulations concerning the disposal of spent dip wash have tightened considerably and require the observation of minimum distances from waterways, bunding and periods of nil grazing of disposal sites, among other measures.
- **Market access.** Over the last three decades, the wool industry has prepared itself for potential market access constraints due to chemical residues in exported fleece, especially into Europe. As a result wool chemicals now carry 'wool harvesting intervals', minimum periods that must be observed between treatment and shearing.
- **Reduced efficacy due to target organism resistance.** Over time, almost all classes of antiparasitic products decline in efficacy due to the development of resistance by the target organism. Notable examples are organophosphates for blowflies, synthetic pyrethroids for lice and all classes of worm drench.

The industry continues to look for ways to reduce its reliance on chemicals through approaches such as 'integrated parasite management' which includes biosecurity to prevent problems such as lice and drench-resistant worms. The industry will need to continue these efforts. It will also need to ensure that chemicals are used safely and in accordance with applicable regulations and market requirements.

5.3 Environment

Climate change – biophysical and productivity impacts

Climate change has the potential to affect productivity but the impact is unlikely to be uniform across geographical regions.

The Southern Livestock Adaptation (SLA) 2030 program⁸⁹ sought to describe climate scenarios in 2030 at a regional level and their potential impact on farm enterprise productivity and profitability, utilising the CSIRO GRASSGRO model and the collective expertise of researchers,

⁸⁹ www.sla2030.net.au

extension experts and producers. Wool production was modelled at eight locations in NSW under each of four climate scenarios. The main results of the modelling are shown in table 5.

Table 5 Results of modelling of climate change impacts on wool production in eight sites in NSW, conducted as part of the Southern Livestock Adaptation 2030 project

	Rainfall change	Pasture production change	Stocking rate change	Profit change (wool)	Profit change (beef)
Yass	-10%	-7%	-29%	-40%	-61%
Goulburn	-10%	-7%	-25%	-40%	-62%
Cootamundra	-10%	-5%	-17%	-28%	N/A
Grenfell	-5%	-11%	-24%	-51%	-190%
Trangie	-7%	-16%	-10%	-19%	N/A
Temora	-8%	-9%	-13%	-33%	N/A
Glen Innes	-10%	+1%	-6%	-4%	N/A
Narrandera ²	-9%	-23%	-47%	-86%	N/A

Notes on the table:

1. Results shown are an average of the results of four climate models and compare 2030 estimate with 2000-2009 actual data. There was significant variation between the outputs of the individual models, ranging from more drastic outcomes to (in one or two cases) improvements – for example, for Cootamundra, profit change varied between -66% and +15%
2. Results for Narrandera were noted as needing more work and should be interpreted with caution

The SLA 2030 modelling suggests that climate change will have a significant negative effect on profitability across most regions of NSW. These impacts occur despite apparently small changes in temperature and rainfall. The regions that are least affected – and may even benefit from a productivity perspective – are those with high rainfall and especially cold winters (above 900m, e.g. Glen Innes), where temperature increases are expected to provide a net increase in pasture production.

Adaptation options may mitigate some of the impacts of climate change, but some of these mitigation options are already 'factored in' to address declining terms of trade.

The SLA modelling also examined a range of climate change adaptation options and their effect in ameliorating losses in profitability. In many cases these measures do reverse some of the forecast climate-induced losses and even increase profit on current levels, genetic improvement and the use of summer feedlots being the most promising adaptation measures. However, genetic gain is a strategy available *regardless* of climate change, and one that is required for producers to implement simply to address declining terms of trade and remain at baseline profitability – which is not accounted for in the modelling.

The positive news for wool enterprises in the eight regions of NSW modelled is that profitability was less affected than that of beef production. (SLA modelled lamb enterprises in only one of the regions.) The risks associated with cropping, too, are also expected to increase – including, in addition to moisture effects, events such as hail, and frosts around flowering time, which are expected to increase in prevalence. Wool is a less risky enterprise than cropping and climate risk will only increase in future, increasing the attractiveness of wool sheep for broadacre landholders in many areas.

Climate change – regulatory impacts

Government policy responses to climate change in coming years will also affect the wool industry.

The other potentially significant impact of climate change on the grazing industries is that exerted by the regulatory response to climate change as governments attempt to reduce net carbon emissions.

Australia has a target to reduce greenhouse gas (GHG) emissions to 5% below 2000 levels, or to 25% 'if the world agrees to an ambitious global deal capable of stabilising levels of GHGs in the atmosphere at 450 ppm (parts per million) carbon dioxide equivalent (CO₂-e) or lower', by 2020. By 2050, the target is 80% below 2000 levels⁹⁰.

The current government's strategy to meet Australia's emissions reduction targets is its 'Direct Action Plan' rather than a price on carbon. Central to Direct Action is an Emissions Reduction Fund from which government will purchase emissions reductions through a reverse auction system in which businesses bid to sell the cheapest reductions (\$/tonne of CO₂-e) .

The Fund will also incorporate activities under the Carbon Farming Initiative (CFI) which was commenced under the previous government. The CFI allows farmers and landholders to earn revenue for undertaking carbon abatement activities – either sequestration (storing carbon in soil or plants) or emissions reductions (for example, reducing livestock emissions). Eligible activities earn Australian Carbon Credit Units, some of which can be claimed nationally as part of Australia's progress towards its targets under the Kyoto Protocol, while the rest are not recognised internationally.

Currently there are very few methodologies (formally-described ways to implement and monitor specific abatement activities and generate carbon credits) available to broadacre producers. It remains to be seen therefore what methodologies will be developed and taken up by woolgrowers. One, which is the subject of much current research, is opportunities to use genetics to decrease methane emissions via the incorporation of breeding values for this factor into breeding programs. However, such selection pressure on this will come at a cost to other production or quality traits.

Other environmental services

Society will continue to demand environmental 'services' from farmers, but may have to contribute to the cost of these.

Farmers and other landholders are increasingly expected to provide other environmental 'services' to the broader community, such as biodiversity protection and rehabilitation of

⁹⁰ www.climatechange.gov.au/climate-change/greenhouse-gas-measurement-and-reporting/australias-emissions-projections/australias

degraded land. In a recent article for the Australian Farm Institute newsletter, Keogh (2014) notes that despite legislation of increasing stringency over the last 20 years, and the locking up of large blocks of land, a number of indicators of Australian environmental health continue to worsen.

In future, the wool industry may require a QA system that vouches for the industry's environmental stewardship (as well as its care for animal welfare, as described above). Different models of funding the provision of environmental services by farmers – in which there is a contribution by taxpayers to recognise the public good delivered – will need to be examined, however, as the current regulation-based approach is neither equitable nor effective (Keogh 2014).

The NSW Government has recently published a review of the State's biodiversity legislation, prepared for the Office of Environment and Heritage by an independent panel (State of NSW 2014). The review recommends, *inter alia*, the repeal of the Native Vegetation Act 2003 and elements of other legislation and their replacement by a single, integrated Biodiversity Conservation Act.

The government is yet to respond formally to the review. If it adopts the report's recommendations then the regulatory burden on agricultural producers – arising from State legislation – is expected to be reduced.

Appendix 2: Some brief scenarios

Following the development of the situation analysis and consideration of some of the possible implications, the temptation would then be to develop 'a single future' for the NSW wool industry by 2025. However, whatever future was selected it would almost certainly be wrong and would be extremely limiting in creating an environment to generate useful discussion. Instead four short scenarios have been developed which, it is hoped, will elicit some responses (admittedly some scenarios are quite 'challenging', especially for a ten-year period).

Please note that none of these 'scenarios' represent our view of the future of the wool industry in NSW. In fact it is highly unlikely that any of the scenarios will eventuate as we have described them. They are provided instead to demonstrate how trends that we can identify today may play out and interact over the next ten years. Our aim is to prompt a response and to create a discussion about what may happen in the industry and what the implications might be for producers, industry and NSW Government.

Scenario 1: Sheepmeat dominates –‘Hop in for your chop’

Situation in 2025

- Meat prices have appreciated rapidly with growing demand from China, other Asian countries and the Middle East in particular
- As a result, there is strong demand domestically for grain and fodder for livestock use. This helps to underpin the price for grains but of course global demand and supply are the key drivers
- In relative terms, wool has not kept pace – it continues to have a market but long-term prices have been only steady, providing reasonable returns to mid-microns but only just covering cost of production for fine wool

Wool industry of 2025?

- The move to meat sheep from wool sheep has continued in the high rainfall zone, and there are fewer Merinos as producers gain the confidence to shift towards more specialist meat breeds
- Producers in the sheep / cereal zone have increased Merino ewe numbers, which offer the flexibility of lamb production using a terminal sire, when seasonal conditions suit, or running dry sheep – and in all situations providing a wool clip
- In both cases, the push for plain-bodied, larger-framed animals continues
- In the pastoral zone, Dorpers and other breeds have increased in popularity and so reduced labour requirements related to wool production
- Across the clip, average fibre diameter has increased and quality (staple strength etc.) has declined because wool is essentially a second-order product to meat

Potential implications

- Market data and analysis is critical to give confidence that the global demand for sheepmeat is not simply cyclical but an enduring shift
 - There is a need for better genetics to underpin sheepmeat production for both Merinos and meat sheep, and a greater commitment to improving reproductive performance and lamb survival
 - Sheep are valuable so there are loud demands to protect them from predation and biosecurity threats
 - The importance of export markets for sheepmeat mean that food safety, biosecurity etc. are high priorities
 - There is a need to better understand the sheep / cropping interface
 - Year-round continuous supply of sheep and lambs is an important issue both to meet market requirements and to reduce the seasonality of domestic employment in processing sheep
-

Scenario 2: Global economy takes off – ‘GFC officially finished’

Situation in 2025

- The global economy has finally shaken off the effects of the GFC and is growing strongly, notably in China, where growth has moderated on earlier rates but has settled at a still healthy 5-7% pa as it has developed into a more mature economy based on domestic consumption, branded, high-value products and increased demand for services. Traditional wool destinations (e.g. Europe, Japan) are also strong
- Prices for all agricultural commodities are high (grains, sheepmeat, beef) but comparatively, wool is doing especially well, because of constrained supply
- Profitability of Australian agriculture is high, and there is money to invest and to pay down debt, including the capital pouring in from China, the Middle East and elsewhere
- Demand for land and thus land values has increased, not only as a result of the returns offered by agriculture but because wealthy city people are buying country retreats, especially in closer settled areas of high amenity value

Wool industry of 2025?

- Wool production is increasing in the high rainfall zone, where flock structures have gradually been adjusted to retain a higher proportion of wethers in the flock at the expense of lamb production and cattle; breeders have progressively placed more emphasis on increasing wool cut while maintaining or reducing fibre diameter
- In the sheep / cereal zone, producers have increased sheep numbers at the expense of crops, both to reduce the risk associated with cropping and to take advantage of the high wool prices
- There is little change in the pastoral zone where there is less flexibility to increase sheep numbers, although less emphasis is being placed on feral goat capture and more on sheep flock management
- Because producers are making money, levy revenue is high and RD&E is thriving, including investments in long-term research, as is marketing
- Producers are generally happy and motivated so industry structures are stable

Potential implications

- Sheep are valuable so there are loud demands to protect them from predation and biosecurity threats
 - Global prosperity means that consumers demand demonstrably high standards of welfare and environmental stewardship
 - More knowledge is needed on the sheep / crop interface
 - Inbound investment from China and other countries drives a public debate about foreign ownership, demand for advice from property owners about opportunities for harnessing foreign capital and from investors for management advice
 - There is debate about government policy on land use (particularly the locking up of valuable agricultural land for urban or lifestyle stewardship)
-

Scenario 3: Climate change accelerates – ‘It’s just not like it used to be’

Situation in 2025

- Changes in climatic conditions have accelerated far more quickly than expected.
- What the science indicated could be evident by 2030 and beyond is fully evident in 2025
- For many of the wool growing regions of Australia, average daily temperature has increased by 1°C and rainfall reduced by 10% (since 1990 averages)
- Of course there are ripper years and then times of prolonged droughts
- And there are times of far more regular extreme events (floods, fire, heat-waves etc.)
- As a result, on average for most regions where sheep are run, there are shorter springs, warmer winters and hotter, drier and longer summers with (in the south) less regular autumn breaks
- The hardest hit areas are the dry margin in the sheep / cereal zone
- Overall pasture production is reduced as are the levels of animal production (meat and wool) as stocking rates have had to be reduced or else land degradation would become common-place (and governments and society were coming down hard on such situations)
- Shorter pasture growing seasons make it more difficult to finish lambs to processing weights on paddock feed. Feeder-finisher systems are adopted on a tactical basis (though under a shadow of strict environmental regulation)
- But it is not all doom and gloom as some colder more elevated areas in NSW (e.g. Orange) are actually seeing improved pasture production as a result of warmer winters, reducing one of the major production limitations
- As a result of climate variability accelerating, government regulation and societal pressure for carbon reduction schemes and environmental stewardship has increased quickly (a Carbon Pollution Reduction Scheme operates)

Wool industry of 2025?

- Generally lower stocking rates as a result of lower pasture production puts a downward pressure on sheep numbers and wool production
- Sheep numbers in HR zone are faring okay as there are less cattle being run
- In the sheep / cereal zone, there are small increases in sheep numbers as cropping (especially at the dry margin) is a very risky business and sheep are more resilient
- Pastoral areas see continued reduction in sheep numbers as the predation and management challenges of the last two decades have continued, including stock water limitations
- Producers face a greater social licence to operate, which is costly
- Wool production overall is about the same as a decade earlier, but there is greater within and between season variability in fibre production and fibre quality

Potential implications

- Need a better understanding of the mixed farming dynamics, and especially the integrated role of animals in cropping enterprises
- Need better understanding of how to deal with extreme events (they can be ‘game changers’), heat stress, and climate variability

- Need enhanced medium term climate predictions to provide greater flexibility
 - Better risk management tools – for production and price. Possible increase in electronic trading
 - Costs of production likely to increase and management adaptations are crucial so greater focus on increasing profitability through better genetics, pasture management, confinement feeding etc.
 - Climatic changes have increased the focus on biosecurity issues and government support programs
 - Carbon farming and ecosystem services are new income streams for farmers
 - Need an economical market for lambs that fail to reach processing weight on green feed / stubbles
-

Scenario 4: Market changes – ‘Casualisation concerns’

Situation in 2025

- Over the last decade the move toward greater casualisation in the apparel market continues unabated, as expected
- However, it wasn't expected that emerging Asian markets, especially China, would jump on the casual market band-wagon so quickly at the expense of ‘dress-for-success’
- The impact on the men's suiting market (which used to account for about 14% of Australian wool use) has been significant
- To a large extent, menswear has gone down the ‘fast fashion’ (lower price point, casual styling, rapid design turn-over and ‘reasonable’ quality) pathway, at the expense of wool and to the benefit of competing fibres
- Blends are still evident but they tend to be low wool content
- High quality pure wool remains the high end fashion in men's suiting and wool is still an important material for knitwear etc.
- Women's wear continues to be a small niche for wool as it has for some time now – further impacted by the fast fashion trend that is now impacting on menswear
- Superfine wool is well suited to the active leisure-wear market and has made significant gains into it, but for reasons of price, product range and colour fashion its move into the active leisurewear market has not been quick or broad enough to avoid an overall drop in demand for finer wool in that 17 to 20 micron range

Wool industry of 2025?

- Demand for wool, especially in the finer end has dropped
- Wool further loses volume and value market share to other fibres and prices reduce
- In the high rainfall zone, the focus turns more toward ‘dual purpose sheep’ and less on fine wool
- In the sheep / cereal zone, there are less sheep because of overall reduced demand
- The pastoral zone remains at its current low production level because of predation and management capacity (labour requirements for large flocks)
- There is a continuation of the reduction in wool production that was first started back in the early 1990's

Potential implications

- Smaller wool industry as more producers liquidate their flocks
 - Greater focus on dual purpose and easy to manage sheep – genetics, pastures etc.
 - Continued focus on lowering the cost of production
 - Less R&D undertaken and adopted
 - Human resources previously allocated to wool are moved into other industries (government and private sector)
-

Appendix 3: People consulted in the preparation of this report

NSW DPI Project Steering Committee:

- Ian Rogan, Independent Chair
- Joe Sullivan (DPI)
- Alex Russell (DPI)
- Ashley White (DPI)

Industry participants:

Producers:

- J.B. & Alison Tancred
- Phillip Attard
- Mathew Coddington
- Charlie Merriman
- Ken Baldry
- Ed Storey

Brokers:

- Robert Ryan
- Marty Moses
- Don McDonald (and producer)

Buyers / Processors:

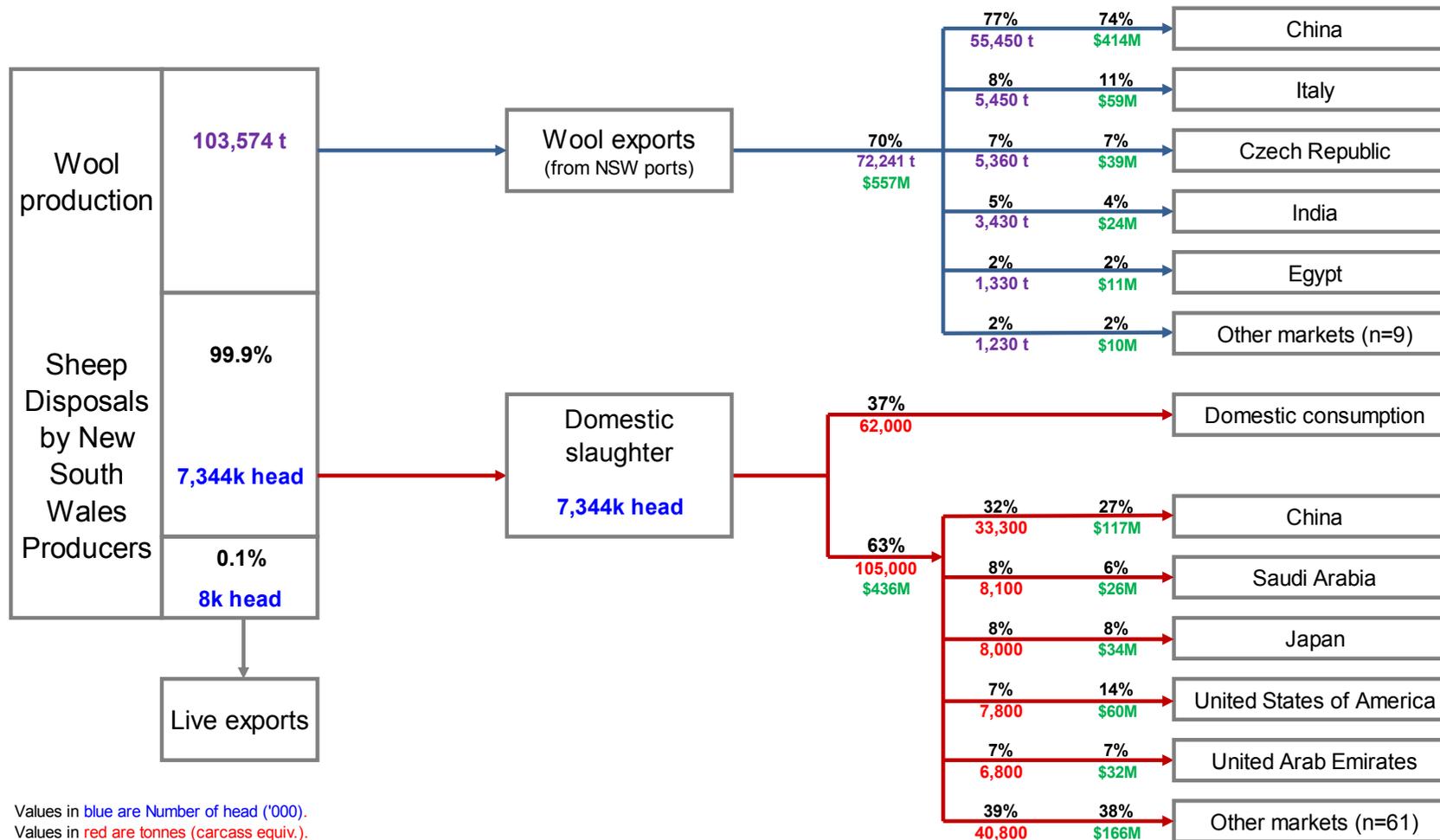
- Andrew Blanch
- David Michell

Special expertise:

- David Sackett (Growth Farms)
- Paul Swan (AWI)
- Mick Keogh (AFI)
- James Rowe (Sheep CRC)
- Sandy McEachern (Holmes & Sackett)
- John Keniry (AWEX and producer)

Appendix 4: Outputs from the NSW sheep industry, 2013-14

(excluding interstate movements of sheep and wool)



Values in blue are Number of head ('000).
 Values in red are tonnes (carcass equiv.).
 Values in green are \$A million (FOB).
 Values in purple are tonnes (greasy wool equiv.)
 Totals and sums of component items may differ due to rounding.

Source: Based on ABS data, DAFWA analysis