



Future Woolscapes

What might the world and the wool industry look like in 2030?



Overview of commissioned research papers

A supplement to the Brief Summary report

June 2006



future scenarios
and opportunities

LandWater & Wool
Shaping the future



Australian Government
Land & Water Australia

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Overview

Between 2004 and 2005, 20 representatives from the wool and other industries came together to begin an 18-month long process of examining a range of key issues that may impact on the world and wool industry over the next 25 years.

While recognising that the future cannot be predicted, the group **analysed trends and patterns evident today and looked at how they may shape the wool industry's future.**

Through a process known as scenario planning, the group was constantly challenged to think differently about the future as a way of dealing with the uncertainty of the world we live in.

A major contribution to the deliberations of the **Land, Water & Wool Future Woolscales National Forum** was the provision of several briefing papers on key topics seen as potentially critical to the Australian wool industry in the medium- to long-term.

The **Future Woolscales** project commissioned experts in the field (both within Australia and overseas) to prepare these papers.

A listing of these papers and a short summary is provided below. All these papers can be found on the Australian Wool Innovation Limited website (www.wool.com.au) or via the **Future Woolscales** project page on the Land, Water & Wool website (www.landwaterwool.gov.au).

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Paper 1: “The Potential Impact of Climate Change on Woolgrowing in 2029”

CSIRO Sustainable Ecosystems, Canberra, May 2004

This paper briefly discusses the most recent rationale for and predictions relating to **climate change (temperature, rainfall and weather events)**.

The impact of these predictions on plant growth, animal production and possible consumer response is examined.

The most recent report of the Intergovernmental Panel on Climate Change (Watson, 2001) concluded that there is now **strong evidence for a human influence on global climate** and that these trends will continue for the foreseeable future due to continued emissions of carbon dioxide (CO₂) and other greenhouse gases from fossil fuels and other sources.

Climate projections for Australia indicate that by 2030, mean annual temperature will have **risen between 0.4 and two degrees Celsius**, there will be a higher incidence of **extreme hot and cold days** and there will be an increase in climate variability, with a **higher occurrence of El Niños**. Rainfall projections are more complex, with mean annual rainfall predictions ranging from between minus 20 percent and plus five percent in the South West to between minus 10 percent and plus 10 percent in the Central East. Decreases are predicted as being most pronounced in winter and spring, with some inland and Eastern coastal areas possibly becoming wetter in summer.

In terms of the Australian wool industry, these climate changes are likely to have the following implications:

- **Likely increases in pasture and fodder crop growth**, with likely increased growth under higher CO₂ concentrations (and in some areas, higher summer rainfall). This will be generally offset by lower nutrient content and, in some regions, by the impacts of rainfall deficits and droughts;
- **Water resources are likely to come under strain**, with water supplies being reduced in areas where evaporation increases and rainfall decreases. Rainfall is also likely to become more variable;
- **Reduced wool production** and quality in marginal areas and possibly some **increased productivity** in higher rainfall regions. There is a potential for increases in vegetable fault where pasture composition changes (particularly in regard to weed content) and dust contamination due to increases in land degradation;
- **Negative animal health impacts** - increased thermal stress (particularly in the north) and subsequent increases in animal water demand, and susceptibility to pests and diseases, as well as decreased reproductive and growth rates;
- **Increased land degradation** issues with greater stress on the land principally brought about by rainfall deficits and increased variability; and
- **Increased competition** from other agricultural activities, particularly in regard to cropping and water/land resources (an issue most likely to affect the high rainfall wool growing regions).

Paper 2: “Towards a Profitable and Sustainable Australian Grains Industry – Pointers to a Future Woolscape” Lovett & Associates, Canberra, May 2004

(Note: A Guide to Future Woolscales based on the Grains Council of Australia document “Single Vision”)

This paper briefly discusses the Grains Council of Australia’s “Single Vision” paper as background to a long-term planning approach for the Australian wool industry. In particular it briefly discusses:

- **The transition the grains industry has made** over recent years from being a supplier, or “disposer”, of grain to becoming a sophisticated marketer, accustomed to meeting demand (for example in the case of wheat where there are already five to six main grades, 40 to 50 segregations and more than 30 identified end uses);
- Consolidation of the industry over the past decade in diverse sectors from plant breeding to bulk handling through to the farm level. A recent study (Pocknee and Associates 2004) predicts that, **by 2020, the number of grain farmers will halve**. The same study also predicts that, from the present to 2020, total demand for Australian grains for **existing market uses will increase by no more than 20 percent**, to some 70 million tons. Emergent uses, however, are predicted to be as **high as 120 million tons by 2020**;
- These **new opportunities**, some of which are already attainable, include:
 - **agriceuticals** - grain-based foods which provide consumers with daily doses of medicines and vaccines;
 - **aquaculture feeds**, adding value to crops such as lupin and with major export potential to, for example, China;
 - **biodegradable products**, where starch-based products may replace plastics;
 - **cosmetics**, with oats and rice flour “facials” already being promoted for their “natural” properties;
 - **livestock feeds**, a promising area where GM grains afford the possibility of tailor-making grains to meet specific requirements, as against using additives to supplement grains purchased at lowest price; and
 - **non-allergenic cereals**, in which enhancement of the naturally-occurring, non-allergenic protein thioredoxin, breaks chemical bonds in other proteins, rendering them more digestible and, thus, less allergenic.
- The potential for vertical integration of major domestic and international players is prevalent, and global alliances are forming. The latter are of particular importance to Australia, not only as an exporting nation but also in terms of using a small, but excellent R&D capacity, to gain access to intellectual property and technologies, offshore.

Paper 3: “Social Pressures Likely to Reshape Australia’s Woolgrowing Industry over the Next 25 Years”, Wilkinson, Department of Primary Industries, Bendigo, May 2004

This paper discusses how Australia’s woolgrowers are operating under a variety of social pressures that are reshaping the industry including:

- Demographic trends; and
- Social pressures.

The paper then summarises the likely characteristics of the next generation of Australia’s woolgrowers.

Key points include:

- The demographic structure of Australian woolgrowers has changed dramatically over the past 25 years and this will continue, with the **average age of woolgrowers expected to continue to increase** until around 2016 or 2021;
- **Farm children will continue to migrate** to the cities, partly in response to the cost-price squeeze, but mostly because of greater social, economic and cultural opportunities;
- **Fewer woolgrowers will be able to retire** and hand their farm to a child or have the desire to “sell up”;
- There will be increasing **pressure on relationships** as understandably women now want a greater emotional commitment and often their own career;
- **Demand from urban Australians** for land in the more attractive and accessible areas will increase and this will put upward pressure on land prices making expansion more difficult;
- Rising concerns about **animal welfare** are a natural result of ethical concerns moving beyond people to animals;
- There will still be demand for shearers and shedhands. In commercial woolgrowing areas, as large farms swallow small ones, **the labour supply will tighten**;
- Computer technology will increase the information available to woolgrowers, no matter how isolated they are. However, there will remain a need for **professional advisers** to help interpret it;
- There will still be wool grown in **amenity areas**, but it will be fragmented in small flocks; and
- Commercial wool production will be concentrated in the **pastoral country and the high-rainfall, open country**, where the number of farms will keep reducing and their average size will keep increasing.

Paper 4: “Land and Animal Management – 2029”

Mackinnon Project, University of Melbourne, May 2004

This paper considers how Australian wool production in 2029 may differ from that which exists today.

It suggests that:

- The Australian wool producer will be expected by society and consumers to know, understand and **sustainably manage his/her land and animals**, and also be able to detail all practices (especially regarding animal welfare and environmental considerations);
- **Competition for land** that is currently used for sheep farming will continue into the foreseeable future. Urbanisation, efficient and sustainable water use, technology improvements for alternative agricultural enterprises and the likely growing demand for food products from South East Asia are key drivers of future land use in Australia;
- The area exclusively allocated to **sheep farming is likely to diminish**, especially in the high rainfall zone of Australia. Mixed farming is likely to increase, as will leasing of smaller farms to professional managers;
- A substantial proportion of sheep enterprises in Australia will be **owned by city interests** who have little agricultural background or expertise, creating a separation of land ownership from land management;
- Increased urbanisation in Australia will also lead to a **disjunction between urban and rural dwellers**, resulting in a reduced understanding of agricultural practices by the majority of Australians;
- **Emerging technologies** such as improved understanding of the biological characteristics of sheep, through genomics and proteomics which, if pursued vigorously, promises to provide improvements in quality and disease resistance;
- Electronics and communication are likely to provide opportunities for farmers to **monitor and manage their farming system** and in particular the risks associated with climate, production and price – but at what cost?
- It is possible, that some current practices, such as shearing **will not be acceptable in 25 years time**. Alternatives to current methods of wool harvesting are urgently required;
- Driven by product safety and integrity concerns, the **mandatory identification of animals** is likely (as well as mechanisms to collect information on individual animals); and
- Professional lobby groups will have the potential to exert an even greater effect on **public opinion** in 2029 than is currently the case.

Paper 5: “Competitor Trends in 2029”

PCI Group, United Kingdom, June 2004

This paper provides a glimpse into the dynamics and interplay between man-made and natural fibres over the next 25 years. It examines many of the factors that shape supply and demand and influence choice between fibres from the textile processor and end consumer. These factors include relative fibre prices, regional fibre availability, economic development and industrial and trade policies, lifestyles, consumer/cultural fibre preferences, fibre performance, fibre and textile engineering, environmental constraints; and fibre/brand marketing.

Some of the information and predictions made by the PCI Group include:

- By 2000 the **global fibre market** reached nearly 53 million tons. Cotton’s share was around 37 percent, wool’s share was under three percent and man-made fibres had a 61 percent share;
- Moving forward to 2029 **man-made fibres** should continue to gain share of the global fibre market, reaching 74 percent while cotton’s share drops to 24 percent and wool to two percent. These gains are driven almost exclusively by gains in polyester (staple and filament) whose share of the global fibre market is predicted to reach 57 percent in 2029;
- **Total fibre production** is expected to almost double between 2003 and 2029, rising from 57 million tons to 107 million tons;
- **Cotton** is projected to rise by 37 percent to 27.6 million tons, up 7.5 million tons compared with production in 2003;
- **Wool** volumes show some growth (22 percent) from the very low level reached in 2003 (1.2 million tons). This rather conservative projection is based not only on the relatively high price of wool but also on polyester’s gain in wool’s traditional markets;
- In terms of final demand, total fibre consumption is projected to rise from 9 kg per capita in 2003 to 14 kg per capita in 2029. Over this period:
 - Consumption of **man-made fibre** rises from 5.6 to 10.5 kg per capita
 - **Cotton** consumption barely increases, from 3.3 to 3.4 kg per capita
 - Per capita **wool consumption** declines from 0.21 to 0.18 kg per capita
- Sometimes **oil prices** are given significant weight in the analysis of fibre prices. However, PCI argues that as fibre production is a very marginal activity in terms of oil (much less than one percent), its impact may not be so great;
- **New fibres** - Microfibres are generally polyester filaments (although also in polyester staple or nylon filament) that are one denier or less. The finer the filament, the softer the fabric but also the more difficult to process. The development of microfibre has opened up a whole new market for polyester, enabling it to enter niches such as upholstery, leather substitutes, upper market fashion, performance sportswear, and most important of all, achieve comfort through moisture management. The latter opened up the performance active wear market;
- **Processing trends** - There are also major trends in textile machinery development (beyond polymerization and extrusion) which will also have an impact. These include greater processing speeds for weaving and spinning - Vortex Spinning can reach speeds of 400 metres per minute. This compares with ring spinning speeds of up to 25 metres per minute;
- **GM cotton** is widespread. In China, the largest cotton producer, over 50 percent of cotton production is in pest resistant GM varieties. In the USA, the second largest cotton producer, nearly 75 percent of production is in GM varieties; and
- **Recycling** - in theory, recycling of synthetics should be relatively easy entailing a melt back to polymer and some purification. However, while virgin fibre costs remain as low as they are today, pricing is unlikely to drive recycling of apparel and home textiles.

Paper 6: "Project Narelle – Markets & Consumer Preferences to 2029" Ian Fergusson & Associates, Brisbane, June 2004

This paper examines the likely market structure and consumer preferences for wool over the next quarter century. It was produced by an extensive web search.

It first notes why people have bought woollen products in the past and how their selection criteria is changing. It briefly addresses the forces and drivers that will shape markets and consumer patterns over the next 25 years. It then discusses the outlook for the industry, markets and consumers in three time segments over the period of the study. The paper closes with implications for the industry and the **Future Woolscapes** project. Some key points covered include:

- **Consumers select textiles** for a variety of reasons which include aesthetics, comfort, ease of care (including storage), durability and serviceability, and appearance retention;
- In the past, quality was associated with brand image and the criteria above. These remain important, but the emphasis is shifting to **sustainability and clean and green attributes** (which apply to all stages of production and manufacture);
- In the global domain the two major driving forces are **demographics and the international security situation**. The former determines the potential markets, while the latter may influence accessibility to those markets;
- Today's **6.3 billion** people will become **8.9 billion** by 2050. By 2029 less than 20 percent of the world's population will live in the "developed nations". Significantly, teenagers and young adults in these populations will have an increasing proportion of discretionary income;
- At a national level, the main drivers for change are reflected in **government policy**. Aspects to monitor include foreign affairs and trade,

macro-economic policy, plus policies on the environment, agriculture, industry and research and development;

- Within the industry, the major driver for change will be **technology**. Most notable will be developments in bio-technology and nano-technology, which could be applied at many stages in the value chain;
- Over the next **seven years** the outlook is that current trends will continue and the consumer experience will remain largely unchanged. There will be developments in the value chains of wool and competing fibres based on the application of new technologies, but these will be incremental rather than revolutionary;
- The further forward one looks (**eight to 15 years**), the less certain the estimates and the more likely the possibility of a single groundbreaking development, or a series of iterative changes. It is probable there will be multiple radical innovations as the new technologies are mastered and the bio-molecular revolution gathers momentum. The centre-of-mass of the markets will shift to the East; there could be intense competition in all traditional market segments; and completely new fibres and processes could also emerge;
- **By 2029**, the international world order and global economic situation may have changed significantly. The new alignments and economic groupings will determine which markets receive / demand Australian wool. The major markets will likely be in Asia and South America;
- On the technology front, "**...we shall witness a major paradigm shift within the 25 year time horizon of this study, as the world moves into a completely new bio-molecular era.**" This will see products and processes as yet undreamed of. Some may threaten the very existence of wool; others could be its salvation.

Paper 7: “Project Dolly – Impacts of the New Technologies” Ian Fergusson & Associates, Brisbane, June 2004

This paper examines the likely impacts of the new technologies on the industry over the next quarter century:

- In the **5 to 10** year time-frame the technologies with the most potential are genetics and molecular biology - working together:
 - In the mid-term (**10 to 15 years**) the major breakthrough is likely to be in biotechnology with the commissioning of integrated agro-chemical refineries (“eco-converters”);
 - Towards the end of the period (**25 years**) nano-sciences should mature and the applications (such as extracting carbon for nano-built objects from airborne pollution) will have profound implications;
 - The threats posed by new technologies may emerge for several reasons:
 - Because **competing materials** gain a significant competitive advantage;
 - Because **wool fails** to exploit the potential of the new technologies;
 - Because **wool growers** do not meet the expectations of clients and consumers in their own value chain; and
 - Because **consumers** develop an aversion to any product or process in which scientists are perceived to interfere with nature.
 - **New competitors** may emerge. Those that warrant particular attention are the ones that exploit a “natural” tag, that have demonstrably eco-friendly production processes, and that legitimately claim some of the same qualities as wool;
 - **New technologies** is a broad term for the application of recent major scientific developments such as **materials science, nanotechnology, biotechnology, genetics, and organic machines**;
 - **Materials science** is the study of the characteristics and uses of all types of natural and synthetic inorganic materials, from metals, ceramics and crystals to plastics and semi-conductors.
 - **Nanotechnology** is the studying and fabricating at atomic or molecular level. The nano (n) metric prefix means one billionth of a unit or 10⁻⁹.
 - **Biotechnology** is the application of discoveries across the whole range of the biological sciences – especially addressing the building blocks of biology, genetics and cells and their processes at a molecular level.
 - **Proteomics** is the analysis of which portions of a gene “expresses” (is responsible for the formation of) which proteins in the organism hosting that gene.
 - **Genetics** is that branch of biology that deals with heredity, especially the mechanisms of hereditary transmission and the variation of inherited characteristics among similar or related organisms.
 - **Recombinant DNA** is DNA prepared by transplanting or splicing portions of genes from one species into a host of a different species. Such DNA becomes part of the host’s genetic make up and is replicated (is “recombinant”). Genetics work in recombinant DNA is often referred to as **transgenesis**. **Cloning** is a simpler process than transgenesis.
 - Although **organic machines** is not a scientific term, it can be used to refer to any intricate organism or natural system - the brain, the liver, a single blood cell; or, the whole biosphere of Earth. The scientific domain of the “organic machine” is **bio-molecular machines** and the field of **molecular biology**.
- It is important to remember that the impact of new technology is likely to be neutral. It may pose threats to one industry while opening amazing opportunities for another.

Paper 8: “The Potential Impact of Biotechnology on the Australian Sheep Industry in 2029”, Prof. H Raadsma, University of Sydney, June 2004

This paper specifically examines the potential role and impact of biotechnology on the Australian sheep industry.

Biotechnology, as a set of platform technologies, is potentially well-positioned to **dramatically impact the wool industry** by decreasing cost structures and/or improving income through superior product range and quality. It is unlikely that there will be a generic single biotechnology that will achieve a change in all key factors.

Biotechnologies in the livestock industry are based on the combination of advanced reproduction technologies (ART), advanced selection and diagnostic tools based on genetic technologies, and genetic modification (GM).

Advanced reproduction technologies (ART) include:

- Artificial insemination (preservation of sperm cells for wide spread distribution)
- Sexed semen (separating X and Y chromosome bearing sperm for single sex offspring)
- Use of sperm stem-cells
- Multiple ovulation and embryo transfer
- In vitro production of embryos (“test-tube embryos”)
- Cloning via somatic-cell nuclear transfer (production of multiple copies of elite sheep)

Genetic Technologies include:

- DNA markers and genetic selection (use of DNA tests for production traits in existing breeding programs)
- DNA diagnostics of pathogens
- Gene-expression profiles (understand interaction of genes and gene products in living animals)
- GenART- combination of genetic and reproductive technologies

Genetic Modification (GM) include:

- Somatic gene transfer (gene therapy, correction of genetic defects, bypass production limits)
- DNA vaccination (use of DNA plasmid/vector to create an immune response)
- Gene silencing (method to switch off specific genes)
- Germ-line GM (genetic modification that is passed on to offspring)

Stem Cells

- Stem Cells (cells with the ability to divide and differentiate into different types of cells)

Paper 9: “Will Wool Growing be a Viable Business in 2029 – A Review of Price and Productivity Trends”, Holmes & Sackett, Wagga Wagga, June 2004

This paper discusses the **decline in real wool prices** over time and how well that decline has been matched by producers achieving **efficiency gains**. In addition, it considers the decline in cost of production that is likely to be required for wool production to remain viable and competitive with other industries that require similar resources (as wool production). Also the possible means of achieving such a reduction are presented and discussed.

All commodity producers suffer from declining terms of trade. This situation has been occurring since the industrial revolution, which provided the catalyst for specialisation across a range of sectors in the economy.

Over the next 25 years, the authors predict that real wool prices will **decline** by between 1.4 percent and two percent per annum. Accordingly, **wool producers will need to lower their cost of production** by similar amounts per annum to match the declining prices. This is equivalent to a reduction (in 2004 prices) of 12-15 cents/kg clean per annum for 19-23 micron wool and a reduction of 43 cents/kg clean per annum for 16 micron wool.

Some of the main points discussed in this paper include:

- Meeting declining prices through **productivity gains** is likely to be relatively easy for most wool producing businesses if they focus on implementing key existing technology. This appears not to be currently occurring due to a combination of the lack of a dynamic culture, where new technology is often perceived as a threat rather than an opportunity, and the low levels of education and lack of business focus. These factors when combined mean that a large proportion of the industry does not understand the determinants of successful and profitable wool production businesses;
- The easiest gains are likely to come from current technology while **implementing genetic improvement programs** which focus on fibre diameter reduction rather than increased fleece weight. Fibre diameter reduction results in a higher quality product, enabling producers to move between price grades and avoid declining real prices;
- There is an opportunity to invest to achieve **productivity gains** across a broad front (genetics, pasture, productivity, labour productivity) rather than rely on one area. This is likely to result in incremental gains with relatively low risk compared to relying on large gains from one or two technological developments. Quantum leaps in technology are the exception rather than the norm, though when they do occur the benefits can be spectacular eg. Sub-clover and super;
- There are major structural issues in the industry, primarily related to **labour and enterprise size**, which are likely to impede productivity gains. However, if they can be overcome there is the potential for substantial gains. If they are not overcome further declines in the relative profitability of specialist wool producers is likely to be inevitable; and
- Gains that improve **per head (genetic) and/or per hectare productivity** should be the priority. Cost cutting per se is likely to yield little or no gain unless it focuses on improved labour productivity.

This PowerPoint presentation provides a detailed overview of the changing face of consumers and retailers over the next 25 years.

It commences with the proposition that about every three decades a new science or technological development emerges to transform the global economy and society:

- The first third of the last century was shaped by **chemistry** (antibiotics, medicine);
- The second third by **physics** (the atom);
- The final third by **information** and **communications technologies** (the internet); and
- The first third of this 21st Century may be driven by **biology and bio-engineering, gene therapy, super bugs, and terrorism.**

This document then discusses the following issues:

- Possible global **demographic** drivers (regional strength, population growth, wealth, age structure etc.);
- The strength of **China**;
- The possible role of “**Environmentalism**”;
- Health and human **wellness** being strong drivers for future consumers;
- The strength of **women** consumers;

- Retail structural changes – the emergence of **mega businesses**;
- The **information explosion**;
- The changing face of **consumers**:
 - Spirituality and human reconnection will be sought
 - Higher quality of life not just acquisitions
 - Desire for new experiences and innovation will grow
 - Consumers will become even more impatient and demanding
 - Consumer vigilance will grow;
- The emergence of the **e-consumer**;
- Possible **fashion** changes; and
- The implications for the wool industry.

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