Future Broadacre Agricultural Landscapes

Proceedings of the Conference and Workshop, 15\textsuperscript{th}-17\textsuperscript{th} June 2004

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A report for the Rural Industries Research and Development Corporation

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Agriculture in the grainbelt of Western Australia will be increasingly under pressure from forces such as increasing energy costs, declining rural populations, increasing community expectations over food quality and production processes, new technologies to improve production and efficiency, resource degradation and climate change. A lot of existing research has short time horizons, with poor continuity and connectivity with other research, and little consideration of its place in the ‘system’ and the user need. It also often fails to balance its contribution to a healthy economy with the needs for a healthy society and environment. In response to these common concerns, the major research institutions in WA jointly convened this conference and workshop with the aim of developing a shared vision for research and development to underpin a prosperous and sustainable future for the grainbelt.

A range of significant global and national trends plus the perspectives of a diverse selection of social, economic and environmental interests from the grainbelt region were considered during the two-day conference. These inputs were used to inform the workshop discussion on day three. The workshop addressed four core questions in relation to research and development in the grainbelt: Where are we now? Where do we want to be? How do we get there? What do we do next?

Outcomes from this conference have the potential to change the direction of research and development for the WA grainbelt. Lessons and insights gained from FBAL should be incorporated into current and future strategic processes.

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This report is an addition to RIRDC’s diverse range of over 1500 research publications. It forms part of our Resilient Agricultural Systems R&D sub-program, which aims to foster the development of agri-industry systems that have sufficient diversity, integration, flexibility and robustness to be resilient enough to respond opportunistically to continued change.

Most of our publications are available for viewing, downloading or purchasing online through our website:


Peter O’Brien
Managing Director
Rural Industries Research and Development Corporation
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Miles Dracup
Chair, Steering Group

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- Department of Agriculture Western Australia
- Centre for Legumes in Mediterranean Agriculture
- Western Australian Herbicide Resistance Initiative
- CRC for Plant Based Management of Dryland Salinity
- The University of Western Australia
- Murdoch University
- CSIRO
- Curtin University of Technology
- Department of Conservation and Land Management

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The FBAL Conference and Workshop was organised by a Steering Group with guidance from a Reference Group.

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Executive summary

Background

This volume contains papers or slides from talks presented at the Future Broadacre Agricultural Landscapes Conference held at Joondalup in June 2004. It also contains the summary of the Workshop held the day after the Conference.

Agriculture is at a cross roads, facing many significant challenges, such as increasing energy costs, declining rural populations, increasing community expectations over food quality and production processes, new technologies to improve production and efficiency, resource degradation and climate change. Unless we embark on a strategic journey and develop informed responses, we will be at the mercy of whatever directions the various forces take us.

The Future Broadacre Agricultural Landscapes (FBAL) Conference and Workshop was convened by a partnership of: Department of Agriculture Western Australia, Centre for Legumes in Mediterranean Agriculture, Western Australian Herbicide Resistance Initiative, CRC for Plant Based Management of Dryland Salinity, The University of WA, Murdoch University, Curtin University of Technology, Department of Conservation and Land Management and CSIRO. The CEOs or their equivalents were involved in both the planning and the event, along with their senior managers. This reflects the need for, and importance of, good strategic planning of R&D for the grainbelt. To achieve this we carefully developed an appropriate framework, and attracted the necessary diversity and quality of speakers, participants and stakeholder support. FBAL explored the question:

How can research help enhance the future economic prosperity, vitality of communities and environmental quality of broadacre agricultural landscapes in the southwest of WA?

The two-day Conference considered a range of significant global and national trends plus the perspectives of a number of different voices from the grainbelt region. These inputs were used to inform discussion during the Workshop held on day three.

Approximately 70 people from across the farming, research and development (R&D), business, local government, state government, community and NGO sectors attended the Conference, with approximately one-half participating in the Workshop.

The conference

During the first half of the Conference, invited speakers explored the most significant national and international trends and their likely impacts on the WA grainbelt. They took standpoints of economics, society, politics, environment and technology, and explored the various emerging trends. Equal time was allocated to talks and discussion, allowing participants plenty of time to air their views.

A number of the trends transcend country borders, such as climate change, declining terms of trade, globalisation, agricultural protection and energy costs. Others, such as rural depopulation (and associated ‘coastalisation’), increasing farm sizes, increasing awareness and concern for the environment, land degradation and loss of biodiversity, while reflecting global trends, have a more regional basis. Other likely key issues for the future that were discussed included increasing use of information technologies, biotechnologies, and payments for ‘clean and green’ products. While the grainbelt is currently economically viable, its natural and social capital was seen as dwindling.

Speakers agreed on the continued importance of R&D to underpin the improvements necessary to maintain agriculture’s productivity and ensure continued adaptability and flexibility. However, there
was general agreement that this should not be to the exclusion of environmental issues, since, even from just a pragmatic point of view, social and political pressures could easily mount to raise environmental standards, and play a major role in the future shape of agriculture.

With the southwest’s position as a global biodiversity hotspot under massive stresses, there was general agreement that biodiversity conservation needs to be built into the future direction of the grainbelt. Rural depopulation and declining communities inevitably drew wide attention, with some happy to accept it, whilst others advocated building regional diversity in industries and value adding as part of strategies to revitalise regions. Building regionally focused strategic partnerships involving the city and the country, and industry, community and government, was proposed as a means of fostering and focusing the broadly based changes needed.

In the second half of the Conference, a range of ‘local voices’ discussed their perspectives on the grainbelt from standpoints of: governance, community, indigenous people and youth, business, and large and small farms. They discussed what they saw as good and bad elements of the grainbelt, where they would like to see it going, and the role of R&D.

Some of the fairly consistent themes from the ‘local voices’ included: impacts of ‘fly in fly out farming’ on local communities, ‘walk in walk out’ research and the increasing divide between the city and bush; lack of adequate resources for regional bodies; and failure to adequately address social and environmental costs. Participants heard about regions that have pro-actively improved their positions, such as Birchip and Augusta-Margaret River. As with discussions during the first half, most called for: better integration of conservation, farming, and community; R&D processes based on true partnerships with strong leadership; and planning for greater regional diversity and value adding. Some other key research messages included: create farming systems that harmonise with landscape function; develop bush foods industry; reduce dependence on oil and investigate biofuels; create more differentiated food with activity further down the value chain; look at ways of making conservation pay; focus on getting the right mix of R&D.

Not surprisingly, two scenario planning exercises presented at the end of the conference largely reflected similar future issues to what had already been aired. These included energy availability, environmental impacts, biodiversity, climate change and variability and the need to raise input use efficiency including rainfall. However, they demonstrated there are realistic opportunities, which probably require different agriculture, but industry and regional strategies need to address these future issues.

It is impossible to capture the richness of the discussion following each presentation, and informally between sessions and over meals. However the event successfully created a ‘think tank’ on the future of the grainbelt. Through keeping the number of participants low, but inviting well informed representatives from a range of perspectives, industries, and organisations, a great diversity of thought was aired. This led to ‘movement’ in many people’s opinions as they developed an appreciation of other perspectives, to which they had previously rarely been exposed. The talks and discussions became input into the Workshop that followed the Conference.

The workshop

The day three Workshop was facilitated by Craig Salt using the Strategic Conversations™ approach developed by Dr Tony Golsby Smith from Second Road Thinking Systems. Four core questions were addressed in relation to R&D in the grainbelt region of WA during the Workshop:

- Where are we now?
- Where do we want to be?
- How do we get there?
- What do we do next?
The Workshop brought together the essence of discussions over the previous two days on how the grainbelt is positioned and elements and aspirations of a more desirable grainbelt.

Above all, people agreed on the need to improve the balance between social, environmental and economic health. For R&D to be valuable to the future it needs to be: innovative, holistic, integrated, balanced, flexible, collaborative, have a long term horizon, foster on-going learning and attract high leverage. Governments would have clear directions aligned with their constituents, residents would have viable futures, farmers would have prosperity, and the public would enjoy good economic, social and natural capital.

After bringing the threads of conversations over the three days together, the Workshop agreed that some large transitions are needed. Participants agreed on the need to integrate environmental and social drivers better into R&D investment decisions. They also saw that funds providers, researchers and users needed to be less fragmented and brought closer together into a more effective user-focused business model, which is more inclusive of the broad range of stakeholders. This would be aided by a more informed process for R&D investment decision making, and better linkages and coordination between the strategies of the various groups and interests in the region.

From the outset, the Future Broadacre Agricultural Landscapes Conference and Workshop set a high bar. It was premised by the fact that a lot of existing research has short time horizons, with poor continuity and connectivity with other research, and little consideration of its place in the ‘system’ and the user need. It also often fails to balance its contribution to a healthy economy with the needs for a healthy society and environment.

**Outputs and outcomes**

Many participants believed that the diversity of perspectives and discussions had alone been very valuable, and bringing together and focusing many influential and informed minds on research for the grainbelt’s future had a powerful mobilising effect.

Following the Workshop, a TalkBook™ was produced as a record of the conversations on day three and distributed to all participants. A one-page BlueSheet™ was then prepared by Craig Salt as an argument for addressing the question raised at the beginning of the Conference and Workshop. Members of the FBAL Steering and Reference Groups decided that lessons and insights gained from FBAL should be incorporated into other current strategic processes (particularly planning of the Agricultural Research Institute and the prospective Wheatbelt Futures Cooperative Research Centre bid).

FBAL was a worthwhile venture for a broad range of stakeholders for a variety of reasons. The following major benefits have been identified:

**For all stakeholders in the grainbelt region:**

- Increased dialogue:
  - Across sectors
  - Between individual organisations
  - Between disciplines and special interest areas
  - Stretched thinking and broadened perspectives on the future of the grainbelt

**For R&D leaders and administrators:**

- Informed views on the grainbelt, providing valuable and timely input into future strategic decision-making
For researchers and special interest groups:

- Agreement about the need for, and potential benefits from, adopting a balanced approach (i.e. economic, social and environmental) beyond just production
- Agreement that effective partnership between researchers, funds providers and users is needed, and that it should be widely inclusive and transparent in approach
- Catalysed holistic and strategic thinking about the role of research for a more sustainable grainbelt with regional prosperity and sense of place

For conference and workshop sponsors:

- Highly informed thinking about the future of the grainbelt and implications of current trends from diverse points of view. This has been / will be captured in this Proceedings, several journal papers and Workshop report.
1. National and international trends

1.1 Economic trends and drivers affecting the grainbelt of Western Australia to 2035

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Abstract

A majority of the farm businesses in Western Australia remain profitable, with rates of return comparable to non-farming sectors. However, there is continuing pressure on poor performing farms, as well as a range of social pressures, which mean that there will continue to be a steady fall in the number of farms in the grainbelt of Western Australia. Most remaining farms will continue to be profitable, due in significant part to successful R&D. Farms will continue to be highly diversified. We expect the real prices of most agricultural commodities to continue to fall, although we note predictions for meat prices to rise in the medium to long term. Key uncertainties about price trends include: future levels of agricultural protection in developed counties; the levels of price premia for ‘green’ products; the rates of productivity improvement for agriculture in developing countries; and energy prices. Key uncertainties about R&D/technology include the availability of funds for R&D and the contributions of biotechnologies. Use of information technologies will increase, though not as much as some expect, and in some cases driven by shortages of skilled farm labour rather than production advantages. The fundamental elements of managing a farm have altered little, and we do not expect them to change in the next 30 years. Successful farm management will continue to depend largely on good decisions about the farm’s enterprise mix, machinery replacement, land leasing or purchase, labour hiring and off-farm investments. Agricultural R&D should continue to address a diversified portfolio of issues, including attention to environmental issues, but not neglecting the need for ongoing productivity improvements in agriculture.

Introduction

In preparing this paper, we have attempted to maintain an awareness of the pitfalls that await people who speculate about the future. One peril is the certainty that specific predictions beyond the short-term future are likely to be wrong (Freebairn 1975; Godden 1999; McCalla and Revoredo 2001). For example, consider the views, from less than a decade ago, of leading agriculturalists speaking about broadacre agricultural industries in Western Australia.

‘I anticipate there will be 100,000 ha of yellow lupins grown in 10 years time.’ (Cowling 1995, p33)

‘I believe that in 2005 we will be producing no more than 4 million ha of cereals, perhaps 1 million ha of lupins and about 1 million ha of other broadleaf crops.’ (Perry 1995, p96)
‘It is forecast that varieties of *Lupinus angustifolius* [white lupins] will be cultivated on 1.5 million ha before the year 2000.’ (Nelson 1995, p104)

The actual outcomes for 2003 were around 30,000 ha of yellow lupins, 6.35 million ha of cereals, and 0.51 million ha of white lupins. The intended time frame for this paper is 30 years, so we approach the task with high expectations that at some future time our speculations will also be used to illustrate the how wrong one can be.

The second trap for writers on the future is the temptation to cover the full diversity of issues that will affect the future. We recognise that there is a diversity of potentially relevant issues, but we have attempted to retain a relatively narrow focus, based around factors that do and will affect the business decisions of farmers.

The paper begins with general background on broadacre agriculture in Western Australia, and then discusses likely drivers of change in the future. Changes that currently appear relatively likely are suggested. The paper ends with discussion of some implications for agricultural R&D.

**Background on broadacre agricultural businesses in Western Australia**

**Profitability and farm numbers**

A majority of the farm businesses in Western Australia remain profitable (BankWest 2003). For example, in spite of the poor seasons in 1998, 2000 and 2002 in many agricultural districts, farm businesses in the broadacre region of Western Australia averaged a rate of return to capital of around two percent over the period 1998/9 to 2002/3 (BankWest 2003) (e.g. see Figure 1.1.1). The top 25 percent of farm businesses averaged a rate of return to capital of 8.1 percent over the same period.

![Central Agriculture region - Annual rate of return compared to inflation rate.](image)

Figure 1.1.1. Farm businesses’ average rate of return to capital in the central agricultural region¹: 1989 to 2002. (Source: Based on ABARE farm survey data.)

¹ This region contains 3124 farm businesses and the data in this figure are based on an annual sample of 50 farms.
Carroll (2003) has compared the relative capital gain of an investment in farmland compared to one in listed property trusts or a diversified share portfolio represented by the all ordinaries index. He found that for the period 1987 to 2002 the compound growth for farmland value was 5.1 percent per annum compared to a compound growth of 2.9 percent and 5.4 percent per annum for the listed property trusts and the all ordinaries index respectively. Hence, on capital gain alone investment in farmland is a relatively attractive investment.

Although Carroll used national data, local ABARE farm survey data (e.g. ABARE 2003) and Valuer-General data show that broadacre farms in Western Australia achieve average rates of capital appreciation typically between 3–7 percent per annum. For example, the shires of Merredin, Moora, Perenjori, Narrogin, Kojonup, Dumbleyung and Esperance (Scadden zone) shown in Figure 1.1.2 have recorded compound growth rates in farmland values of 5.1, 6.1, 6.5, 3.2, 4.0, 4.2 and 5.9 percent per annum respectively over the period 1985 to 2001.2

![Land values in key shires](image)

Figure 1.1.2. Land values in key shires in the broadacre region of Western Australia: 1985 to 2001 ($/ha). (Source: Based on data supplied by the Office of the Valuer General.)

Although broadacre farming in Western Australia has been profitable for most businesses, there has been a slow but steady decline in the number of farm businesses operating (Figure 1.1.3). There are now around 6030 farm businesses in the broadacre (wheatbelt) region (ABARE 2003). The bottom quartile of farm businesses are under sustained financial pressure and many of them will eventually leave the industry (Alexander 2002). BankWest (2003) data show that the bottom quartile of broadacre farm businesses in Western Australia generated a rate of return to capital of -4.9 percent per annum over the period 1998/9 to 2002/3. Average equity for this group was 82 percent, so if they are forced to sell up, most have sufficient equity to ease the family’s transition.

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2 Based on fitting an exponential growth curve. $R^2$ values for the 7 shires ranged from 0.51 to 0.88 and were mostly above 0.65.
The other main driver of farm sales is a lack of family members seeking succession of the farm business.

The distribution of wealth and size of farms is highly skewed. Grain delivery data reveal that around 14 percent of grain growers deliver over a third of the State’s grain and that a quarter of grain growers deliver over 54 percent. Similarly, over the period 1997/98 to 1999/2000, WoolDesk data reveals that approximately 14 percent of woolgrowers in Western Australia produced half of the State’s wool.

Increasing farm size increases the demands on farm management. So too do increases in the range of crop types, crop management methods and animal breeds now available. The resulting tendency is for farming systems and farm businesses to become more complex, requiring more sophisticated management or at least greater reliance on advisory services.

**Enterprise diversity**

Most broadacre agricultural businesses engage in a portfolio of enterprises. There are number of factors that influence this diversity, and all of these will operate into the future.

1. Product complementarity can increase the benefits of diversification. Examples of positive interactions in broadacre farming include nitrogen supplied by leguminous pastures or crops to following cereal or oilseed phases; the disease and weed break advantages that one phase of a rotation bestows on a subsequent phase, and the wind-break and shelter benefits for livestock provided by tree belts (Morrison et al. 1986; Pannell 1987).

2. Most farmers are averse to risks (Bardsley and Harris 1987; Bond and Wonder 1980), and diversification can be an effective risk management strategy (Samuelson 1967), although in Western Australia this is probably a less important driver of diversification than the other factors described here (Pannell et al. 2000).
3. Land heterogeneity results in certain enterprises being agronomically better suited to different parts of the farm landscape.

4. Fixity of some farm assets, at least in the short run, restricts the profitable range of selection of some enterprises and thereby encourages diversification. For example, a farmer with relatively small machinery (and hence a relatively long seeding program) may find that the lower yields obtained for later sown crops are insufficient.

The trend to increasing farm size tends to reinforce the last three of these factors in their influence on diversification.

Diversified farm businesses in Western Australia have proved resilient and profitable. Diversity has enabled businesses to cope with variation in climate and to capitalise on changes in the relative prices of agricultural commodities. It has enabled generations of farmers to be equipped with a range of management skills, created flexibility and supported entrepreneurial action. These positive outcomes are likely to continue and will encourage farm businesses in the future to remain mostly characterised by enterprise diversity.

Notwithstanding its size, success and focus on external markets, the region’s agricultural industry is only a minor contributor to world agriculture and commodity trade. The region produces less than one percent of the world’s wheat, less than six percent of the world’s apparel wool, and less than one percent of most other major products such as sheep meat and canola. For this reason, farm businesses in the region may be able to exploit niche markets at times, but in general they will be price-takers on international markets.

What will drive farm-level decisions?

Prices and costs

Prices for freely traded commodities are determined by the balance between international supply and demand. Globally, demand for agricultural products has risen steadily over time, reflecting increases in population and wealth but, in general, increases in supply have been even more pronounced, so that over the long term, the ratio of output prices to input costs has tended to fall (Figure 1.1.4). This phenomenon is variously referred to as the ‘cost-price squeeze’, declining terms of trade since, or falling real output prices. The trend is a decline of around 2.2 percent per annum.
There have at times been predictions that this long-term trend had run its course and would soon be reversed, but so far all such predictions have proven wrong. With moderation in world population growth now evident, continuing technological progress in developed countries (e.g. biotechnology), and evidence of improving agricultural productivity in many parts of the developing world, we judge that continuing declines in real prices of agricultural commodities over the next 30 years are likely. This creates an imperative for continuing productivity improvements (see next section) to ensure the ongoing economic health of broadacre farming.

If there are real price increases, they appear most likely to occur for meat products, in response to increasing demand in developing countries. For example, CIE (2001) predicts the following increases in meat prices by 2020: beef 72%, sheep 33%, pork 27%, and poultry 6%.

Apart from the general trend and fluctuations in different prices, in recent decades there have been several key changes in markets and marketing that will have an enduring impact on broadacre agriculture.

- Increased segregations for grain crops, especially wheat. New segregations (e.g. Australian Soft, Australian Noodle, Shochu barley, Hi-Pro lupins) based on end-user requirements were introduced along with payments for protein.
- Increased price volatility for many farm commodities. With the collapse of the reserve price scheme in 1991 and cessation of the guaranteed minimum price scheme for wheat, price risk management now has an increased importance for many farmers.
- Greater deregulation of commodity marketing. Deregulation of domestic grain marketing and opportunities for licensed exports of grains have increased the number of players in the marketing of grain produced in the broadacre region.
- Establishment of substantial export markets for live sheep. In the 1970s export markets for live sheep emerged. Despite some disruption of the trade to Saudi Arabia, the live export trade has grown, with 3.2 to 4.3 million head being exported annually over much of the last decade. The live trade accounts for around 50 percent of the State’s sheep turnover.
Greater retail and consumer concerns about food safety and increased demands for quality assurance in production, processing and distribution of commodities (Focused Management 1998; Grain Pool 2001, 2002). For example, chemical residues in wool, meat and grain and the hygiene status of meat products became topical concerns at various times, reflecting the heightened requirements for food safety. The increased emphasis on food safety, quality and identity preservation is leading to an increased use of contracts in farm production. As a result farmers’ production options and management regimes are increasingly prescribed.

A shift in market focus towards Asian and middle-east markets.

We identify the following main unknowns in the area of prices and costs over the next 30 years:

- Whether there will be substantial progress in reducing agricultural protection in Europe, the US and Japan.
- Whether the trend towards greater environmental awareness among consumers will translate into price premia for ‘green’ products that are sufficiently large to affect production decisions.
- The rate of development of agriculture in developing countries. If there is an acceleration of progress, there will be further downward pressure on prices.
- Changes in energy prices. Dunlop et al. (2004) note that, ‘Evidence suggests that in the coming decades oil consumption will overtake global oil supply capacity.’ Will comparable energy sources become available at comparable cost? Will agriculture be a source of bioenergy?

Yields, new technologies and productivity

Broadacre farmers in Western Australia have experienced particularly high levels of productivity growth in grain production compared with producers from many other regions, with average per grain farm productivity growth of 3.5 percent per annum, over 21 years up to 1998–1999 (Ha and Chapman 2000).

Improvements in productivity may arise through technological advances, improvements in management and through exploiting economies of size. Major technical advances in the last two decades have included the following:

- There has been an increasing array of herbicides, reducing the need for tillage, and improved spray technologies supporting the earlier sowing of crops. However, the problem of herbicide-resistant weeds, not initially anticipated (Perry et al. 1980), became important in the 1990s.
- New crop and pasture options and varieties have become available over the past three decades. These include high-yielding wheat varieties suited to a range of season lengths and market classifications (e.g. noodle, hard and soft) new crop types, (e.g. canola, lupins, field peas and faba beans) and new legume pasture species (medics, serradellas, clovers and subterranean clover selections) (Nichols and Nicholas 1992; Nutt and Paterson 1998; Nichols 2004). Tagasaste became more widely grown, particularly in the West Midlands and lucerne has gained greater acceptance in recent years (Bennett et al. 2004).
- Improvements in farm machinery for tillage, spraying and harvest have increased the ease and efficiency of many farm operations. Farmers have invested in larger machinery with work rates that offer economies of size and have markedly increased their capacity to store grain on farm. Interest in controlled traffic technology also has emerged over the last few years (Blackwell et al. 2004).
• Improved communications (fax, mobile phone, internet) and computer technology have increased the speed and range of information received by farmers.

• A greater variety of sheep breeds (Awassi, Damara, Dorper) are now grown and are preferred to merinos in some markets.

The crucial role that increasing productivity plays in the economic viability of agriculture is starkly illustrated in Figure 1.1.5. It shows that, at the national level, productivity growth has approximately cancelled out falls in real prices since 1953. Accumulated productivity improvements since 1953 now constitute most of the gross value of production for agriculture.

![Figure 1.1.5. Gross value of agricultural production (GVP), showing that portion due to accumulated productivity improvement. (Source: Mullen 2002).](image)

Among current efforts to develop agricultural innovations, those of the CRC for Plant-Based Management of Dryland Salinity appear particularly significant. If successful, they will initiate a significant shift towards the production systems based on new perennial plants (pastures, shrubs, trees and possibly grain crops), partly replacing existing annual plants which currently dominate agriculture. They will also provide improved options for production on salt-affected land, which is forecast to continue to increase in extent. How successful the CRC is in moderating productivity loss due to salinity remains to be seen.

Another prominent environmental concern is climate change. Change in rainfall has already been detected for south-west Western Australia. Forecast further changes include the following:

• Decreases in rainfall in autumn and spring. Increased evaporation. Shorter growing seasons.

• Warmer winters and springs. Higher CO₂ concentrations, increasing crop yield in some seasons, but perhaps decreasing grain protein.

• Rising temperatures. Changes in heat or chill accumulation and the frequency of temperature extremes. Reduced risk of frost. More hot days during grain filling could reduce yields.

• Impacts on on-farm water storage. More intense, but less frequent, rainfall. Need to increase storage capacity.

• More frequent extreme weather events (e.g. consecutive days of extreme heat, extreme thunderstorms).
• Altered risk from insect pests, weeds and plant diseases.

Of course, given the uncertainties of climate change, the precision of such predictions is necessarily low. Given that the predicted onset of climate change is gradual, incremental technological improvement and plant breeding improvements will lessen the severity of many of the impacts on agriculture.

Other key unknowns in this area over the next 30 years include the following:

• Funding levels for R&D. There is some doubt as to whether the Australian Government will continue to match R&D funds levied from farmers. It is conceivable that there could be dramatic reductions in the level of funds offered through the existing rural R&D corporations, perhaps with major changes in the number and operation of those corporations.

• Biotechnology. Notwithstanding its relatively modest impact so far, there may be dramatic breakthroughs in the application of biotechnology. Whether the current public resistance to biotechnology continues in Australia will probably depend on the nature and advantages of any future breakthroughs.

Policy

We have discussed policy changes in relation to marketing bodies and a potential change in R&D funding. Another area where policy may change is in relation to environmental issues. There is a well-documented tendency for rising living standards to result in greater emphasis on environmental concerns, and this trend appears to be playing out in Australia, at least over the long term.

There is plenty in agriculture to concern those who are sensitive to the environment, including:

• dryland salinity (Ferdowsian et al. 1996; National Land and Water Resource Audit 2001)
• loss of soil structure (Howell 1987)
• soil acidity (Glencross and Clarke 1984; Porter and Wilson 1984; Dolling and Porter 1994)
• water-repellency of some soils (Blackwell 1993)
• waterlogging (Bligh et al. 1983)
• wind erosion (Marsh and Carter 1983), traffic hard-pan (Bowden and Jarvis 1985)
• deterioration in remnant vegetation (Hussey 1993)
• nutrient run-off causing pollution problems (Yeates et al. 1984; Prout 1993)
• Western Australian agriculture contributes approximately 32 percent of State emissions of greenhouse gases, due primarily to livestock and burning of savannah and temperate grassland
• loss of biodiversity. Among OECD countries, Australia has a relatively high percentage of threatened mammals and a high number of extinct or threatened plants. Land use change for agriculture has caused nearly 90 percent of temperate woodlands and mallee to be cleared.

Efforts to enhance the environmental performance of agriculture through the National Landcare Program, the Natural Heritage Trust and the National Action Plan for Salinity and Water Quality have been criticised on various grounds, including their failure to deal effectively with the more substantial of the above issues. One can easily imagine social and political pressures for a further raising of the environmental standards expected of agriculture. Resulting policy tools, whether
positive (subsidy based) or negative (penalty based), if substantial enough, could play a major role in shaping future agriculture.

On the other hand, the cost of dealing comprehensively with the above set of environmental issues would be many times greater than the public funds currently available through the main policy programs. It may be that public funds continue to play a marginal role in protecting or enhancing the rural environment. We would not be surprised to observe this. We also do not expect a dramatic increase in environmental regulation governing agriculture. The economic and social costs to rural areas would be so high that the political costs seem likely to outweigh the political benefits.

**Personal and family goals**

A number of factors have contributed to the exodus of families (both farming and non-farming) from rural areas. Most farm businesses continue to be owned and operated by farm families. However, farm families have needed to make decisions from which they hoped to benefit financially. Among these decisions have been those involved adoption of labour-saving technologies and increases in farm size that together have reduced opportunities for on-farm employment and reduced the number of farm families. Further, the dominance of agriculture in the broadacre region has meant limited employment opportunities outside of agriculture in the region.

Rationalisation of government services in rural regions has further lessened employment opportunities, and this, combined with the decline in agricultural employment, has fuelled depopulation pressures in many inland rural areas of Western Australia. For example, on the national scale, total employment in small inland towns dependent on agriculture declined by 7 percent from 1986 to 1996 (Garnaut et al. 2001).

Other factors contributing to the exodus of labour from rural areas include:

- lower average earnings in inland regions relative to metropolitan regions (Garnaut et al. 2001)
- much less industrial diversity compared to metropolitan regions (Hogan et al. 1999)
- lower educational opportunities for children in rural areas.

Countering the social, economic and government policy pressures that encourage depopulation is extremely difficult. Attempts to reverse a local decline can often be at the expense of some other adjacent region.

One observable trend is for some farm families to reside in metropolitan areas or large coastal regional centres, with the farm manager commuting to the farm for only part of each week. Perhaps this trend will increase if inland rural areas continue to become less attractive places for families to live.

A further consequence of lower rural populations is likely to be even greater difficulty in delivering environmental outcomes that are not closely linked to production benefits. The traditional reliance on voluntary contributions to environmental protection is less tenable as the resident population falls.
Some speculations

After examining the views of various futurists and findings of management studies (e.g. Coates et al. 1998; Karpin 1995; Coopers and Lybrand 1995a 1995b; Kohl 2001), Kingswell (2002) concluded that in coming decades broadacre farming is likely to become characterised by:

- fewer, larger farms and fewer people employed directly in farming
- maintained diversification of farm businesses (cereals, pulses, oilseeds, pastures, livestock, fodder shrubs, perennials and off-farm investments)
- agricultural commodity prices continuing to decrease in real terms (Pinstrup-Andersen and Pandya-Lorch 1998; Tweeten 1998)
- more volatile agricultural commodity prices (Tweeten 1998)
- increased demand for and supply of animal feeds
- continued production growth from yield improvement and an increased proportion of the landscape sown to crops (grain and fodder). Biotechnology, particularly in the plant sciences, will underpin productivity improvement and new product development. Market acceptance of many biotechnologies, now negative, will improve with emergence of plants offering environmental and health benefits
- changing dietary patterns, increasing incomes and shifts in population structures in many countries will be increasingly important market drivers
- broadacre farming will maintain its emphasis on exports, productivity improvement, and product and market development. Farmers will continue to invest in improvements in technical and scale efficiency, and pursue input and product innovation
- participation in supply chains as an equity partner as well as a raw product supplier will be an emerging option for farmers
- the relative importance of agriculture in the nation's economy will continue to decline
- greater commitment to sustainable farm practices due to regulatory and market incentives
- greater emphasis on quality assurance, production certification, identity preservation, environmental amenity, supply chain management and food safety
- risks surrounding contract and marketer relationships and changes in consumers' perceptions of food health, safety and environmental impacts will become more prominent
- greater use of contract services by farmers (e.g. machinery management, plant and animal health services, information management services, labour training and management)
- greater separation of land ownership and land management
- increased difficulties in gaining access to reliable and skilled labour will see further use of labour-saving technologies, in-built skilled technologies, robotic and intelligent technologies
- greater dependence on electronic technology (AFMS 1997) and electronic management
- effects of climate change largely addressed through incremental technological improvement and plant breeding.

The combination of high equity of many farm businesses, smaller family size, family break-up pressures and more investment choices outside the business, means a fine balance will have to be
maintained regarding the financial and social viability of the farm business. Tensions between the achievement of financial and social goals will prompt some farmers to leave the industry. Others will adapt in an attempt to achieve both ends (e.g. fly-in-fly-out farm management).

Future farm management may depend to an increasing extent on sophisticated information technology. However, on the basis of history, we suggest that change in this direction will not be as great as some expect. As Malcolm (2000, p. 40) observes: ‘A glance through history suggests that in the most important ways, the fundamental elements of managing a farm has altered little.’ Successful farm management will continue to be dependent largely on good decisions about the farm’s enterprise mix, machinery replacement, land leasing or purchase, labour hiring and off-farm investments.

**Implications for Research and Development**

We suggest that the foregoing discussion has the following key implications for agricultural R&D in Western Australia:

- A healthy R&D sector remains crucial for continuing productivity improvements to ensure the ongoing economic health of broadacre farming. If agriculture retains its levy-based investment in R&D with matching government funds, agriculture is likely to maintain a flow of innovation and knowledge that will assist it to remain successful.

- The combination of increasing farm sizes, social pressures for farm families to reside off-farm, and lower availability of skilled farm labour will reinforce the benefits of labour saving technologies. The main benefits from automated precision agriculture systems may be from a labour saving perspective. This insight may influence the direction of R&D for precision agriculture.

- Our discussion has conflicting implications for the relative emphasis on cropping and animal production. Social and employment trends and ongoing yield increases will tend to encourage increases in the area sown to crops. On the other hand, environmental pressures, new pasture types, and perhaps long term trends in meat prices may encourage animal production. R&D should not attempt to focus on one area but should continue to address cropping, animal production and animal feed production.

- Increased farm sizes, increased enterprise diversity and increased use of advanced technologies have added to the complexity of farm management. R&D that can moderate or help to deal with this complexity will be highly valued.

- The community’s attention to the environment with be maintained or increased. R&D to develop new systems and technologies that are both profitable and environmentally beneficial will remain of high importance. Research to support regional planning and decision making for environmental works will also remain important.
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1.2 Futures for the wheatbelt—is 2030 already here?

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Introduction

This paper presents five significant issues; growth, diversification, education, leadership and skills, which when discussed as signposts to trends, enable an understanding of potential futures for the Western Australian Wheatbelt. The question underpinning our discussion today is: Will there be a rural landscape in Western Australia in 2030?

While this may be a confronting question—it is nevertheless one that needs to be asked. There are some signposts that appear to show a diminution of the importance of rural Australia, and a continued growth in metropolitan settings. The reality is that few Australians who live in cities now have much connection to the bush beyond a romantic, utopian yearning, which may manifest itself with the purchase of clothing, or the occasional foray into a bed and breakfast experience. A sustainable future for the Wheatbelt needs to have more than simply a ‘tourist experience’ but should include broadacre primary production as its foundation.

This paper will pose some of the identified meta-trends as challenges for further consideration. Using the broad areas identified as our framework—we pose a series of questions:

- Is growth the answer?
- Is diversification possible?
- Are we (re)building the necessary skills base?
- Will education be enough?
- Whose leadership?
- Is 2030 already here?

Global trends together with domestic policy decisions have had a significant impact on sustainable regional development of the Western Australian Wheatbelt in the last several decades. In addition, policy decisions in the past two decades in Australia have included: fiscal restraint by government; minimising public expenditure; increased use of market forces rather than government intervention to drive change; and devolution of responsibilities and functions from governments to the private and community sectors.

Our snapshot of the Western Australian Wheatbelt as a result of these policies shows it:

- To have limited industrial diversity, meaning that the regional economies are heavily influenced by the health of the agricultural sector.
- To have experienced significant effects in the quest for economies of scale. This and sophisticated technology demand that rural businesses be located in a high volume urban centre with access to a wide market, which works against the local garage and family grocery store.
• To be challenged by the impact of neo-liberal trade and government policies and consequently working hard to adapt and achieve a competitive edge

• To be ageing with fewer young people entering agricultural industries to take the place of ageing workers.

• To have an overall population increase, which is uneven across the region, as absolute population, growth tends to be along the coastal fringe, and in the key regional urban centres such as Narrogin and Northam or those commuter belt towns such as York and Toodyay, which are only an hour from Perth.

• To be potentially environmentally compromised by intensive farming, fragile soils, encroaching salinity, increasing incidence of soil acidity, changing climatic patterns and increasingly chemical resistant weeds.

Given this context, we would argue that the globalisation of trade and economic activity is increasingly testing the people of the wheatbelts’s ability to adapt and achieve a competitive edge.

Is growth the answer?

Let us first challenge the presumption that growth is necessarily good. As noted by Hamilton, (2003) ‘nothing more preoccupies the modern political process than economic growth. As never before, it is the touchstone of policy success. … High growth is a cause of national pride; low growth attracts accusations of incompetence …’. It is assumed that growth will solve unemployment, provide infrastructure, enhance everyone’s lifestyle and provide widespread wealth. But has growth done all of that for the other regional areas now experiencing growth such as such as Chittering, Gin Gin, Northam and Narrogin? At what level is growth is enough?

Burnley and Murphy (2004, p. 219) suggest that

… growth in itself is not intrinsically any more of a problem in non-metropolitan localities than it is in cities. Rather, it is the way in which it is managed, and the technical, professional and political capacities of those charged with managing it, that matters.

The management of growth demands particular skills of local government in particular and planning for growth needs to occur before the growth occurs. There are inevitable tensions and the issues are inter-related and complex. These are tensions between our now familiar ‘triple bottom line’ approach to the future. But Burnley (2003, p. 269), reminds us that ‘while environmental protection should be the principal goal in Australia, and not subordinated to unfettered economic growth, human survival is also crucial’.

With growth comes a raft of other challenges including pressure on the environment, increased demand for a wide range of infrastructure and its continued maintenance and supporting a range of viable economic enterprises. There are likely to be a range of social issues that come with growth. Inevitably, where an economy appears to be growing, income polarisation and the gap between the wealthy and the poor in fact widens as an economy grows. Perhaps the most stark example was the United States economy in the 1980s: while the economy grew, those at the bottom saw their real incomes decline (Stiglitz 2002). Clearly, growth does not necessarily improve the lives of all people.

For those communities where growth has accelerated in the last two decades it can be seen that an entirely different ‘community’ has been grafted onto the original farming community. Many of these ‘newcomers’ have different social and even industry strengths and ambitions that can create potential dissonance. For example, ‘hobby farmers’ view the agricultural business in an entirely different way
to large-scale broadacre farmers. ‘Seachangers’ are usually a highly diverse socio-economic population with a wide income polarity and varied infrastructure demands. The wealthier ‘seachange’ cohort tend to congregate in coastal areas or places such as the Avon Valley which boast ‘environmental amenity’ but as noted by Burnley and Murphy (2004, p. 230), the ‘price inflation resulting from the influx of money from the cities has negative implications for affordability’, particularly for cheaper housing. Retirees are usually on a fixed income and are unlikely to invest in the community beyond the purchase of their home. They also can have a range of health needs that can ultimately be a drain on the local community (see Haslam McKenzie and Johnson 2004).

The challenge of demographic changes

The Wheatbelt has the most widely dispersed population in the State (Regional Development Council 1999) with people scattered throughout in mostly very small communities. The average density of people per square kilometre for the region stretching from Esperance to Greenough is not quite 0.5 people per square kilometre (Australian Bureau of Statistics 2004). Overall however, the population of the southern half of Western Australian (excluding the metropolitan area) has increased by 179 percent between 1961 and 2001. Similarly, the Wheatbelt region has also increased its overall population since 1961 (see Table 1.2.1). Such increases in rural population have often been used by politicians and regional planners as evidence of growth, vibrancy and perceptive planning in rural regions. However, when the Statistical Sub-divisions are analysed, it clear that the increase in population has not been uniform, with a number of coastal Statistical Sub-divisions showing a significant population increase while most of the inland Sub-divisions have experienced very marginal growth or depopulation (Salt 2004). Those divisions that have experienced growth have several features in common. All have coastal subdivisions and those statistical divisions with Statistical Local Areas adjacent to the capital city, Perth, also experienced substantial growth due to Perth’s urban sprawl.

Table 1.2.1. Wheatbelt population change 1961–2003

<table>
<thead>
<tr>
<th>1961</th>
<th>2001</th>
<th>% diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geraldton*</td>
<td>34 081</td>
<td>31 088</td>
</tr>
<tr>
<td>Greenough River</td>
<td>24 081</td>
<td>14 700</td>
</tr>
<tr>
<td>Moore</td>
<td>7 341</td>
<td>14 008</td>
</tr>
<tr>
<td>Johnston**</td>
<td>5 809</td>
<td>15 928</td>
</tr>
<tr>
<td>Hotham*</td>
<td>19 086</td>
<td>13 885</td>
</tr>
<tr>
<td>Campion</td>
<td>15 937</td>
<td>10 875</td>
</tr>
<tr>
<td>Lakes</td>
<td>6 505</td>
<td>4 677</td>
</tr>
<tr>
<td>Avon*</td>
<td>20 099</td>
<td>28 277</td>
</tr>
<tr>
<td>TOTAL</td>
<td>132 939</td>
<td>133 438</td>
</tr>
</tbody>
</table>

# Statistical Sub-division includes coastal locations
* Statistical Sub-division includes regional town ‘sponge town’
** Statistical Sub-division includes population influenced by mining development (Source: Australian Bureau of Statistics 1961, 2004)

1 The word ‘seachange’ (or words sea change) have become important in the Australian vernacular, underscored by the ABC series of the same name. It has come to represent people wanting to escape the city to pursue Arcadian, nostalgic or alternative lifestyles.
It has become a truism now to say that the average age of the average farmer in Australia is hovering around 60 years and that the age structure of persons employed in agriculture is significantly different from that in other industries. According to the 1996 Census of Population and Housing, the median age for all persons employed in agriculture was 44 years, substantially higher than 38 years for all persons employed in all industries. The median age for males employed in agriculture was 43 years; for females it was 46 years. Both were higher than in all industries combined (males 38 years, females 37 years). The upward movement in the median age of farmers reflects fewer young people entering agriculture to take the place of ageing workers. In the early 1950s almost 11 percent of persons employed in agriculture were under 20; 21 percent of males and 15 percent of females employed in agriculture were aged 20 to 29. By the mid 1990s these proportions had fallen to 16 percent and 11 percent respectively. At the other end of the age scale, the proportion of males aged 60 and over had gone from 13 percent at the 1954 census to 17 percent at the 1996 census, and for females from 14 percent to 16 percent (Pollard 2001).

Nationally, the five communities leading the exodus are all in the Western Australian Wheatbelt, and, of these, three are in Campion, (Nungarin, Westonia and Mount Marshall) (Salt 2001). It is important to note that analysis of the demographic data in the Western Australian Wheatbelt shows that the number of men and women has decreased overall in the last 45 years but the number of women has decreased at a slower rate than that of men. This depopulation trend has occurred against a backdrop of a declining farm labour force generally throughout Australia, and of men particularly on farms. It remains difficult to accurately ascertain the changes in female participation rates (Elix and Lambert 1998; Standing Committee on Agriculture and Resource Management 2001) in the agricultural sector because, in the past, census statistics have not always been gathered in a way that properly accounts for farm women (Haslam McKenzie and Lord 2002) and their work.

There are a number of environmental reasons that are likely to limit the density of people able to live in region. This should be seen in the broader picture of the impact of climate change in Australia in the next century (Stehlik 2003). For example, the availability of potable water is limited to rainfall and this has been reducing over the past 20 years. Already, some towns are at risk of extensive infrastructure damage resulting from rising water tables (Department of Agriculture WA 2001) and soil acidity affects two thirds of the Wheatbelt (Frost, Hamilton, Lloyd, and Pannell 2001).

A negative population trend in an already sparsely populated region causes noticeable social changes. Population losses associated with agricultural restructuring have reduced the demand for services, eroded local government employment opportunities and undermined the viability of many local social institutions. When regional populations are steady or declining there is less reason to look beyond the larger centres for outlets and more reason to rely on advertising to draw people to the larger centres. People in outlying areas are forced to travel, concentrating demand at a few centres.

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2 A survey conducted in 1999 (Regional Development Council, 1999) shows that regional Western Australia is highly mobile and that only 16 percent of all respondents had grown up in the area where they now lived. This is consistently supported by Australian Bureau of Statistics and particularly for non-metro residents (Australian Bureau of Statistics, 1996, 2001, 2003, 2004). The trends show that more than half of non-metropolitan residents had been in the current region for 10 years or less and a third for five years or less. The survey suggested that about a third of people who move to the regions come from Perth and a quarter from overseas or interstate. The remainder move from within their current region or from another Western Australian region.

3 Up until the 1996 census women were not formally counted as rural workers. Ironically, just before some Australian women became among the first in the world to get the vote more than one hundred years ago, the government decided to officially ‘hide’ the fact that women laboured in agriculture, fearful that this would send the wrong message ‘home’ to England about the industry’s viability in Australia (Lake, 1987). When formulating census categories, government officials decided not to classify farmer’s wives as engaged in agriculture because of the shame it would bring on a progressive developing country like Australia to admit that “women were in the habit of working in the fields as they are in some of the older countries of the world” (Lake 1987, p. 179). For these reasons it is difficult to properly ascertain the number of women working on farm enterprises.
A constant concern for all rural entrepreneurs is the escalating cost of time, transport and processing. While larger farms are able to survive more easily in the current economic circumstances, there does appear to be a trend developing towards larger production units at one end of the spectrum and smaller, poorer operations at the other (Dore and Woodhill 1999; Garnaut, Connell, Lindsay, and Rodriguez 2001). As noted by Jones (2001), the Western Australian State Planning Strategy (Western Australian Planning Commission 1997) acknowledged the problems associated with service delivery over such a large area with a persistent depopulation trend, but offered little in the way of suggesting useful solutions to the problems. As service provision changes, the local population inevitably accesses services in the larger centres, and usually takes its custom for other goods and services to the larger centres to save time and sometimes money making it very difficult for the smaller towns such as Brookton and Pingelly to remain economically and socially viable.

Is diversification possible?

Beer, Maude and Pritchard (2003) recognize the inherent challenges for relatively remote places such as the Wheatbelt and advocate the ‘virtual cluster’ whereby firms are linked in collaborative relationships across regions (and even nations) through information technologies. Several local governments are working hard to attract light industry to their towns but expensive infrastructure issues need to be dealt with before that is likely. An example of this is the supply of suitable power supplies. Traditionally, the purpose of regional towns has been to service the farming sector and the power supply infrastructure reflects that role. The establishment of light industry requires larger power grids and many manufacturing entrepreneurs shy away from a town with only a single line of electricity. The development of non-agricultural specific industries shifts the dependence of a rural community away from agriculture, as noted by Sher and Sher, (1994, p. 15), addressing OECD recommendations in 1991 (Organisation for Economic Co-operation and Development 1991), who commented:

Failing to understand and accept the fact that future viability for rural areas cannot come from the agricultural sector alone diverts attention from more productive, longer term approaches to promoting vitality through rural development policies designed explicitly for that purpose. It leads to unrealistic expectations for agriculture policy reform, which is a barrier to its adoption. To the degree that public spending on agricultural policy is intended to promote the well-being of rural areas rather than sectoral purposes, much of it will be used ineffectively or create additional distortions in agriculture in a vain attempt to address broader economic development needs. Only broader, more forward looking rural development policies with an appropriate role for agriculture can assure a better rural future (our italics)

For these ideas to be developed into reality then some serious infrastructure modifications would have to be made that would ensure reliable and affordable information technology hardware and competent service providers. The nurturing of regional linkages and development of local business clusters has the potential to provide firms and markets with degree of economy of scale and scope. The notion of agglomeration and regional clusters has been a popular approach in regional development (Beer Haughton and Maude 2003; Beer, Maude and Pritchard 2003; Porter 1998) for some time, with some notable, but small Australian successes (for example, surf wear cluster in southern Victoria, food processing in Shepparton, Victoria and biotechnology in Melbourne and Adelaide). The latter examples demonstrate that the development of niche or boutique markets is not necessarily limited to agricultural production.

As Australia became an active member of the global economy and less tied to traditional European markets, there was increasing pressure on farmers to be market-driven and ever more efficient to meet the challenges of globalisation. Increasingly, policies to protect farmers from global market trends were regarded as not in their long-term interests and in any case were becoming difficult to maintain in a small economy.
International trends drove many of the challenges and, it can be argued, caused significant changes in regions such as the Western Australian Wheatbelt, where there is limited industry diversity and considerable economic and social dependence on broadacre agriculture. As a result, farmers were amalgamating farms and farming bigger acreages to take advantage of economies of scale, thereby decreasing the number of people living in the region.

Judging by the World Trade Organisation talks regarding further liberalisation of world trade, it seems likely that agriculture will become a less and less important component part of the economy in all Western countries (Monk 2000) as technology and service industries continue to flourish. Successive Australian governments, particularly since the early 1980s, have aimed to reposition the economy away from a domestic focus to a fully integrated global economic player situation. The relative importance of agriculture as an export earner for Australia has undergone considerable decline since the 1950s, when it generated 75–80 percent of the value of Australian merchandise exports (Pollard 2001). Australia’s share of world trade has been declining steadily over the last forty years. It halved between 1955 and 1975 from 2.2 percent to about 1.2 percent at a time when great international prosperity, coupled with a growth of free trade sentiments on the part of governments (formalised through GATT), led to a massive increase in world trade (Walmsley and Sorensen 1993, p. 71). While Australia continued to concentrate on primary industry and mining, more successful economies have concentrated on the development of ‘value adding’ particularly in the agricultural sector. Until the 1980s, tariffs or reserved market prices largely protected primary commodities in Australia. Tariff protection, the history of which dates back to Federation, was blamed for Australia’s perceived poor economic performance (Quiggin 1996). It was claimed that ‘Australia would be better off by taking advantage of all available trading opportunities, even if other world markets are ‘corrupted’ by non-competitive trading practices’ (Quiggin 1996, p. 128). It was argued that protection made Australian industries inward looking, complacent and inefficient, but that an outward looking, export oriented economy, would yield dynamic benefits. Consequently, throughout the 1980s and 1990s, the marketing of agricultural produce has been deregulated in line with GATT and WTO policies.

Are we (re)building the necessary skills base?

As has already been established, primary industry production is likely to become less and less important in Western economies. Since white settlement in Western Australia, agricultural production has always been the dominant industry in the Western Australian Wheatbelt and there are limited indications that the region is likely to markedly diversify away from agriculture.

However, there are no signs to suggest that the cost-price squeeze experienced by the agricultural industries over the last two decades is likely to change. Highly competitive global markets operating within a neo-liberal framework will therefore continue to drive producers to achieve greater economies of scale, continuous productivity improvement and innovation. Inevitably, the emphasis will be on highly sophisticated technology rather than the use of labour. There is likely to be consistent pressure on government to have in place important reliable infrastructure tools such as information technology and energy supplies that currently in the Wheatbelt region can be best described as patchy. A recent Avon Catchment Council report noted that ‘higher energy [and fossil fuel costs] are likely to disadvantage Western Australian farmers with relatively energy intensive production systems’ (Economics Consulting Services 2004, p. 2).

Within the Wheatbelt boundaries are two towns that Salt (2001) refers to as ‘sponge towns’. ‘These are towns that are running counter to the broader trend; that are actually growing within broader regions of decline’ (Salt 2001, p. 64). These towns tend to ‘soak up’ populations from surrounding towns and communities because it is to these larger towns that services and key infrastructure are now centred. They do not attract growth, but rather ‘re-arrange’ regional population bases.
Furthermore, if the population statistics of the major town(s) are withdrawn from the division, then that division also shows a depopulating trend. The most conspicuous example of this is Avon. If the commuter belt towns of Northam, Toodyay and York that are only an hour away from Perth and have shown substantial growth are excluded, the population of the Statistical Sub-division of Avon has actually dropped by 12.28 percent. Narrogin is another such ‘sponge town’.

Our analysis also shows that the Wheatbelt is not a preferred destination. This is for a variety of reasons including its hot summers, perceived uninteresting environmental aesthetics and its proximity to Perth. Sophisticated transport and good road networks help export out products but this also can include the movement of people out of the region. However, more recent evidence shows that the provision of health services in regional urban centres such as Northam and Narrogin are an incentive for people to stay or even a motivator for people to move to those places. Specialist medical and education services continue to be a population ‘push-pull’ factor. Employment is the key motivator prompting movement to the non-metropolitan regions, followed by family/marriage influences and then lifestyle.

Therefore to attract qualified men and women back to the region there needs to be a more diverse economic structure and ‘sophisticated economy to provide meaningful employment opportunities for a better educated younger generation’ (Regional Development Council 1999, p. 16). A contradiction of this does however exist. Skilled workers in the agricultural industry are highly sought after and currently there appear limited opportunities to turn this around. For example, demand for shearers and wool classifiers exceeds supply (Hooper 2004; Smith 2004; Trott 2004) and farm organisations have for some time been lobbying the State government to recognise the need for assistance in agricultural training to provide a supply of skilled farm managers, farm business managers, land managers and other skilled workers. An International Rural Student Exchange program has also been in place enabling young international rural visitors fill labour gaps but this is a temporary measure and does not provide long term labour security for the industry. This issue is particularly important if farming is to increase its technological inputs and scale in order to meet global competitive and remain ahead of the cost-price squeeze.

**Is education enough to turn around these changes to a positive future?**

Attaining an education at tertiary and sometimes secondary level often means that the next generation leaves the community, sometimes permanently. Many parents feel their family unit is broken up prematurely as indicated by a farmer from the Campion Statistical Sub-division, ‘if children need to go to Perth for work and education, family ties are broken; it is difficult to keep the family together’. In some cases, those people are lost to the regional community forever, thereby contributing to regional population decline.

It will be interesting to observe how the recent changes announced by the current State Minister for Education extending the compulsory school age to 17 years will be implemented in non-metropolitan high schools. On one hand, the government is rationalising education facilities while on the other hand, there is a requirement for all children to remain in the school system for at least two years longer.

Adult education and vocational training opportunities are very important in an increasingly technical agricultural industry. Once again, the demand for reliable and technically sophisticated information technology infrastructure is likely to be paramount for business and people throughout the Wheatbelt. Adult education and the provision of training are already recognised by many to be a growth opportunity in regional areas. The average age of residents in the Wheatbelt region is currently 38.8 years compared to the State average of 33.3 years. The trends show that the average age is increasing; in 1997, the median age in the Wheatbelt was 34.6 years.
This trend is attributable to young people leaving the region to pursue secondary and tertiary education and less and less of them returning to the region.

This trend has been ongoing since the early 1980s when the State government began rationalising infrastructure, including schools, throughout rural, regional and remote areas of Western Australia. This worrying trend has been recognised by the health sector, where new medical schools aimed at training doctors for rural and remote communities have been established; and in the tertiary sector more broadly, where on-line distance education has made accessibility to further education more possible. Curtin University of Technology, for example, has just opened campuses at Margaret River and the Pilbara, to complement ones existing in Geraldton, Northam and Kalgoorlie. Is this enough? How can we attract young people to rural remote localities or encourage younger people to return to their own communities to live and work and build a sustainable future?

Perhaps even more worrying is the recent data published (Bureau of Rural Sciences 2004) that shows the negative rate of change in the number of youth in the Wheatbelt has decreased more than 10 percent in all local government areas since 1996 except those adjacent to Perth or regional urban centres such as Albany, Geraldton and Northam. While the population trends remain as they are, there are no indications that the government is likely to change the accessibility of schools for people living in the Wheatbelt.

This has interesting flow-on effects. The Avon Catchment Council predicts that the diminution of infrastructure, particularly that which targets young families will increase the incidence of farmer commuting and corporate farming. This is already occurring (see Haslam McKenzie (1999b) and Tonts (2000)) although family farm enterprises still predominate (Australian Bureau of Agriculture and Resource Economics 2001; Garnaut et al. 2001). However, in the past five years there has been increasing recognition that young men are experiencing difficulties attracting women to the region, and consequently finding marriage partners. During a research project conducted in the late 1990s (Haslam McKenzie 1999b) investigating the diminution of infrastructure in the Western Australian Central Wheatbelt the social effects of declining infrastructure, particularly the lack of higher education and job opportunities as well as a dearth of leisure activities for young people in rural communities were discussed (See Appendix a). The *Australian Women’s Weekly* has been running a ‘bush match making’ initiative through their publication for the last two years and SBS Television is due to screen a reality-type TV show in September called: *Desperately Seeking Sheila* which they advertise as a ‘light hearted look at a social serious problem affecting rural areas … the difficulty for men outside the cities to find a partner. … For a lot of guys its hard to develop a business or themselves when they are spending all their efforts trying to find a sheila and its not an option to leave the farm’ (Kent 2004, p. 3).

These social issues are no longer light hearted, but in fact, deep seated with no meaningful short-term solutions and the long-term impact of this scenario has a potential environmental and economic cost. For as long as there have been family farms in Australia, women have been an integral part of the agricultural labour force (M. Alston 1995; Elix and Lambert 1998; Liepins 1995), and this ‘crisis’ reflects their important contribution and how their labour and knowledge are sorely missed. While there have been relatively low unemployment statistics in the region for the last two decades, those who are unemployed and seeking work leave the region and go elsewhere. Importantly, the incidence of under-employment would appear to be relatively high. An issue for many young women, particularly those who have a qualification is the limited opportunity in the Wheatbelt to use their skills and professional experience. This was borne out by a number of reports (Elix and Lambert 1998; Haslam McKenzie 1999b; Haslam McKenzie and Lord 2002; Regional Development Council 1999).

Kilpatrick and Loechel (2004) and others (Falk and Harrison 1998; Kilpatrick 1996; Kilpatrick and Bell 2001; Kilpatrick and Falk 1999) present a forceful case showing the close relationship between the sustainability of rural and regional communities and their industries and the provision of local adult education opportunities.
Their research findings showed that ‘the combination of new knowledge and enhanced social capital provided by learning interactions becomes a powerful tool in helping individuals, businesses and other organisations to manage change, both individually in their own situation, and collectively by working together as a community’ (Kilpatrick and Loechel 2004, p. 9). Their work highlights the need for collaboration and partnerships between businesses, employers, industry groups, training providers, all three tiers of government and community groups in order that skills for relevant industries and communities are up to date and therefore ready for change and new business and social capital opportunities. The use of telecentres scattered throughout the Wheatbelt as well as school facilities enable the dissemination of a variety of training programs. Field days also continue to be a key source of networking and information dissemination. An acknowledgment that field days are no longer a male domain is increasingly evident with the occasional provision of child care and/or women-only field days.

Whose leadership?

For many in small rural, regional and remote communities, survival requires a good knowledge of local networks, time, an understanding of the administration of community projects, knowledge of potential funding sources and the motivation to make a commitment to community development. Where there is a lack of effective leadership, insufficient human and economic resources, a sense of defeatism or apathy (A. Sorensen and Epps 1996; M. Tonts 1999b) or difficult economic circumstances in the community, effective business and economic development is less likely to materialise. Research shows that economic strategies are less likely to succeed if social and community needs are ignored (M. Tonts and Jones 1996).

The push by government for communities to be more self-determining and self-reliant has shifted the focus of community development to local leadership. While populations in the Wheatbelt of Western Australia have continued to diminish over the last thirty years, local leadership has often been confined to an ageing, mostly male few, many of whom have had a long tenure on formal leadership positions. The definition of leadership has undergone a number of historical developments and remains a matter of contention and debate (see Alston 1998a 1998b; Hearn 1992; Mant 1997). Nonetheless, the traditional views of leadership, which focus on individuals in formal positions of power, have been challenged by the view that leadership is more inclusive and has multiple dimensions (Haslam McKenzie and Lord 2002).

Agriculture is an industry in which a great deal of information has been collected over the last decade on the numbers of women in leadership positions. According to Alston, the proportion of women in formal leadership positions may be as low as five percent (M Alston 2000, p. 1) but the statistic is increasing. Women are also playing a more visible role in local government where they are now 25 percent of the elected members through out the country. Research indicates that women’s formal and informal leadership is often critical to the functioning of the agricultural industries and to the broader community (Elix and Lambert 1998; Haslam McKenzie and Lord 2002), but it is only relatively recently that women’s style of leadership is being better understood and appreciated.

It is clear that women have a greater public role in agricultural production and possible diversification models as could be seen during the 1990s (Stehlik, Lawrence, and Gray 2000; Jennings and Stehlik 1999) primarily as a result of the impact of drought. The greater emphasis on keeping good financial records and farm management planning has usually fallen to farm women and their role in agri-politics is increasingly visible (Haslam McKenzie 1999a; Haslam McKenzie and Lord 2002). The recognition of the need to encourage new styles of leadership was underscored when the Court Coalition government established the Rural Women in Leadership course in 1998 as part of the Progress Rural Western Australia programs (more details follows as a case study). This program presented an opportunity for rural women over the age of 40 to examine leadership issues and to learn to effectively manage the many issues facing women in rural Western Australia.
The course offered the women access to training opportunities that would help them to recognise their own skills and support them in their commitment to contribute effectively to their communities and industries. Similarly, programs have been piloted that specifically target young people and minority groups (the ABC Haywire Program and the Western Australian Government Indigenous Leadership program), but there has not been a broad dissemination and therefore limited outcomes for rural regions. Sadly, many of the government programs are short lived or under-resourced, further undermining the long-term benefits, most particularly building resilient capacity.

The changes in global markets and government policy and their subsequent impact on family farms are inter-related. As farms become bigger and more capital-intensive and profits marginal, fewer farmers and their families can afford to devote as much time to the community as they have in the past (Garnaut and Lim-Applegate 1998). The net effect of this is the diminution in the sense of community and perhaps even of the community itself (Stehlik 2001). As governments withdraw services, the onus is on communities to do their work and, together with business enterprises, to offer either the labour or the capital to sustain the communities themselves. Now, the locations of some towns no longer necessarily reflect the historical requirements for which they were established. Nonetheless, many of the communities that have grown around the towns feel a strong sense of place and identity and some resist the diminution of their town and its infrastructure (Stehlik 2004).

It is evident from research (Economics Consulting Services 2004; Haslam McKenzie 2002; Regional Development Council 1999; M. Tonts 1999a) undertaken in the Wheatbelt that an attractive feature of rural life is a sense of community that this also has the potential to enhance the environment and the satisfaction of individuals within that environment. This view supports the work of Stayner (1999), Putnam (1993), Bolton (1992) and many others. As noted earlier, current approaches to regional development emphasise the role of local leadership and communities in attending to their own survival. Some communities have succeeded in responding to the changes while others, mostly smaller communities, have capitulated and disappeared from the map. The development of viable enterprises and vibrant rural communities with the potential to be in command of their economic, social, cultural, and/or environmental situations rather than being victims of the world economy or government policy is the goal of many rural communities.

A leadership case study

One particular State government strategy to develop leadership and less tangible values and goals such as a sense of community and ‘place’ in order to meet the challenges of sustaining and revitalising rural and regional areas of Western Australia was the Progress Rural Western Australia (later shortened to Progress Rural WA) project. This initiative established by the State Coalition government in 1998 endeavoured to meet the challenges thrown up by the McKinsey (McKinsey and Company 1994), Bureau of Industry Economics (1994) and Kelty Reports (Taskforce on Regional Development 1993). These reports emphasised the importance of local economic development in promoting and strengthening economic and job growth through the fostering and development of local leadership. They argued that strengthening regional economies by encouraging local leadership was essential to the growth of the Australian economy and its ability to actively participate in global markets.

Progress Rural WA consisted of seven programs, funded and overseen by a State government department (Primary Industries; Fisheries) but driven and directed by regional community members. The programs were not industry specific, but aimed to capture and build the capacities of rural communities by enabling people to learn about community economic and social development and to be supported in their efforts to develop their communities and regions. By devolving decision-making to communities regarding their future, encouraging community promotion of local attributes and the development of community leadership, the project aimed to facilitate the development of new businesses and the rejuvenation of established businesses to take advantage of previously unforeseen business opportunities.
A government department co-ordinated and part-funded the programs, although participants were usually required to pay a portion, perhaps with some local community contribution, to promote local commitment to a successful outcome.

The subsequent Labour government built on the success of the Progress Rural WA programs but targeted indigenous and the northern regions of the State rather than the Wheatbelt. Nonetheless, the lessons learnt and the strategies established under the Progress Rural WA banner continue to reap benefits in the Wheatbelt. While economic viability was a desired outcome, the Progress Rural WA programs encouraged and valued the less tangible goals such as a sense of community and 'place' which were quite different in emphasis to regional development as it had previously been funded in Western Australia. The programs incorporated the ‘human’ and less quantifiable elements of society, which nonetheless, have been established (M. Alston 2002; Putnam 1995; Sher and Sher 1994) as the difference between quality of life and existence. It was anticipated that devolving decision-making to communities regarding their future, encouraging community promotion of local attributes and the development of community leadership might progress to social and economic capital, thereby rebuilding vigorous and sustainable rural and regional communities.

While the Progress Rural WA initiative did not build the population base in the Wheatbelt it did introduce innovative ideas and new ways of viewing success in terms of regional development (see Haslam McKenzie 2001) including the regional branding initiative. In the past it has not been unusual for local governments to emphasise and protect their power from other local governments and the State government. However, local governments have the potential to link their communities with higher levels of government in developing responses to social and economic problems. As noted by Tonts (1999a), the adoption, success and impact of local development initiatives can vary considerably from place to place. The Progress Rural WA initiatives eroded some of the insecurities felt by individual shire councils and their members. With the input and support of graduates from the various Progress Rural WA courses, local governments and communities have been able to adopt a more constructive and co-operative relationship, particularly in the Central Wheatbelt shires. Together, they have promoted successful and proactive community development. It was felt that they had less to lose by ‘thinking regional’ whereas larger towns were less likely to give up whatever regional advantage they enjoyed. Dore and Woodhill, (1999, p. 6) stated that ‘regional initiatives need to operate within a system that acknowledges there is often joint Commonwealth-State responsibility in relation to economic and environmental matters, but which also accepts the importance of the private sector, and State and local spheres for service delivery’. Importantly, the tangible outcomes of the Progress Rural WA programs demonstrated the validity of the claim that regional development is the equal responsibility of government, communities and the individuals who live there. Furthermore, it showed that with equal commitment, communities and regions can move forward in a viable manner and have the confidence and capacity to actively engage in the international marketplace.

Is 2030 already here?—some social signposts

As the process of globalisation increasingly exposes regions to a wide range of new pressures for change that threaten their sustainability, a refocussing on a sense of community and place may in fact restore some of the creative human aspects associated with sustainability and consequently, the socio-economic fabric to which an economic value can be attributed. McDowell (1997), argues that one must pay attention not only to what happens, and how and why it happens, but where it happens. It is her insistence that ‘place makes a difference’ (p. 5) and sense of ‘place’ is an emotional and social experience which can be harnessed for economic and environmental benefit. For McDowell (1997), the physical environment is ‘not only … a container for the social practices and everyday interactions in workplaces … but also … an active influence on these behaviours’ (p. 12).
Generally, the capacity to look beyond the region for markets and opportunities is vital, but the potential of the local community is also often overlooked. Bolton (1992) suggests that ‘sense of place’ is relevant to the policy debate because sense of place is a factor in regional and local identity and is an important form of intangible capital that has positive externalities. According to Gray (2000), there is considerable interest in social capital (or the capacities for organisation and trust which community members share) in Australia, and its anticipated potential as a basis for the development of local solutions to local and wider problems including those of an economic nature. The responsibility for community well-being has been increasingly devolved to local authorities and organisations (M. Tonts and Jones 1997). In order for communities to help themselves, as directed by the Federal government in particular, there is an expectation that a person, people, a group or community organisation will take the lead, co-ordinate community support and access funding sources or agencies (Haslam McKenzie 2001). This becomes increasingly difficult as towns and communities become progressively smaller.

For example, the local agricultural show, which traditionally brought the community together for a social outing as well as an opportunity to showcase produce and ideas, has been a victim in smaller communities. This is probably for a number of reasons including changing tastes in entertainment and a more mobile population, making access to sophisticated entertainment and knowledge in the capital city more accessible. Organising events such as this devolves more and more to individuals, as service clubs fold, struggling to maintain membership and the pool of local volunteers dries up. The diminishing number of service clubs is not just a rural problem, it is a worldwide phenomenon, but it has a significant impact on small rural communities struggling to maintain a sense of community. The costs (labour, time, telephone, diesel, hire of goods, insurance and so on) associated with running such an event are sometimes hard to recoup and for some towns, a show is a thing of the past. Similarly, sporting clubs, often at the core of a town’s community activities are also threatened by diminishing numbers and changing tastes in leisure activities. In rural Australia, sport has played a vital and integral role (Stoddart 1986) constituting an important avenue for socialisation (Atherley 2003). It has also been recognised as the ‘social cement’ of communities (Bourke 2001; Sportscape 2001).

Nonetheless, small communities in the Wheatbelt are developing new and highly successful and innovative social activities that are drawing not only local interest and commitment to their organisation, but attract broad patronage from beyond the region. These activities tend to meet the social needs of a wider community cohort rather than particular age groups or gender. Some examples include Corrigin’s ‘Dog and Ute’ event which brings thousands to the town every year. Similarly, the Kulin Races which is also a weekend-long event and the source of significant community funds. These type of events enable all the community groups to gather and fund raise at the one event as well as join together to showcase ‘their place’ and enjoy the social benefits of a community. The Dowerin Field Day is one of the largest field days in Australia and brings visitors and funds, not only to Dowerin, but the surrounding communities as well. The small town of Hyden has a unique geological phenomenon and has used that to great effect, drawing tourists year round to see it.

These community activities are undoubtedly different to those of the past, such as the Show and the football carnivals but provide an opportunity for local people to contribute their shared, underlying interests in, and commitment to, their community. It is this capacity of people to work together for the wellbeing of the entire community, rather than specific or individual interests, that is termed capacity building because usually, where there is a nub of enthusiasm and a sense of inclusivity, then it is likely that other community members will join in and so increase the human and social capital that is garnered for the benefit of the entire community.

Each of the examples cited above have demonstrated growing commitment to the annual events by local residents. Capacity enhancement is also about expanding knowledge, thereby developing or enhancing skills and fostering new learning. Building knowledge in a community is only useful if it is shared and therefore made accessible for others to use.
This process is likely to include the broadening of networks and alliances, opening opportunities for partnerships and collaboration with other individuals or groups, hence extending the potential for building the knowledge base and its capacity.

Community activities can be seen as both an avenue for entering the community and for establishing friendships and social support that sustain individuals when services are not available. As noted by Cocklin and Alston (2002) services in rural communities often play a part that extends well beyond the commercial or social functions they are designed to provide. Often they are an essential component of rural social networks; symbols of community vitality, as well as a source of employment and valued skills in the community—focal point of community. Women in particular interact with the community on a number of levels. The availability of childcare services and schools is an important source of community networking for women who do not have family ties or other connections in the community. It is where they develop friendships and support networks and often around which they shop and spend leisure time as well as building social capital. Even when their children have left the local school, very often it is this institution that symbolises the town and where women have invested their future through their children’s education and socialisation. It would appear that the local school means more to a small community than simply a place to educate children. It is a meeting place and central focus for the energy of the community.

Is 2030 already here?—some economic signposts

We would support Coombes (2001) in his suggestion that there is an emerging common understanding of the active role that regions can play in facilitating economic development. He categorically states that regional development is not the exclusive province of government, but the interaction between business, community and government. Furthermore, each participant in the regional economy has the potential to directly contribute to development as well as the capacity to take on a leadership role.

Spiller, Gibbins and Swan (2000) make a convincing case that future economic success for non-metropolitan regions generally will depend on a region’s ability to engage with and generate ‘new economy’ services and activities, particularly those linked to the knowledge economy, but currently, there are few signs if any, that this notion has been given any serious consideration. These claims are strongly supported by other economic commentators (Beer et al. 2003; Stimson et al. 2002; Spiller and Budge 2000) reviewing the performance of Australian regional economies in the last decade. Those local economies that have embraced finance, technology, knowledge, foreign market investment and sophisticated business services (usually the capital cities), have excelled, often at the expense of old economy industries (O’Neill and McGirk 2002). While the dominance of the agricultural industry in the Western Australian Wheatbelt might not change, one might surmise however, that the way farming is conducted and the commodities farmed might indeed vary.

Fiscal restraint by government is evident in contracting public expenditure budgets and the increased use of so-called market forces, rather than government intervention, to drive change. It has been suggested by Edgar (2001), Jensen (1998) and Powell (1996) that rural regions in Australia have been hit harder than metropolitan areas by much of the micro-economic reform and structural adjustments of the 1980s and 1990s. This also relates to specific issues such as the quality and availability of services in rural areas (Garnett and Lewis 2000; National Economics 1999).

This would appear to be the case in the Western Australian Wheatbelt where there has been a decline in the availability and/or quality of health, education and financial services since the mid 1980s. It has been noted by Jones (2001) and Alexander and Jones (1998) that the Western Australian Planning Commission has suggested in the State Planning Strategy (Western Australian Planning Commission 1997) that approximately 26 towns be further developed and services be consolidated in them so as to make them service centres or ‘one stop’ destinations.
From this, it is inferred that the other 30 or more smaller towns will either wither altogether or struggle to survive against the odds (for a discussion of the impact on small communities, see Stehlik 2000). It is difficult to assess from official data sources, such as the Australian Bureau of Statistics, whether the decline in the availability and quality of services and infrastructure has contributed to the movement of people from the smaller rural localities to larger regional centres or vice versa. Certainly the depopulation trend in the Wheatbelt region has made it uneconomic for many services to continue a presence in the region and so they have been withdrawn or centralised.

There are few signs that government policy is likely to move away from neo-liberal economic influences and therefore the way education is delivered in the future to children and mature aged learners in the Wheatbelt is likely to be very different to the community school model. There are already many examples of online learning facilities, not least the well established School of the Air, but as population and services dwindle, parents have demonstrated that they are willing to change their life style, live separately, leave their community and/or commute long distances in order for their children to get the education they deem suitable and the social benefits from interacting in a community school environment. When these facilities are not available parents will move to a community that has educational services or will change their living arrangements so that the worker based in the Wheatbelt commutes from the family base (see Haslam McKenzie 1999b; James 2001).

Leading us towards 2030

Three case studies are now provided which show us some leadership towards the future. These are: regional branding, food miles and clean and green products.

Regional branding

While the communities in the Wheatbelt are small, there is a discernible determination demonstrated by some residents to respond to the challenges and opportunities presented by the ‘new economy’. Further, as noted by Spiller et. al (2001) ‘it is increasingly important for regions to retain local consumption expenditure as much as possible and target consumption expenditure generated in other regions’. One initiative being pursued by regional groups in Western Australia to avoid the ‘quicksand’ scenario and retain local consumption expenditure is regional branding and marketing.

Regional branding and marketing is a strategy being developed by a number of European and North American regions (for example, Provence in France and the Maritimes in Canada) in an effort to create niche markets and promote local industries, thereby preserving jobs and regionally-based local businesses. Regional branding aims to commercialise and internationalise agricultural industries through the pursuit of value adding and diversification within primary industry production. It is inclusive of a range of growers and producers with diverse product offerings combined with other business and service interests in a region that together, can promote and foster commercial opportunities. Regional branding is a self-help strategy, creating an identifiable image for a region’s products and services. A brand has the potential to promote the benefits of products and services from that region. At the same time, it provides an opportunity for producers to build their capacity in new fields: specifically the marketing and promotion of rural areas using tourism and product branding. The key is to develop a brand that is instantly recognisable to consumers and supportive of individual marketing efforts and, in the process, the assumption is that this will help to re-build viable rural communities.

The agreed benefits (Hall and Hubbard 1996); associated with regional branding include:

- Highlights product (eg agriculture, commerce, tourism attractions, facilities, infrastructure) within its community
• Creates economic opportunity
• Creates local support for local product
• Promotes a clear and consistent image and message
• Fosters strong community effort
• Encourages public and private sector partnerships
• Creates a marketing focus on the consumer/target market.

Already, there is a genesis of regional branding in the Heartlands Regional Branding Group, centred around the Central Wheatbelt. The Wheatbelt region has a great variety of food products and industries, including fresh and saltwater seafood, olives, wine and viticulture, preserves, horticulture, floriculture, beef, sheep, flour, a range of organically grown foods and rain water. There is a growing tourism interest in the area, especially in spring for farm stays and the wildflowers. Importantly the Heartlands area is en route to a variety of other inland tourist areas, such as the goldfields, the southern coast and the Eastern States.

Specifically, they looked to encourage:

• Value adding, including processing and organic production
• Diversification strategies
• Innovative development of ideas such as chemical free beef, wool, aquaculture etc.
• Producer cooperatives in action
• Marketing strategies
• Supply chain management.

The goal of the Heartlands Regional Branding Group is to establish greater awareness of the products in Western Australia and to that end, they aim to set up a city-based warehousing and distribution system so those products can compete with supermarket style distribution networks. The Heartlands Regional Branding Group has targeted the management of commercial outlets, but they realise that these groups are unlikely to see their product unless the market demands the goods. In order to educate the market, representatives from the Heartlands Regional Branding Group showcase the region and its wares at field days, shows, community markets and food festivals. This strategy is having a modicum of success with some smaller metropolitan supermarket outlets stocking and marketing the Regional Branding Group’s products.

**Food miles**

While value-added agricultural products have struggled to attain industry dominance in the past, it is important to understand why that is the case. Transport networks in the Wheatbelt have been largely influenced by history (the day’s walk for shepherds) and the dominant industry, (broadacre agriculture). Until the early 1980s, the railway network played an important role in transporting freight, stock, grain and to a lesser extent, people. But, in line with Federal and State government policy, such expensive infrastructure has now been largely withdrawn to be replaced by the private sector operating trucking businesses. Until now, road networks revolved around the key agricultural market hub, Perth, but if the Regional Branding initiative was to develop more fully, the transport networks might link more strategically with key regional tourist destinations such as the Margaret River region and as the Ningaloo Coast develops, that region as well. This would greatly enhance freshness and reduce ‘food miles’.
While the notion of food miles has not been an issue for planners or strategists in Australia, they are an emerging health issue and certainly on European social and environmental scientists’ radars (Lobstein, n.d.). Food miles are an interpretative concept related to carbon footprints, measuring the distance food travels from where food is grown to where it is ultimately purchased or consumed by the end user. The further and longer food travels ‘from plough to plate’, the more likely it is to be vulnerable to fossil fuel supply, preservatives and chemical colour enhancements. Food miles have become critical in places such as Europe where space for growing food is premium making local food increasingly expensive. More than 50 percent of Great Britain’s orchards have been grubbed out since the 1950 and now with highly fluid global markets, British supermarkets offer their customers apples from Australia, New Zealand, South Africa, South America and the USA at a considerable discount to the local product (The International Institute for Sustainable Development 2002). By default, those people who cannot afford to eat local food are those likely to eat the less healthy, mass produced food that is grown in far away places.

While the concept of food miles represents a social, environmental and health disaster for the lower socio-economic strata of European and Asian society, it is a potential boon for Wheatbelt agriculturalists and horticulturalists. By 2030, it is highly likely that Asia and in particular the most populous country in the world, China, will be looking to Australia more and more for its food because we have the productive capacity and there are less food miles between here and Asia then there are between Asia and Canada, the USA, Africa and South America. In the fast emerging middle class Chinese society, there will be important status associated with gourmet foods such as those grown by the Heartlands Regional Branding Group and places like New Norcia. China could be a very important market for West Australian primary industries and value added agricultural products.

**Clean and green**

As noted earlier, Australia’s share of international agricultural production is steadily declining and while the unfairness of trade agreements could be endlessly debated, the reality is that Australia’s position in the global trade system is tenuous while the economic super-powers are able to strongly influence international trading terms (Capling 2001; McMichael 1996). Therefore, Australia must create for itself niche markets or present to the market place something that differentiates Australian products from the rest. Australia’s status as a ‘clean and green’ producer may well provide that edge, making the current debate regarding genetically modified crops all the more critical. Without venturing into that debate, it is essential that the decisions taken now are strategically placed. The decisions we make today will impact on the future.

Primary products are often the core materials used by boutique businesses to value-add. For example, within the boundaries of the Wheatbelt upmarket wine and food producers and niche furniture makers and craftsmen are producing small but high quality products and all use local primary products. The eucalyptus oil initiative in Narrogin is touted as having enormous potential harvesting naturally produced oil for a range of industries. Importantly, this is an emergent industry that is environmentally sensitive, provides local jobs and has wide value-added applications. As noted by Crabtree (2000), the development of local, niche or boutique industries that target specific markets have well recognised advantages, not least the development of social and human capital. However, servicing niche markets, particularly those on an international scale (and this is likely given the relatively small Australian marketplace) require close attention to production and marketing excellence. Clients willing to pay a premium demand diligent service and consistency in supply.

Another good example is that offered by the Exclusive Plymouth Brethren in scattered Wheatbelt communities (see M. Tonts 2001). For religious reasons, members of this sect are encouraged to live in non-metropolitan locations and only a few of them operate or work on farms. The majority are associated with new business enterprises such as retail outlets, steel fabrication, manufacturing implements for the mining and agricultural industries and small-scale plastics manufacturing.
Importantly, such activities restore people to non-urban areas with all the advantages of re-populating previously depleted communities. Religious sects are not the only likely contenders for reversing the population shift. Other examples are the flight schools that have been based in Cunderdin and Merredin. Importantly, this is an environmentally friendly business providing an international service paid in foreign exchange.

Conclusions

The combination of globalisation, economic restructuring and policy shifts have contributed to a pattern of demographic decline and spatially and socially uneven development. The challenge for Australian government and rural and regional communities such as the Wheatbelt in the twenty-first century is to face the new global environment realistically with a mindset focused on accepting change and overcoming difficulties. There is now a greater appreciation of the role of social capital, sense of place and commitment to community (Chenoweth and Stehlik 2004). The contributions individuals make to the community are increasingly valued. It has been noted that one of the important determinants of regional development is the capacity of people to live, learn and work together in a happy and constructive environment. Social capital is a concept that relates to social cohesion and it has the potential to engender vitality in rural communities.

In Australia, current approaches to regional development emphasise the role of local leadership and communities in attending to their own survival. In Western Australia, there are few towns or regional centres with more than 5,000 residents (Australian Bureau of Statistics 2004) and the small towns throughout the Wheatbelt are struggling to maintain viable populations. Consequently, their ‘spheres of influence are at risk unless they become forward looking, ready to take on new ideas, risks and look for opportunities in this new, emerging environment’ (Collitts 2000, p11). Observers of this scenario (Collitts 2000; Forth 2000; A. D. Sorensen 1993) have seen many small towns find themselves stuck in, as Collitts (2000) aptly terms, ‘quicksand’ in responding to the challenges of the ‘new economy’. There is a barrier between people with imagination in smaller towns who strike obstacles in developing their ideas due to a lack of management skills, finance, risk taking or knowledge about the greater environment in which they are operating and people outside these towns, especially those in government who possess the management skills, finance and understanding of the greater environment, but encounter difficulties because they lack an understanding of the smaller towns, their obstacles and opportunities. There are also issues of community dynamics and infrastructure deficiencies contributing to the ‘quicksand’.

The adoption of new technology is now more important than ever as farmers try to maintain levels of profitability in the face of rising costs, worsening terms of trade, and restrictions on land use and farming practices imposed by governments as society becomes more aware of the need to develop sustainable farming practices. Satellite technology has been adopted in a number of ways, such as using satellite imagery when making decisions on land use, satellite ground positioning systems to guide spraying and cultivation equipment, and satellite communication technology for controlling equipment in remote areas, such as pumps and generators. Pollard (2001) notes that, across all agricultural industries the relative importance of inputs into agriculture have remained stable over the past two decades. Marketing expenses (e.g. commission, packaging, freight and cartage, insurance, handling costs), and wages are the two main operating costs. Marketing expenses have generally been 11–14 percent of total operating costs. Wages have remained at about 13 percent, but declined slightly to 11.5 percent during the mid 1990s. Despite significant price increases, fuel and fertilisers have remained at around 5 percent and 7 percent respectively of total farm operating costs (Pollard 2001). The most variable input, in terms of relative importance, has been interest paid. In the late 1970s it was about 8 percent of farm operating costs, rising to about 13 percent in the late 1980s, a reflection of the overall upward movement of interest rates in the economy, accompanied by increasing farm debt. The 1990s saw a fall in rates, and in interest costs as a proportion of farm input costs to about 8 percent (Pollard 2001).
Communities and the people in them are working in new and different ways. The economic base of the regions has diversified and new markets have been identified—eg tourism, value adding, mining and niche industries such as eucalyptus oil. People are highly mobile, and the advent of sophisticated telecommunications has the potential to enable creative community and work options. The rider here is that telecommunications must be reliable, accessible and relatively cheap. In many parts of Western Australia this has not been the case.

There are communities in the Western Australia Wheatbelt that understand their own resources and options for the future. Most often, this occurs where there is partnership between government, the private sector and the community. We argue that the following principles be adopted to assist them in planning a sustainable future:

- developing community self-help strategies
- procuring partnerships
- developing new styles of leadership
- managing change—taking command
- income diversification
- using the changing workforce
- accessing and using the greater mobility of rural, regional and remote populations
- re-focusing on social capital
- developing sense of community and attachment to a place

In this paper, we contend that the future is here already; harsh environmental conditions, market trends and government policy have been influential in the rationalising of the Western Australian Wheatbelt for more than two decades but we can attest that the Wheatbelt is still there and will always be there, but perhaps in different industry, social and environmental guises. The problems are not easy ones to solve and yet already the signs are there that viewing growth, diversification, education, leadership and skills, in new and creative ways will go some way to ameliorating the severity of the economic, social and environmental conditions that are confronting the Wheatbelt.

This paper reinforces the claim made by Sher and Sher (1994) that the future viability of rural areas cannot come from the broadacre agricultural sector alone, but that new, creative rural initiatives have the potential to renew rural vitality. New ways of providing and maintaining infrastructure in small and often isolated communities is a challenge for government and community leaders. However, it is important to note that communities and regions cannot address these issues on their own. Entrepreneurialism and initiative is to be encouraged by local interests and those of the government and corporate sectors all of whom will reap long-term benefits.

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Appendix A

(Re)building a skills base—issues from interviews

‘N’ from the Hotham Statistical Sub-division typified many on-farm interview responses.

I/viewer (Daughter) has left the district. Is that a regular thing that daughters leave?

‘N’ Yes, there are no work opportunities.

I/viewer What about sons, do most sons come back on the farm?

‘N’ All depends on how many you have got, if you have three or four on a small farm you are buggered, one could probably go on it [the farm] and the other two, don’t know what you do with them, give them an apprenticeship in some trade or go to university.

‘R’ from Hotham expressed some of the concerns regarding limited social activities for young people and the increased need for youth mobility to access a social life.

I/viewer Where would your son be likely to find a partner?

‘R’ Probably under some prickle bushes. He is taking a girl out who works locally. That’s good, not so much petrol, wear and tear on vehicles, time spent travelling, wife worrying if he’ll get back in one piece. I worry he might never come back, he might find a waged job down there (Perth). I think most boys round here seem to jag the school teachers or the shire assistants, otherwise they’re down to Perth every second weekend. The boys are stuffed though if the school closes. The hospital went years ago so [there are] no nurses around as potential wives.
Appendix B

Will education be enough?

The following interview excerpts conducted for a Rural Industries Research and Development Corporation project in 1999 were provided by several farmers, who explained in detail how they changed the farm business in response to a perceived need to provide their children with educational options. These families had made the decisions to temporarily live apart in order that the children could have a city education as well as having at least one parent living with them on a full-time basis.

‘S’ from the Lakes Statistical Sub-division recounted how the family came to make their decision.

‘S’ We weren't getting the feedback from teachers that we required. Of the teachers that were there, hardly any of them wanted to be there. (Town) was seen as a place you only stay at until you get somewhere else. They felt they have to do the obligatory 3 or 4 years of country service, get it over and done with. And at (town) school there are all multiple classes where you might have 3 years in the one classroom and that type of thing. I did not want mediocre education for my children.

Both farm enterprises are now entirely devoted to cropping. All stock has been sold. This facilitates being able to leave the enterprise for extended periods and minimises maintenance on fences and water sources.

‘C’ from Lakes explained that the family view their living arrangements as no different to an oil rig worker, with week long shifts.

‘C’ I go back for every school holidays, we go back on some weekends.... when (husband) is cropping. Normally he comes up here. When he is not busy he is here for a lot of time. From January to March he is here a lot, so it is not like we don’t see him for weeks on end. In fact last year there wasn’t a period of more than two weeks that we were apart and that was only once, so while he is seeding we will go down each weekend.

One farmer stated that the farm and the living arrangement is more efficient as a ‘commuter arrangement’ and they will continue farming the land but living in an urban community.

I/viewer Do you think that this arrangement of commuting has enhanced your business operation?

‘G’ It has certainly streamlined it. I guess it has improved (because of the new arrangement). We certainly do things differently now than we did before. The farm runs a lot more efficiently than it did. We work more efficiently….. the farm figures show that it runs more efficiently although it is offset by the fact that it costs a lot more to live down here [in the city]. We do not regret it. Our family and our marriage has benefited.

‘S’ I am continuing on as I am now. Once the children leave school, husband and I would still like to live here in Perth and do what we are doing now.

This couple did admit that they were fortunate they had the flexibility and wherewithal to respond to their children’s education needs in the manner that they have. They also conceded that rural infrastructure will continue to withdraw if more families follow their example.
In terms of your situation, being full time farmers but also living part of the time in the city or away from the farm, what do you see is the future of the community of farming regions, as farms take over other farms and efficient farms move in on less efficient farms?

Well ultimately I guess it is doomed but it seems efficiency and efficiency-to-scale seem to be more important. You can take that right back, say 50 years where there were probably 10 times the population and it’s a terrible shame that that still isn’t the case. It’s a vicious circle and a roundabout, because I can see that infrastructure will continue to disappear. In small country towns like ours, the people aren’t there so they can’t choose to duck into the local shop because it is not there any more, so you cannot be self-sufficient in country communities any more. It’s a shame I don’t know how it can be stopped.
1.3 The city and the bush—partnerships to reverse the decline in Australia’s grainbelt

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Abstract

Major trends that are draining people from the grainbelt are globalisation of the economy (and its associated global urban culture) and coastalisation or the ‘sea change’ phenomenon. Reversing the decline is suggested to require a focus on grainbelt towns in partnership with the adjacent global city. It will require a quality of life ‘pull’ through creating a ‘sea change lifestyle’ without the sea, developing ‘sense of place’ and providing greater social diversity. It will also require tapping of new global city requirements through partnerships between the city and its bioregion to do with biodiversity, new bioindustries, and new water regimes. Hope for rejuvenation can be provided through the recent rejuvenation of inner city areas, which had similar problems to deal with.

Introduction

Reversing decline is always a difficult issue but when it involves long-term decline, as is the case with the Australian grainbelt, it is often seen to be impossible. This paper will try to show how it may be possible to reverse the decline in the bush. It will take some of the major trends that are impacting on the WA grainbelt (though they are the same in the rest of Australia) and it will suggest how the grainbelt can possibly change to create a more sustainable future for the region. The key is seen to be establishing partnerships, especially those that link the city and the bush.

Major trends impacting on the grainbelt

The two major trends impacting on the grainbelt, mostly on demographic change, are globalisation and coastalisation—both are draining the population from the grainbelt.

Globalisation (and associated urbanisation)

The global economy is driven by globalisation of trade and investment. It appears to be the major factor in the creation of wealth in our age and is unlikely to diminish as a global trend. What is not understood often is that this trend is closely associated with urbanisation. The global economy is driven by global city services and global city culture. It is particularly attractive for youth who go to global cities for education, the new jobs and the global city culture. This is draining inland rural areas everywhere (Brotchie et al. 1999).

It is a global phenomenon as cities worldwide are growing at 2.3 percent per year and rural areas at 0.1 percent per year. Coastal cities that are trade centres are growing into megacities as they become the focus of the global economy for that region (Van Vliet 2001).
Sydney is Australia’s ‘global city’ and it attracts people from across the country to its jobs and culture. The ‘western half’s’ global city is Perth and economic and population trends show the globalisation phenomenon to be as extreme as anywhere. As Table 1.3.1 indicates, the proportion of Gross State Product, and the growth of employment in recent years reflects the problem for the grainbelt.

Table 1.3.1. Economic change associated with the globalisation process in grainbelt, WA and Perth. Source: Bank West 2003.

<table>
<thead>
<tr>
<th>Employment (percent)</th>
<th>1987–88</th>
<th>2002–03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture (including forestry and fishing)</td>
<td>6.6</td>
<td>3.6</td>
</tr>
<tr>
<td>Mining</td>
<td>13.0</td>
<td>21.3</td>
</tr>
<tr>
<td>Services (Finance, business, community, cultural recreation and personal)</td>
<td>17.4</td>
<td>23.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Economic Output (percent Gross State Product)</th>
<th>1985–87</th>
<th>2000–02</th>
<th>Change (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>50 000</td>
<td>44 800</td>
<td>- 11</td>
</tr>
<tr>
<td>Mining</td>
<td>27 200</td>
<td>32 500</td>
<td>+ 20</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>78 700</td>
<td>94 500</td>
<td>+ 12</td>
</tr>
<tr>
<td>Services</td>
<td>166 700</td>
<td>284 900</td>
<td>+ 71</td>
</tr>
</tbody>
</table>

The Western Australian grainbelt consists of 44 small towns scattered through an area the size of many European countries, but the population and regional economy of these small towns has been in steady decline for several decades. The region has declined at minus 0.1%/year for a decade whilst Perth has grown at 1.6%/year over the same period. Young people in particular have left the area in search of education and to participate in the global city culture of Perth and beyond.

Coastalisation (seachange)

Not everyone wants to live in global cities. There are many social reasons (usually ageing), economic reasons (usually housing prices) and environmental reasons (traffic, air quality, urban stress) that mean people leave and invariably head for the coast.

The seachange phenomenon is also a global process. Retirees are one large group but there are also other escapees from the global city who have headed for the coast. In the US, 37 million people have moved to the coast since 1960 (Transcan 2004). In Australia there are around 70,000 per year moving to do a seachange every year (Salt 2004). This is 50 percent higher than the growth rate in capital cities.

Coastalisation has no economic base. People don’t go there for the jobs; they go because of the environmental qualities of the coast (its more even climate and the physical and natural attractions) and the apparent attractions of small town community life. It is a long-term process that is also draining in-land towns, especially the older demographic of inland regions.
Hypothesis

The hypothesis of this paper is that the health of the grainbelt will not depend on just the health of the landscape but on the health of grainbelt towns. Most economies are based on towns and regions as combinations—both are needed for a healthy and sustainable future. Too often there is a conflict between towns and regions that do not see the way that they compliment each other. Towns provide the marketing and financial services for a rural community and the social capital and community services that enable people to have a life with identity, meaning and purpose (Jacobs 1984).

Inland grainbelt towns have lost many of their economic and social functions to the big city in their region. The question is whether this is an inevitable process or is it possible to reverse by building up economic and social functions again. This paper will try to show that it is possible but it will need the link between the global city and its bioregion to be re-established. By rebuilding the function of small towns in the grainbelt it can help build a healthy grainbelt region.

The paper will suggest how grainbelt towns could address the problem of their economic and social decline by creating a quality of life ‘pull’ in country towns and a partnership with the global city ‘pull’.

Partnership with the city: quality of life ‘pull’ in grainbelt towns

There are three elements of this ‘pull’ factor:

- Developing a ‘sense of place’
- Creating a seachange lifestyle without the sea and,
- Providing greater social diversity in grainbelt towns

The global city phenomenon is powerful but it is not the only settlement dynamic. It is possible to learn from the coastalisation process and some deeper aspects of how settlements work to create a process that could rebuild grainbelt towns. It is a matter of creating a ‘pull’ factor from the global city and the coast towards the grainbelt towns.

Creating a ‘seachange lifestyle’ without the sea

The ‘seachange lifestyle’ is an environmental movement. It is about the attractions of a simple lifestyle based around an environment that gives pleasure year around. There is no doubt that there are many attractions associated with the Australian coast but it is not the only place with an interesting environment or where a simple life can be created. The grainbelt country town needs to ensure that the environmental features of their area are improving through landscape protection and town planning. They need to ensure that the ‘pull’ of the simple country life can be provided. There need not be an economic base as the coastalisation process certainly is not driven by jobs.

Climatic extremes inland can be managed better through housing design and landscaping that eases the problems of summer heat and winter cold. This is an architectural issue and there is clearly a need for grainbelt architecture to be seen as far better in its climate control than in coastal areas. It need not be a financially difficult process but it should be a planning/building by-law issue.

The use of environmental quality as a means of reversing settlement decline is well developed as a policy in cities. It has not been seen as the priority of grainbelt towns as they have been more pre-occupied with direct jobs strategies.
However, the indirect benefits of having more people in a town has many implications for jobs related to town services. As the global city phenomenon increases with rapidly growing housing prices and more intensive urban living there will be a need for an alternative; the grainbelt could provide that by emphasizing its lifestyle and environmental qualities, as long as such qualities are real and improving. This will depend a lot on the next policy area.

**Building ‘sense of place’/social capital**

There is an important literature on the essential qualities of social capital to provide the base for economic capital in any settlement region (Putnam 1993). This is based on the importance of community values of trust, reciprocity and accountability that are developed when people share in community activities like sporting and recreational clubs. The best kind of social capital for the development of an economy is when people associate with an area over a long time—when they identify and belong. This is the basis of ‘sense of place’.

‘Sense of place’ is a concept of how people merge their environmental and social obligations for an area. It is a concept for any area—including the grainbelt with its history, landscape and ecology.

For a grainbelt to develop its social capital and ‘sense of place’ it will need to tell the story of their area. Leonie Sandercock has said:

For the longest time, ‘story’ was thought of in the social sciences as ‘soft’, inferior, lacking in rigour, or worse insult of all, as a ‘woman/native/other’ way of knowing…. But as Alasdair MacIntyre put it: ‘I can only answer the question ‘what can I do?’ if I can answer the prior question … ‘of what story or stories do I find myself a part?’ Sandercock (2003, p182)

This is a fundamental understanding of social science about what makes a place work, however few grainbelt towns would appear to have made it a priority. It is again a problem of perception about what is real. For many people in agriculture the notion of ‘story’ being important would have met with little more than humour. Real science or real economics would have been acceptable rather than what is the underlying social science or even philosophy behind a place.

There are a number of small towns that have demonstrated that they can change this priority and have found it to be a benefit. The most recent success story in Western Australia is Kojonup where the local community have told their story in Kodja Place, the ‘place of the stone axe’. This tourist/community centre tells the story of the Indigenous, the English and the Italian people in the area and how they have been merged into the social capital of the present community. It dramatizes the story and also acts as a centre for youth to be trained in video production so that they can continue to tell the stories of the community. Only notions of what this can be doing to build up the social capital are available at this stage, however the pride in the centre is an indicator that it is touching the people at a deep level. It has been a source of tourists in the area. Reversing population and economic decline in small inland towns will be difficult but it must begin around notions of what is the town all about, what is its story, before it can create a new future.

The idea of ‘sense of place’ stories or place narratives as they are sometimes called has been highlighted in the Western Australian State Sustainability Strategy (Government of WA 2003). The notion was developed by George Seddon in his book ‘Sense of Place’ which outlines the natural history, Indigenous history and European history of the Swan Coastal Plain, providing through its integrated picture a series of important planning realities that have been the basis of how Perth has understood its future for a generation (Seddon 1972). The State Sustainability Strategy now calls for Regional Sustainability Strategies to develop a new methodology of how Regional Economic Plans, Natural Resource Management Studies and Place Narratives can be integrated through a Community Visioning process. This is the basis of sustainability where the three bottom line areas are not just done as separate exercises but are integrated.
The reality of most regional areas is that the first two bottom lines are now mainstreamed (NRM being a more recent and greatly required part of any region’s future strategy) but the third social area is rarely done. Yet it is the social dimension that provides the deeper level to the other two and is especially important if any kind of decline is to be reversed.

**Increasing social diversity**

Social capital and especially small country town social capital needs to have at its base social diversity. The trust and reciprocity that Putnam (1993) found to be so important for economic development in his studies is the glue that holds a place together but the extent of the capital depends greatly on how much difference is being brought together. The literature on innovation highlights the need for a variety of ideas to be brought together in order for new ones to be generated.

The WA grainbelt has considerably reduced social diversity to any other region in Western Australia. One way to measure this is simply the proportion of the population born outside Australia; the grainbelt region has 12.6%, Western Australia has 26.8% and Perth has 31.3% (Department of Local Government and Regional Development 2003).

Some ways of possibly increasing this social diversity is through the targeting of new migrants. This could be assisted if Federal Government policies on immigration favoured family reunion in regional areas. Another way would be to try and tap the new phenomenon of Eco-Villages. These are a way that families are trying to reclaim community ideals while developing ways of minimizing ecological footprint and in Western Australia recent attempts have also tried to assert the importance of local enterprise (Antonelli 2003). If these develop they could become a substantial part of Australian life as the Co-Housing movement has done in Denmark. These Eco-Villages need a reasonably large area of land for the 100 or so families that come together and they are largely footloose. grainbelt towns have land but rarely imagine how they could attract such groups as they have no concept of different ways of developing. The Eco-Village requires almost no infrastructure as they try to experiment with on-site water, waste and energy. This social experimentation could be easier in a country town but generally would be hit with substantial social barriers rather than economic or physical barriers.

By becoming more socially diverse, building up social capital and creating an environment that is attractive for city dwellers, it may be possible to provide a quality of ‘pull’ in country towns. This depends to a large extent on how the ‘push’ from the global city continues to develop but is likely to be real as housing prices continue to rise and the stress of global city life grows.

It is also possible to see that there are some newly emerging issues that cannot be adequately dealt with in the global city unless they are addressed in partnership with the country towns of their bioregion.

**Partnership with the global city: new bioregion requirements**

The city is sometimes characterised as the consumer of wealth and the rural inland as the producer of wealth. This is of course not true, especially in the new economy of knowledge and services. In terms of Gross State Product, Perth produces the bulk of the state’s wealth (66%) and the grainbelt produces 4% of the state’s wealth (Department of Local Government and Regional Development 2003).

The politics of grainbelt vs. city is not helpful to the grainbelt and in the long term, it is not helpful to the city as it depends on it for a range of ecosystem services that are not included in GSP data. These ecosystem services relate to the bioregion’s character as a source of biodiversity, of bioindustries and...
of water. These are growing in importance and will become a requirement for the global city to solve in the future. They provide an opportunity for partnership with potential to help reverse the decline in the grainbelt.

Thus the paper will conclude by analysing how the politics of the grainbelt needs to move from antagonism to partnership around these fundamental characteristics. These bio-resource partnership characteristics are not including the provision of food, which is merely assumed.

**Biodiversity partnerships with the city**

Every city depends on its bioregional ecosystem and the integrity of this system requires an emphasis on its biodiversity. Rebuilding the habitat structure to enable a region’s biodiversity to flourish is fundamental to conservation. Many texts have been written on how to do this through conservation corridors linking remnants into viable habitat and are the basis of such visionary projects as the Gondwana Links project in WA’s grainbelt. However this kind of rural partnership process (between public and private land holders) rarely considers the potential partnerships with the city.

Biodiversity partnerships between a city and its bioregion can be through the establishment of physical linkages (with corridors that link the city and the bush) and through social linkages. In Perth, the establishment of biodiversity corridors is especially important as it has such high biodiversity in its own right (see paper by Hopper in this series).

The establishment of biodiversity linkages is where there is major potential for economic activity linking the city and its grainbelt bioregion. The main rationale for this is that biodiversity conservation in the regions is highly labour intensive which is not what regions have, but it is what cities have in excess—people, who often are underemployed.

Cities are becoming more and more aware of the global threats to biodiversity. It is possible that this growing sentiment can be tapped. In a recent monograph for the UN Environment Program Newman and Jennings (2004) have suggested that the city should begin to see itself as an ‘ark’ for biodiversity. This already occurs in zoos but the potential is there for intensive rehabilitation and management of urban bush in a way that can rejuvenate the flora and fauna of the region. People in particular parts of the city could adopt parts of the bioregion and provide the expertise, labour, money, flora and fauna that are needed to rehabilitate ecosystems.

The beginnings of this process can be seen in the linkages between city and rural schools, and between particular firms (e.g. Western Power) and regional areas. The programs like Ribbons of Blue which link students in city and rural areas through water are also such a mode.

Biodiversity-oriented parks and reserves in the city are beginning as bush is fenced and intensively rehabilitated. There are public and private ventures that are pioneering such activity—e.g. Australian Wildlife Conservancy property at Chidlow in Perth has helped to bring back the Woylie so that it is the first species to be removed from the IUCN endangered species list.

It is possible to imagine a whole new biodiversity conservation industry being created through this kind of partnership. The implication for employment at both ends of the corridors and social linkages could be substantial. Each grainbelt town should begin by creating its ‘biodiversity centre’ to provide a focus for such activity. Such a place is being built in the Shire of Gnowangerup around the ‘Gnow’ bird or Mallee Fowl.

**Bio-industry partnerships with the city**

Bioregions can be the source of a range of new non-food/fibre industries. These tend to be focused on emerging renewable energy industries that are likely to be needed in rapidly increasing quantities as
the twin issues of oil vulnerability and climate change begin to impact on global cities. Renewable energy can be grown from biomass as well as tapping wind and water. Such renewable industries can also be associated with many other bio-products as well.

The Australian Conservation Foundation examined the potential for renewable energy in Australia and concluded that there was around 90% of current energy use that could be provided by renewables such as biomass, wind and photovoltaic systems. The vast majority of the jobs created would be in regional areas (ACF 2003).

Each city needs to consider a bioregional energy plan that can identify how renewables can be the basis for new energy and new jobs. This will need to include energy for transport as well in the new Hydrogen economy. The role of alcohol from biomass as a source of Hydrogen in fuel cell vehicles is likely to solve the problem of carrying hydrogen (see New Scientist, 21 Feb ’04, p 23).

By-products from biomass energy are ideal for other bioindustries. For example, in the Oil Mallee project in Western Australia with its 1 MW demonstration power plant, Narrogin is based on a diversity of income streams from the oil produced, from activated carbon and from the carbon credits as Mallee roots build up over 150 years or so. These are city markets.

Other bioindustries like Mt. Romance, which is based on sandalwood and Emu Oil have the potential to produce jobs through city markets in cosmetics and pharmaceuticals—the so-called ‘biopharming’ market.

Green jobs in regional areas are growing at a faster rate than general employment (Annandale, Morrison-Saunders and Duxbury 2004) but whether this becomes the basis of a large scale reversal of the decline in grainbelt areas will depend on the scale of collapse of the fossil fuel based energy, transport and chemical industries. It is possible to imagine that the global oil production peak of the early part of this century (now an almost daily point of discussion in major newspapers and journals) and the growing need to address climate change, will accelerate the changes needed. The bioregions of global cities will be the obvious beneficiaries of this change, especially those that have begun to demonstrate how the bio-industry/renewables sector can provide products that meet the global demand for sustainability.

Water partnerships with the city

Throughout Australia cities are doing it hard on water. In Perth, the reductions in rainfall started sooner but the climate change related systems have now covered the whole southern half of Australia. Responses have included demand management systems as well as new sources. The need to consider each city in its bioregion has never been more apparent than with the water crisis of the new century.

Solutions to the grainbelt’s salinity problems, where the whole region has too much water content now, ought to be linked to the city’s needs. Desalination is now a reasonably cheap option. This has led to the kind of scenarios being developed by CSIRO’s Healthy Country Program for desalination at major pressure points and feeding them into urban water supplies. The potential for new jobs in partnership with the city can be foreseen throughout the bioregion. Water is the most basic link between a city and its bioregion. The development of innovation in its supply to benefit both city and region is an obvious area for partnership.
Inner city rejuvenation model for grainbelt rejuvenation

Many of the ideas outlined above are not seen as feasible by commentators on the regions. Often the only conclusion is that we can do little but watch the decline of the grainbelt. Other declines have been reversed however and may contain a message for the grainbelt.

Throughout the western world in the 60’s, the phenomenon of inner city decline set in as car based suburbia took people into green field estates. In Europe, the process of decline was short-lived as they reacted to the freeway systems necessary to make this new urban system work. In Australia, by the mid-70’s, major concerns were expressed as over 10% of the population declined in inner suburbs across urban Australia. In the U.S., the decline continued until relatively recently. However, since the late 80’s the patterns of decline in Australian cities have reversed.

The reversal of the decline in the inner-city has some valuable lessons for the grainbelt. The reversal was part of a deliberate strategy based mostly on the inherent attractions of the inner city in push and pull. The problems, which drove people out of inner suburbs, were based on the preferred environment and better services of the suburb; hence inner areas created more attractive environments and built up their services and amenity to be competitive.

The inner suburbs also recognised it had inherent qualities as a place to locate the new jobs of the knowledge/service economy and thus strategies to create the meeting places, university facilities and offices were deliberately targeted as well as ensuring the fundamental transport infrastructure was in place, especially public transport and the walkability of streets (see Newman and Kenworthy 1999). The success of the inner city in attracting population and jobs has meant that the suburbs are now having to create similar centres and much better public transport to be able to compete with the inner city; most new Metropolitan Strategies in Australia are based on this notion.

The grainbelt can create a similar strategy to reverse its population decline. The process of change to reverse major demographic trends is never easy but requires a clear strategy. Some of the notions suggested above could form the basis of such a strategy.

Conclusions

This paper has argued that grainbelt health will depend on the health of grainbelt towns, not just the land and how it is farmed. Healthy grainbelt towns will depend on how well grainbelt towns can compete with coastal areas in terms of quality of life and how well they can partner with the city as it creates a more sustainable future with its region.

It is argued that grainbelt rejuvenation can happen just as inner city rejuvenation has happened. Fundamental to rejuvenation is the politics of partnership with the city, which is central to all sustainability futures.

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1.4 Environmental change in the Western Australian grainbelt with special reference to biodiversity and climate


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Abstract

The southwest of WA was recognized as a Global Biodiversity Hotspot in 2000, one of 25 regions on Earth where a rich endemic biota is under threat. This presentation reviews what is known of the biota of the grainbelt and its potential for conservation, from a multidisciplinary and multiagency perspective. Contemporary grainbelt plants, animals and environments have a rich and deep history. The globally old, flat terrain of the WA grainbelt has weathered, nutrient-deficient soils and accumulated salt. Inventory and biological survey are still incomplete, but significant recent progress has recorded an extraordinary range of biodiversity which is limited by, and at risk to changes in, land clearing, summer temperatures, rainfall seasonality, soil attributes (fertility, salinity), dieback disease, weeds and feral animals.

The grainbelt is listed nationally as under the highest landscape stress levels. Valley floor animal assemblages could lose 58% of their species by 2030 (84% by 2070) due to climate change under worst-case scenario models, but a less severe impact is likely. It has been predicted that a potential loss of salt-affected populations of 50% of 1922 taxa included in the Salinity Action Plan biological survey, especially on granite soils. Some 15 wetland plant assemblages (out of 34) containing 472 taxa are particularly at risk to salinity. Can we minimise the 6th global extinction event in the grainbelt? We can, if we assume every vegetation remnant matters. An integrated conservation strategy will involve completing the inventory through biological survey, conservation through reserves, ongoing work on threatened species and threatening processes, conducting risk assessments and applying restoration ecology, including ex situ strategies and genetic provenance work. Restoration ecology is an emerging discipline for the grainbelt, requiring a new landscape ethic to achieve conservation outcomes. Biodiversity conservation is urgent, at some cost, but worth it if a major part of the grainbelt’s special and unique character.
**Environmental change in the WA Grainbelt with special reference to biodiversity and climate**


**Significant international trends**

- Ecological interdependence
- Rich, ever-changing environmental history
- The 6th global extinction event
- Biodiversity and global hotspot concepts
- Threatening processes
- Risk management and restoration?
Ecological interdependence of humans
biological productivity

and the
earth
at night

It’s the good Earth

SWWA - scarce fertile land and a small population with big impacts

SWA ever-changing, but globally old

A stable continental nucleus with granite bedrock 2.5 Ga (half the age of the Earth). Massive Permian glaciers ground the land flat from 320-270 Ma.

Then rainforests evolved, with sclerophyll woodlands and heath, and a shift to aridity and SW mediterranean climate 30 Ma.

Some landscapes extant for 100+ Ma

  e.g. granite outcrops.
Ever-changing
Gondwana to the
21st Century

Drifting north,
climate change,
evolution,
human impacts

Rich, ever-changing
environmental history

Laterite - an exhumed rainforest subsurface soil

Massive and continuous deposits in forest

Archipelago of laterite residuals in the wheatbelt
Rainfall - annual and seasonal

Mediterranean climate in place for 20 Ma?

Consequences of flat terrain
- weathered nutrient-deficient soils and accumulated salt

Underground orchid (Rhizanthella gardneri) from the central wheatbelt
Assessment of landscape stress

6th global extinction event
Mammal attrition index - more than 35% of the original mammal fauna of wheatbelt IBRA regions is now extinct
6th global extinction event
- loss of freshwater biodiversity populations

6th global extinction event:
of E.O. Wilson's four major global environmental problems
  - pollution
  - ozone depletion
  - greenhouse effect
  - loss of biodiversity

only the last is irreversible
Concept of biodiversity

the variety of living organisms on earth

coined in 1988

embodies a significant shift from past conservation priorities and policies

- not solely ‘wildlife’ (i.e. mainly mammals, birds) but all kinds of organisms are important

- not solely species but genes and the more nebulous communities/ecosystems as well

The 25 global biodiversity hotspots

(Myers et al. 2000)

Places richest in endemic species under threat
Grainbelt’s Transitional Rainfall Province has more species of concern than expected given its relative lack of species richness hotspots (Hopper and Gioia 2004)

2100 WA plants of conservation concern
- massive habitat loss,
- fragmentation,
- root rot disease impacting 2500 species,
- displacement by 900 invasive weeds, and
- rising saline groundwater tables threatening 470 taxa
Salt is not the major threat to plant diversity in Western Australia

Threats to Declared Rare Flora in WA

Conservation strategies

- Completing the inventory
- Biological survey
- Conservation through reserves
- Threatened species
- Threatening processes
- Risk assessment and restoration ecology
- Landscape ecology and a new ethic

Courtesy Dr David Coates
Completing the inventory  
- plants

Number of currently recognised native southwest Australian vascular plant taxa described per decade

Biological survey  
- vegetation approach

Pioneered by Diels (1906)  
Updated by Beard (1980)  
Comprehensive mapping  
Intuitive boundaries  
IBRA bioregions an outcome  
Are they good surrogates  
for predicting pattern in the biota?
Biological survey - floristic approach

- 7380 taxa in WA Herbarium
- Computer mapping
- Comprehensive
- Modelled boundaries

IBRA bioregions not good surrogates

(Hopper & Gioia 2004)

Biological survey - hotspots of plant species richness

A new predictive map for plants

(IBRA bioregions

(Hopper & Gioia 2004)
Study Area: 205,000 km², 24 survey areas, total of 304 quadrats, each of 1 ha.
SAP Biological Survey
- Flora

3160 taxa from 1512 quadrats (half in wetlands & half in upland units)

- 15 apparently new taxa, 9 of these from wetlands.
- 2 presumed extinct taxa (both from wetlands, *Frankenia conferta* & *F. parvula*).
- 863 taxa were recorded from only a single quadrat (27.3% of the 3160).
- 2543 taxa were recorded from less than 10% of the quadrats (80.5% of the 3160).

Flora of wheatbelt:
- isn’t well known
- has globally high turnover across the landscape with many rare taxa.

Survey areas classified in terms of total species composition, with minimum spanning tree links

(McKenzie et al. 2004)
Gradational. Main clusters are climatically distinct.

Summer temperature, rainfall seasonality and soil fertility/salinity are major correlates of biotic pattern.

Congruence in pattern was low between plants, spiders, scorpions and herpetofauna.

IBRA bioregions are inexact surrogates for Grainbelt biodiversity.
Conservation through reserves
- invaluable but not enough

Threatened species
off reserves - *Banksia cuneata*

- Inhabits light sandy soils of the central wheatbelt
- Early enthusiasm for burning road verge population misplaced as weed control not planned for - local extinction hastened
- Subsequent recovery plan better informed
- Adopted by Shire of Quairading as floral emblem
- Secure in Badjaling Nature Reserve
- Ongoing management required especially of pernicious interaction of soil disturbance, weed invasion, fire and fertilizer drift

Biodiversity conservation has to involve local communities at landscape level
Risk assessment and restoration ecology

- 107 species of small ground-dwelling animals of salt-free valley floors
- 2030 - predicted summer temperatures +2ºC, winter rainfall decreased by 10%
- Above animal assemblage could lose 58% of its species (84% by 2070) due to climate change [ignoring behavioural escape and rising salinity]
- Potential loss of salt-effected populations of 50% of 1922 taxa included in SAP biological survey, esp. granite soils
- Includes 472 plant taxa at risk from salinity
- Unknown number at risk due to dieback, weed invasion, fertilizer enrichment, feral animals in the Grainbelt

Risk assessment
Aquatic invertebrate species richness versus salinity in WA grainbelt (Pinder et al. in MS)

Threshold at 2.6 g/l = sea water

Salinity (TDS, g/l)
Salinity risk assessment - flora

• 15 wetland plant assemblages (out of 34) containing 472 taxa are particularly at risk to both rising saline groundwater and drainage of saline waters into saline basins.

• These threatened assemblages include those of freshwater claypans, and a previously unrecognized group of taxa that occupy freshwater seep areas around the edge of saline systems.

Ex situ conservation
- an insurance strategy (not a replacement for conservation in the wild)

Seed storage
works for some species, not all

Tissue culture
cool storage (4-10°C)
• short-medium term
• reduces frequency of subculturing

Cryostorage (-196°C)
• long-term
• resource efficient
• genetic stability
**Restoration ecology**
set realistic goals, identify threats, mitigate, collect appropriate seed, reintroduce, monitor and review.

What to restore - function, composition, structure, pattern, heterogeneity, species’ interaction, resilience?

**Provenance atlassing** - how local does seed have to be collected to maintain genetic integrity?

DNA fingerprinting is resolving this question
Provenance delineation of *Mesomelaena pseudostygia*

No genetic differentiation detected

Courtesy Dr Siegy Krauss

Provenance delineation of *Anigozanthos manglesii*

Significant local genetic differentiation detected

Kings Park

Midland

Bold Park

east

west

Courtesy Dr Siegy Krauss
Threatened species recovery programs

Corrigin Grevillea (*G. scapigera*)

Genetic management of recovery through translocation -
the Corrigin Grevillea, *G. scapigera*
In 2003, only 2 “wild” plants remain

1. Genetic assessment
   Rossetto et al 1994

2. Propagation from cuttings of 10 clones

3. Establishment (96-98)
   >300 plants

 Restoration ecology
- smoke stimulates germination of 20% of flora (unknown until 1990s)

Restoration ecology
- smoked water application
Restoration Ecology
- from eucalypts with generalist pollinators to orchids with extreme specificity of pollinators and helper fungi

Restoration of Native Orchids - Benefits from a research partnership between industry, academe and the community
Restoration ecology

• Restoration ecology is in its infancy – most landcare plantings are landscape gardening – need to move towards restoration of sustainable, biodiverse systems if biodiversity conservation is an objective of landcare projects

• With exotic organisms now well established, new restoration approaches are needed incorporating weed and feral animal control as essential activities

• Biology of many native organisms poorly understood – ongoing scientific research essential to devise restoration programs and reduce costs

• Some recent highlights – control of some exotics (foxes, veld grass), translocations, ex situ propagation and cryostorage, Lake Toolabin, Kings Park scarp etc.

Remember the big duality! – coastal and wetland systems easier

• Biodiverse ephemeral wetlands neglected:
  • paperbark flats
  • seasonal pools, seeps and gnammas (rock pools) on granite

• Terrestrial systems removed from the coast and wetlands the greatest challenge:
  • leave the soil surface intact wherever possible
  • manage weeds
  • beware of frequent fire, especially on sandy soils (use smoked water as a restoration tool)
  • disperse propagules, but wisely! – use local seeds/cuttings to conserve local forms
  • expect change – induced or otherwise
  • expect failure, celebrate successes
  • learn through research and adaptive management

• This is a long term business
Landscape ecology and a new ethic

• Every vegetation remnant matters
• Is economics the primary motivator?
• Will a new land ethic achieve the same outcome?

Caring for country - rural and urban

The future

‘Why should I care about future generations? What did they ever do for me?’

– Groucho Marks

Community’s heritage needs a whole of community response

Biodiversity conservation is:
– urgent,
– at some cost,
– but worth it if a major part of the Grainbelt’s special and unique character is to last
Conclusions 1

- Contemporary Grainbelt plants, animals and environments have a rich and deep history.
- The globally old, flat terrain of the WA Grainbelt has weathered, nutrient-deficient soils and accumulated salt.
- Inventory and biological survey still incomplete, but significant recent progress has recorded an extraordinary range of biodiversity.
- Grainbelt biodiversity is limited by, and at risk to changes in, land clearing, summer temperatures, rainfall seasonality, soil attributes (fertility, salinity), dieback disease, weeds and feral animals.
- We have international responsibilities in SWA as custodians of one of the 25 global biodiversity hotspots.
- Grainbelt is listed nationally as under the highest landscape stress levels.

Conclusions 2

- Valley floor animal assemblages could lose 58% of their species by 2030 (84% by 2070) due to climate change.
- Potential loss of salt-effected populations of 50% of 1922 taxa included in SAP biological survey, esp. on granite soils.
- 15 wetland plant assemblages (out of 34) containing 472 taxa are particularly at risk to salinity.
- Can we minimise the 6th global extinction event in the Grainbelt?
- Every vegetation remnant matters.
- Restoration ecology is an emerging discipline for the Grainbelt, requiring a new landscape ethic to achieve biodiversity conservation.
1.5 Science and technological innovation: a key to the future of the WA grainbelt

Prof Rick Roush
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Abstract

The productivity of the WA grainbelt is under serious threat from a wide range of environmental, economic, and social factors, including salinity, acidification, erosion, invasive pest (including weed and disease) species, evolution of resistance to pesticides, declining agricultural terms of trade, probable long term increases in fuel costs, climate change that is likely to result in at least more variable and probably hotter and drier weather, declining public appreciation for and political influence of agriculture and rural communities, an aging farm population, and rural decline.

At least in broad terms, key components of the solutions to some of these problems are already known, even if economically difficult. Salinity management will require an increase in the use of deep-rooted perennial plants, and even then the most optimistic scenarios are that we can only slow salinity damage. Acidification can be reduced with the use of lime, sodicity with gypsum. Other problems, such as global warming, are beyond the capacity of Australia to change on its own. It would be overly optimistic to claim that science and technology will develop significantly less costly and more attractive solutions to these problems, or that it can solve the problems that are economic and social in origin, but research and development are critical to reduce the negative impacts of changes that are inevitable for WA. Many of these problems will have to be addressed within Australia, which is already a leader in the development and adoption of relevant technology. There are probably few technologies internationally of which Australian experts are not already aware. Still, we need to think ‘out of the box’ to apply what we know; as Einstein once observed, ‘Imagination is more important than knowledge.’

Perhaps one of the most obvious areas for imagination is to create ways to add value to WA agriculture while enhancing the perenniality of landscape. With the increasing affluence of Asia, meat will be in demand. Perhaps WA should consider how to provide more meat with less land in annual cropping, even if it means harvesting kangaroos. China already consumes a wide range of more unusual animals. Crops and crop varieties may be more closely matched to local conditions with the aid of information systems. Carefully developed, biofuels might help to reduce operating costs. Despite the public debate over GM crops, they have potential to reduce some of the impacts of environmental change. The international wheat centre in Mexico, CIMMYT, is already testing drought resistant wheat. A team at UC Davis led by Eduardo Blumwald has already produced salt tolerant canola and tomatoes. Although still futuristic, other GM technologies such as nitrogen fixation could address the costs of fertilizer and fertilization as a source of soil acidity, while still other researchers are studying ways to reduce the toxicities from acidity.
Science and Technological Innovation: A Key to the Future of the WA Grainbelt

Rick Roush
University of California Statewide Integrated Pest Management (IPM) Program

How research might contribute to a sustainable future for the WA grainbelt

• Where are we now?
• Where do we want to be?
• How do we get there?
• Consider most significant national and international trends
• What are their likely impacts on the WA grainbelt?
Where are we now?
Threats to the Grainbelt

- Environmental
  - Salinity
  - Acidification
  - Climate change: variable, hotter, drier
  - Erosion
  - Invasive pests, diseases, weeds
  - Evolution of pesticide resistance
More Threats to the Grainbelt

Social and economic
- Declining terms of trade
- Long term increases in fuel costs
- Declining public appreciation for, and political standing of, agriculture and rural areas
- Aging farm population

General solutions to some of these problems already known, even if costly and unpalatable

- Salinity: more deep rooted perennial plants and reduction in annual cropping, but will only slow the process
- Acidification: reduced with lime
- Sodicity: gypsum
- Erosion: better land management
Some solutions are comparatively simple, even if not easy

- Invasive species: threats from globalisation, well-intentioned introductions of new species, and hunter/gathers of novelty
  Need risk assessment, interdiction
- Pesticide resistance: rotate, reduce use, and other tactics

Other problems transcend Australia

- Climate change
- Declining terms of trade
- Long term increases in fuel costs
Still Others Must Be Addressed in Australia, But Transcend “Hard” Sciences

- Declining public appreciation for, and political standing of, agriculture and rural areas
- Declining public understanding of science
- Aging farm population
Research and Development won’t solve all these issues, it’s not THE key

• But it is a A Key to the Future of the WA Grainbelt
• Crop varieties will play a large role because input costs are lower

Imagination is more important than knowledge
-Einstein
What can R & D potentially address and how?

• Salinity, by slowing the problem through increased perenniality and crop tolerance
• Acidification, through reduced fertilizer use
• Maintaining crop production even in the face of more variable, hotter, drier years (drought)
• New products to address trade issues
• More efficient farming practices and the potential for biofuels to address fuel costs

Salinity

• Increased perenniality of cropping, but be careful of introducing new weeds
• Sell meat rather than grain? Kangaroos?
• More care to matching vegetation and crops to landscape
• Salt resistant varieties through classical breeding and GM
The cropping system must change

Imagination is more important than knowledge
-Einstein

Crop productivity

• Increased use of break crops like canola
• Continued classical breeding and GM
• Closer match of varieties to local conditions
Key crop to increase?

Fuel use

Biofuels to address fuel costs?

• When all energy costs are considered, including building infrastructure, not necessarily as attractive, but room for improvement
Crop stress

- Drought, Cold, Salt: Linked by common processes
- Betaine preserves osmotic balance
  Choline oxidase from bacteria
  Arabidopsis and rice

Inducible overexpression of Dehydration response element (DRE)
The Arabidopsis Genome Initiative.

The 5 Arabidopsis Chromosomes
- Gene sequences
- Expressed sequence tags
- Transposable element densities

The Arabidopsis Genome Initiative.

Drought stress

Richard Richards, CSIRO
Drysdale 23%> Diamondbird in NSW
Breeding on carbon isotope signature for more efficient exchange of CO$_2$ and water

CIMMYT testing GM drought tolerant wheat using DRE
Salt tolerance

- India: Salt tolerant rice with gene from mangrove; 3X saltwater
- Blumwald: Salt tolerant Arabidopsis, tomatoes and canola
- Transporter protein
- Salt sequestered in vacuoles
- Extracts salt from the soil, 6% of dry weight in leaves, no effect on fruit

Salt tolerance of wild-type (WT) plants and transgenic Brassica plants overexpressing AtNHX1 grown in the presence of 200 mM NaCl

(Blumwald lab, UC Davis)
Weed Competitive and Fungus Resistant Crops

• Increased seeding rates in Australia
  • $124M in NPV, rate of return 43%

• Fungi difficult to control
  • Fungicides as Carcinogens: US NAS

• Cultivars
  • RuBisCo???

Soil acidity

Nitrogen fixing cereal crops that produce only what they need, just in time

• Haber-Bosch feeds half the world, but uses natural gas

• Nitrogen fixation difficult to do
Plants as factories

- Non food crops to diversify cropping system!

Possible molecular farming products include:

<table>
<thead>
<tr>
<th>1) Primary Products</th>
<th>2) Derived Products</th>
</tr>
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<tbody>
<tr>
<td>Monoclonal Antibodies, Immunoglobulin (Ig) fragments- Fabs, scFv (Passive immunity)</td>
<td>Bio-plastics - PHAs (polyhydroxyalkanoates, chemically related to polyesters).</td>
</tr>
<tr>
<td>Antigens (vaccines) (Active immunity)</td>
<td>Nutraceuticals: Macro: Carbohydrates, Fats Micro: Vitamins, co-factors, minerals, Phytochemicals: carotenoids (beta-carotene, lycopene, lutein), flavonoids (quercetin, kaempferol, allicin), isoflavones (phytoestrogens - genistein and daidzein), isothiocyanates (glucosinolates, indoles, and sulforaphane), phenolics (reservatrol, catechin), tannins</td>
</tr>
<tr>
<td>Structural: proteins, peptides, hormones, (interleukins, interferons and colony stimulating factors)</td>
<td>Enzymes: food, feed, industrial, therapeutic, diagnostic, cosmetic</td>
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<tr>
<td>Enzymes: food, feed, industrial, therapeutic, diagnostic, cosmetic</td>
<td>Anti-disease therapeutics: Factor VII,</td>
</tr>
<tr>
<td>Enzyme inhibitors</td>
<td>Non-nutrient phytochemicals: fragrances, flavors</td>
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<tr>
<td></td>
<td>Fibres: polymers, lignins</td>
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</tbody>
</table>
Public support for GM?

Organics as a market?
“Clean and green”?

• Can Australia afford to wait?

Buy the technology from China?
“Ignorance ain’t what you don’t know, it’s what you do know that ain’t correct.”

-Will Rogers

What must be addressed outside R&D

- Declining public appreciation for and support of agriculture and rural areas
- Declining public understanding of science, such as bringing in new species
- Aging farm population
Imagination is more important than knowledge
-Einstein
2. Local voices

2.1 Influencing the direction of research

We have been told that the focal question for this conference is; ‘How might research contribute to a sustainable future for the WA grainbelt?’

My task is to answer this question from a ‘governance’ perspective. The Macquarie Dictionary defines governance as: 1. government; exercise of authority; control.——or 2. method or system of government or management.

Both of those definitions are explicit. So the question really becomes, ‘Who exercises authority and control over research that is relevant to the grainbelt and; does the system of management deliver quality research that benefits those who pay for it.’

While they were not prescriptive about it, conference organisers suggested I examine four areas that may be of interest to delegates.

- Regional governance and regional structures. How well do they represent and service the interests of the grainbelt, particularly from a research and development perspective.

- Research and development by Local/ State/ Commonwealth government, their relationship with private sector R&D providers and their responsiveness to grainbelt needs.

- Representation of grainbelt interests on authoritative or decision making bodies.

- Ramifications of political or economic trends to R&D and service provision in the grainbelt.

With regard to the first bullet point, with the notable exception of the Department of Agriculture, those Institutions responsible for the provision of R&D have little or no infrastructure in the grainbelt. It will be argued by Curtin University that they have Muresk on its western fringe. Yes, they do and I look forward to seeing how the new Director of Muresk, Dr Graeme Robertson, can turn that underutilised facility around and make it more relevant to the university and to the grainbelt.

It is not appropriate to make too much of the fact that there is little or no research infrastructure in the grainbelt. It is impractical to expect existing research institutions will be relocated. If agriculture research infrastructure is to be expanded in Western Australia, indications are it will continue to follow the established pattern.

Recently, the expressions of interest that came from those parties signalling their desire to participate in the proposed new Agricultural Science, Food and Natural Resources Management Institute made it abundantly clear that such a facility, if built would be on or close to the campuses of existing urban based universities.

While those of us who live in regional areas might wish for something different, in all practicality research within the grainbelt will be limited to field trials conducted in the region by researchers based in Perth.
The contentious issue in the first bullet point is the reference to regional governance. In examining how well the grainbelt is served by our present system, I chose to look at it generally rather than from a research and development perspective.

The governance structures that exist in regional Western Australia are usually part of a larger, whole of state body that takes its instruction from Perth or, in some instances Canberra.

The exception is local government. It is genuinely decentralised. Unfortunately local government is significantly disadvantaged. It is a delegated authority of the State and therefore its autonomy is limited.

In a democracy the most powerful interventions that can be applied to autonomy are the statutes by which a body is empowered, or the financial constraints imposed by one arm of government upon another. Local government is forced to suffer both.

Consequently, local government is focussed on its core business of delivering services to its residents in the most efficient way its financial resources permit. It does not have the capacity to fund significant levels of research and like most of us can only make observations from the sidelines about what should be researched.

If you believe as I do, that State and Commonwealth Government policies are only as good as the funds they appropriate to deliver outcomes, then the grainbelt, like all other parts of the Australian hinterland has been short changed for years. Irrespective of the source of public funds, the vast bulk of taxes are spent where the votes are.

Let me give three examples:

- Freight is one of the biggest input costs for grain growers. And yet funding for improvements to regional transport infrastructure is in decline. Not so for urban passenger transport.

- Perhaps I should declare an interest here, because I was responsible for placing the Regional Development Commissions Act on the Western Australian Statutes. But, over the past four years the nine regional development commissions have been reduced to bureaucratic shells because they have been starved of funds.

- One government department that could boast some regionalised structure is shrinking its personnel back to the metropolitan area because it too has suffered successive funding cuts. I refer of course to the Department of Agriculture. Its focus now seems to be solely on managing its dwindling resources. Innovation or new initiatives in agriculture are invariably the first casualty of spending restraint.

Any endeavour by the two other spheres of government, Commonwealth and State, to deliver good regional governance and to provide some equity to non urban dwellers in this country, is severely compromised by that most fundamental principle of democracy: that while a minority may be heard, the majority rules. Australia is one of the most urbanised countries in the World and those of us living in the regions are constantly subjected to the will of the majority.

No matter how well intended some individuals in government or the bureaucracy may be; the hard fact is that the grainbelt is part of the minority and is treated accordingly.

With reference to the second bullet point, agriculture ploughs a higher percentage of its earnings into research than do other industries. Most of this comes from levies imposed by statute, but it is encouraging to see the establishment of bodies like the Council of Grain Grower Organisations (COGGO) or the Western Australian No Till Farmers Association (WANTFA) who often augments the compulsory levies appropriated for research with funds they raise voluntarily.

One important trend in research and development is the increasing involvement of the private sector in the conduct of research. This has been brought about by bodies like the Grains Research
Development Corporation (GRDC) directly funding private companies rather than institutional bodies.

In addition, industry is also more directly involved with universities. Much of today’s research originates from Cooperative Research Centres (CRC’s). This model relies heavily on the capacity of universities and other research institutions to win grants from both state and commonwealth governments. One of the conditions usually attached to these grants is that a proposed CRC must have a private sector partner, a significant funding source from industry, or both.

It is interesting to note that the higher level of direct involvement by industry in research and development has been accompanied by isolated calls to end compulsory levies.

Research and development has played an important role in the grainbelt maintaining its profitability despite declining terms of trade. New varieties, more flexible management systems, more efficient equipment and advanced technology have all played a part in improving farm productivity to the levels needed to combat higher input costs and declining terms of trade.

Any reduction of funds for research and development would be a backward step.

It is however, reasonable to demand adequate representation on those bodies that spend funds acquired from industry or are established to give industry or communities a voice in policy direction.

I suspect most of you share my philosophy about committees, seminars or conferences. They are a long, long journey to somewhere. It is not obligatory to participate but if we do not there are two possibilities. Firstly, we might miss the journey and secondly, by default we may have given the job of representing us to some one who does not have our confidence.

There is no shortage of allegedly representative committees. A quick poll in this venue would indicate that most if not all of you are on one committee or another. The questions are; do you make a difference? Do you come home with a satisfied sense of empowerment or are you frustrated in that you have been merely a rubber stamp for the executive?

It is important that those questions are answered. It is certain that in today’s complex society the number of committees will be more, rather than less. At any time it is equally certain that opposing views are being expressed about those issues your committee may be wrestling with. In that environment of division and uncertainty, it becomes much easier for the executive body to disregard input from committees and do what they choose.

The grainbelt is represented at many levels of organisation. Our capacity to influence decision makers is directly related to the quality of our representatives on committees and the preparedness of decision makers to listen.

It must be concluded that, while the grainbelt may be well represented, outcomes suggest it receives very little consideration from the nation’s powerbrokers.

Finally, I turn to the fourth bullet point. This opens Pandora’s box. While I am tempted, it would be more appropriate to focus on one single issue. Undoubtedly, the grainbelt’s biggest challenge is managing demographic shift.

In their race against rising input costs and declining terms of trade, farmers and agricultural service industries will do whatever is necessary to remain viable. Do not expect them to buck the trend of trying to do more with less. It means there will be a continuation of higher capital investment and reduced labour requirements in the grainbelt.

They can still make an effort to slow the rate of population drift. The tendency to follow the fly in fly out policy of the resources industries should be strongly resisted. The number of farmers or key service industry personnel who operate on a drive in drive out basis is growing. If the two key industries in the grainbelt continue that practice, why should the rest of Australia, especially governments, care about what happens in the grainbelt?
Governments should care and they can do something. They have to close the gap between urban and rural living. I suggest action in two areas. The first is remedying one of the biggest financial disincentives that turn people away from the bush, the high cost of living. A genuine regional tax allowance that does more than offset the higher cost of country living would restore some equity to regional dwellers.

Secondly, in areas like the grainbelt where market failure may cause essential services delivery to fall below acceptable standards, be prepared to step in and where practical, maintain them with interventionist policies.

The economic future of the grainbelt will be determined by global demand for agricultural product. These days, when assessing overall performance, it is popular to talk about the triple bottom line. While the social and environmental fabric of the grainbelt is directly related to our economic well-being, the final arbiter of our quality of life will be those people who reside in it and the governments who represent them.

**I have every confidence in the economic future of the grainbelt. With respect to social and environmental values, I am not so confident.**
2.2 Grainbelt or brainbelt? — beyond outdated stereotypes

Wendy Newman
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PowerPoint presentation
Outline

- What do sustainable communities look like?
- What are the inhibitors and enablers for sustainable communities?
- The ‘grainbelt’ of the future – what does it look like?
- Relevant R & D for today and the future

Sustainable Communities ..... 

- take an integrated approach to creating a sustainable future
- maximise the use of limited time and resources in areas that will yield the greatest strategic benefits
- develop plans that merge social and economic goals and build capacity
- mobilise sectors of the community around priorities
Sustainable Communities....

- focus their energies on mobilising internal assets while leveraging outside resources to achieve goals
- establish a critical mass of cooperating organisations implementing and evaluating
- have strong inclusive and visionary leadership
- promote well being through participation, consultation and involvement

From: Strengthening Communities Unit, NSW Premiers Dept

Sustainability inhibitors

- The grainbelt stereotype – limiting perceptions within and without
- ‘Get big or get out’ mentality
- Measurement too often focused on economical, statistical (quantifiable) data not people, social (qualifiable) data
- Burnout & capacity – less doing more
- Conservative backlash, parochialism
Inhibitors cont.....

- Projects v’s Plans – life of govt. short term approach
- ‘Can do’ communities thwarted by ‘can’t do’ bureaucracies (accountability overboard?)
- Limited support and understanding for capacity building
- Traditional research approaches – statistical ‘accuracy’ driving the silo approach, inhibiting relationship building
- Lack of easily accessible information

Sustainability enablers

- Capacity building through life long learning, action research, appreciative inquiry
- Innovation, adaptive to change
- Quality planning through good info, visioning the future, bite sized bits
- Creating accurate and positive perceptions – people, diversity, opportunity
- Integrated, holistic, cohesive, co-operative approaches
The “Grainbelt” of the future

- Reduced emphasis on primary industry
- Greater industry diversity, value adding – proper recognition of the SME!
- Brainbelt, not Grainbelt – opportunities from the knowledge economy
- Opportunity from adversity – environmental management

“Grainbelt” of the future

- Social measures of success as well as economic considerations
- Relationships, networks, sense of community
- Volunteerism (social capital) measured in GDP!!!

PEOPLE, PROCESS and PRODUCTION!
R&D today, the future

☐ Accessible – message & medium
☐ ‘Real’ – for the people by the people
☐ Integrated, holistic, cross discipline
☐ Triple bottom line imperative

“Never doubt that a small group of committed citizens can change the world. Indeed, it is the only thing that ever does.”

Margaret Mead
The future is now

Bob Grant
Strategy & Business Development, CBH Group, bob.grant@cbh.com.au

Abstract

The paper discusses broadacre farming in the south west of Australia, primarily from a business perspective. Rural businesses reflect the economic health of farming and the continued and long term decline in producer’s terms of trade will be the most significant influence on the future of broadacre farming in Western Australia. The narrowing margin between commodity prices and the cost of production is redirecting investment beyond the farm gate and towards upstream processing and value adding. In future, Western Australian broadacre farmers, rural business and researchers will need to see themselves as being active participants in a global food chain rather than involved in the production of primary products—if they are to survive. Agri-businesses are rapidly consolidating with a probability that two or three will dominate. This will provide opportunities for many smaller players to fill niche markets with highly differentiated product. Western Australian farmers will not be able to sustain their current R&D funding contributions into the future and, while private enterprise will pick up some of the shortfall, this will only be in the context of R&D outcomes meeting commercial hurdle rates and progress regularly measured against strict performance criteria.

Introduction

The Western Australian broadacre farming area makes a significant contribution to Australia’s overall agricultural production. Specifically, the area is suited to grain, wool and livestock production.

From a national perspective, the region has the disadvantage of being isolated from the more heavily populated and industrialised eastern seaboard which, to date, has limited opportunities to value add primary products for domestic consumption. However, there is a geographical advantage in being close to major export markets, particularly the Asian region.

Western Australian broadacre farmers face a range of challenging issues. From a commercial perspective, this paper argues that the single most challenging issue is the sustained long term decline in farmers’ terms of trade. This trend is intergenerational and the consequences have already seen significant shifts in rural populations to urban areas and the subsequent closure of towns and supporting businesses.

The reality is that, other than the occasional short spikes arising from global changes in supply/demand, the decline in rural commodity prices is unlikely to be reversed. This fact is well known and confronts agriculture worldwide.

Up until now, maintaining profitability has been the result of larger farms, fewer farmers and increased productivity arising from technology and improved agronomic practice. However, time is up. The quick wins in productivity gains have largely been delivered, the remaining gains will be hard fought and it is inevitable that future investment, including R&D, with marginal gains will be re-directed to investments with higher returns and carrying less risk.

The questions are—have all participants realised this and, if so, how will they respond and survive?
What is good and not so good about the WA grainbelt at present?

From a business perspective, there are a range of good points in respect of the present WA grainbelt. Conversely, there also exists a range of disadvantages for rural based businesses, some of which present substantial barriers.

Opportunities

Western Australia is fortunate in that it is within close proximity to Asia—the world’s most populated region and with the fastest growing markets for a whole range of goods and services. Included is the potential for a range of existing and new agricultural products.

The immediate downside for the Western Australian grainbelt, despite the ‘clean and green’ credentials, is its future capacity to share in this potential is restricted by climate and soil to predominately cereal crops and livestock, and to a lesser extent oil seeds, pulses and boutique aquaculture operations.

The upside is that Western Australia broadacre farming is very good at what it does and these products are those that Asia either cannot produce or has a shortfall. However, tariffs and trade barriers still exist in respect of many imported processed and semi-processed products into many markets. Coupled with Australia’s higher labour costs, these barriers inhibit opportunities for on-shore value adding of agricultural produce and favour the export of bulk commodities.

Terms of trade

The single most important issue facing Australian and global agriculture, both in an historical context and for the future, is the continued decline in the terms of trade for primary producers. Table 2.3.1 shows ABARE (2004) data demonstrating this issue, however, there is no shortage of evidence to demonstrate the trend of a narrowing gap between the price received and the cost of production.

Table 2.3.1. Past and projected terms of trade for primary producers (ABARE 2004)

<table>
<thead>
<tr>
<th>Farm price indexes</th>
<th>Unit</th>
<th>2001/02</th>
<th>2002/03</th>
<th>2003/04f</th>
<th>2004/05z</th>
<th>2005/06z</th>
<th>2006/07z</th>
<th>2007/08z</th>
<th>2008/09z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prices received by farmers</td>
<td>Index</td>
<td>100</td>
<td>99.7</td>
<td>98.0</td>
<td>91.7</td>
<td>91.7</td>
<td>92.2</td>
<td>92.5</td>
<td>92.7</td>
</tr>
<tr>
<td>Prices paid by farmers</td>
<td>Index</td>
<td>100</td>
<td>106.2</td>
<td>106.5</td>
<td>107.8</td>
<td>110.2</td>
<td>112.9</td>
<td>115.3</td>
<td>118.0</td>
</tr>
<tr>
<td>Farmers’ terms of trade</td>
<td>Index</td>
<td>100</td>
<td>94.0</td>
<td>92.0</td>
<td>85.1</td>
<td>83.2</td>
<td>81.7</td>
<td>80.2</td>
<td>78.6</td>
</tr>
</tbody>
</table>

f = ABARE forecast; z = ABARE projection
While the table is a snapshot in time, a look at the CBOT price for wheat over the past 100 years would equally demonstrate that, in real terms, farmers are receiving far less for their grain today than ever before.

The sad reality and consequences of a long-term decline in the terms of trade are evident throughout rural Australia with considerably fewer producers, declining rural populations, closure of essential services such as schools, banks, health and other service providers as well as a host of small businesses. One town holds its own, or grows, while another five disappear.

Marginal returns mean either economic failure or moving into high volume/low margin undifferentiated operations (hence the rationalisation within all sectors of agriculture), or changing to high margin, low volume, highly differentiated product. The risk profiles can vary substantially between these market sectors.

**Productivity gains**

There is no doubt that there have been substantial improvements in on-farm productivity. Research and development have played the most significant role in these gains, not the least being improved crop varieties, yields, better use of soils and fertilisers, improved disease resistance, and farming practices in general.

These productivity gains have been essential to maintain a globally competitive position. Without them, WA broadacre farming would arguably have ceased to be economic many years ago. The disappointing aspect is that the vast majority of the economic gains have been exported with the product and primarily benefited the consumer rather than the farmer.

The evidence suggests that investment, driven by the higher returns, is now beginning to be directed further up the value chain and the value. The challenge for supply side agricultural research will be to substantiate continued investment behind the farm-gate when the farmer may now be better served by investing in processed food production rather than raw commodities alone.

**Infrastructure and essential services**

Land transport and general logistical infrastructure is comparable, or better, than our trading competitors. Road transport is efficient, however there are increasingly less major carriers prepared to operate on the thin margins that prevail. Rail operations are essentially limited to bulk commodities and the Western Australian rural rail network, outside of main trunk lines, carries insufficient volume to be considered sustainable in the medium to long-term.

Telecommunications in some areas is below the standards expected in a comparable metropolitan business environment although there are signs that it is improving.

Essential services, such as power and water are generally adequate in the major regional centres but can vary from inadequate to non existent in more isolated rural areas. The lack of either one of these can be a major impediment to business. Even where services are available, the cost of associated head-works and connection can be very expensive for large businesses and beyond the financial capacity of small and medium sized enterprises.

**People, skills and culture**

Western Australian farmers are considered industrious, productive and amongst the most efficient dry land farmers in the world.
The lack of substantial subsidies and reliance on international prices has developed a culture of on-farm independence and agronomic innovation. Australian agricultural research and development is highly regarded internationally.

Beyond the farm-gate, WA farmers are largely considered to be conservative, slow to accept change and suspicious of government and big business.

The drift of rural populations to urban centres, particularly by the young and better educated, has resulted in a shortage of skilled labour in many rural districts. This is a substantial cost to rural businesses that not only have a higher turnover of trained staff, but have to set higher than average remuneration levels in an endeavour to attract suitably qualified replacements to settle in rural communities that struggle to provide adequate education, health and social amenity.

What would a really good WA grainbelt be like in the future?

Improved terms of trade

The best news for the WA grainbelt would be a reversal in the global terms of trade for agricultural commodities.

Higher sustainable margins for agricultural produce would reverse the population drift to urban areas and the resultant higher multiplier effect of an increase in disposable income and the ensuing economic benefits to rural communities and associated businesses. The centralisation of education, health and other community services would cease. People would have a reason to stay on the land and still more would be attracted for the first time. New opportunities would develop as a consequence.

A hundred years and more, of declining commodity prices are unlikely to change. But there are other ways to improve farm profitability.

Demand side investment

Failing an unexpected, substantial and global reversal in the terms of trade, the future would see WA farmers as significant investors in the demand end of the value chain. Farmers, and more particularly, the agri-businesses in which they already have substantial investments, have already commenced serious investment in up-stream processing of farm produce.

The future will see WA farmers not only producing raw commodities, but receiving increasing value from national and international investment from the demand side of the value chain through equity in value adding produce beyond the farm gate. Some examples include CBH’s joint venture with the Salim Group (Indonesia); Ausbulk’s acquisition of Joe White Malting; Graincorp’s and Cargill’s (USA) acquisition of Goodman Fielder’s flour milling operations.

These are but examples of the beginning of a change in investment strategies and a re-direction of the investment dollar.
The right market segment

The future Western Australian broadacre farmer will be either a low-margin/high-volume producer, or will be a high-margin/low volume niche producer (Figure 2.3.1). Rural based businesses are already establishing the future trend.

Consolidation/rationalisation has occurred at an increasing rate. Rural merchandising is dominated by Elders and Landmark. A decade ago there were 15 major players in the Australian grain industry—with the recently announced merger between ABB Grain/Ausbulk that number is now down to four. These are substantial companies, each with annual sales exceeding a billion dollars and with increasingly diversified investments.

On the other hand, there are niche organisations establishing around these major players. These organisations and individuals have some competitive advantage in being more flexible and able to respond faster; or have lower overheads; or able to be more focused; or some other capability.

Environmental sustainability

There is little doubt that environmental issues are significant and the WA grainbelt has a substantial challenge ahead in terms of salinity and changes to rainfall patterns.

Nevertheless, with time and focus the former has the potential to be addressed. The latter leads to debate on the ‘green-house effect’ and issues in respect of global warming. This paper does not attempt to make a contribution to either and will allow other at this conference to take the lead.

However, from a business perspective, the sustainability of broadacre farming in Western Australia is a matter of substantial consideration in strategic planning. Major infrastructure projects are long-term investments with significant capital at risk. For instance, the economic impact of producing an average 15 million tonne crop versus a 25 million tonne crop in 2020 translates into hundreds of millions of dollars in capital investment in storage, transport and logistics services.
What is the role of R&D today and what is its role in the future?

Today

To date, the role of R&D has been largely focused on the supply end of the value chain. The substantial on-farm productivity gains have necessarily concentrated on varieties, yield, quality, nutrition, husbandry and a host of other activities directed at enabling efficient farming operations.

As discussed earlier in this paper, and following decades of R&D expenditure, primary producers’ terms of trade continue to decline. The majority of R&D economic benefits are competed away with the primary beneficiaries being consumers.

Despite some excellent outcomes, the Australian research effort is perceived by business to be overly fragmented with serious questions as to how much of the research expenditure and effort has been diluted through duplication and, as a consequence, how much more may have been achieved.

Governments are reducing publicly funded research dollars with an expectation that private industry will, at least in part, pick up the shortfall. The limited capacity of a rapidly reducing number of primary producers to fund R&D needs to be acknowledged by all. Put simply, farmers no longer generate the profit margins to support R&D at historical levels.

Tomorrow

Business has commenced to invest further along the value chain and will have an expectation that R&D will follow. No doubt, research will need to continue behind the farm gate if farming is to remain sustainable and Western Australian farmers are to remain competitive relative to their international rivals.

Nevertheless, both farmers and the commercial organisations of which they are the major shareholders, will be attempting to extract the highest return on their investment and this will, and is, leading them into upstream value adding opportunities and the formation of stronger relationships with their customers—including national and international processors with distribution networks in key markets.

Future R&D funding will be primarily provided by private enterprise and will be more evenly balanced in respect of on-farm research and research focused on maximising returns post farm gate.

Furthermore, research expenditure will be competing for limited funding also being directed toward growth and value-adding opportunities further along the value chain. Research outcomes will need to not only promise equal, or better, commercial returns to receive initial funding—projects will need to achieve pre-established milestones at regular review periods to be able to progress to the next stage.

If there is a current view that funding for agricultural R&D projects is scarce—then it will be significantly tougher in the future.

References

2.4 The WA grainbelt landscape in 2030?

Chris Henderson
C&E Henderson, Varley WA, chris_gregmaun@bigpond.com

Introduction

Grain farming in WA has met many challenges over the decades. In my farming career we have thrived on meeting those challenges and I’m sure that the industry will continue to rise to the challenge in future decades. We are seeing accelerated change in the landscape with continued reduction in the rural population and the imminent demise of some smaller more remote communities. This poses the logical question: ‘What will the grainbelt landscape look like in 20 years?’

In our farming district we have seen an increasing shift to absentee ownership with owner/managers commuting to the farm for periods of work from their city or large centre residence. In some cases employed managers are filling the day to day management role on the owner’s behalf. I believe that this trend will continue and to an extent start to effect inner areas.

Grain Farming offers opportunities to corporations with returns capable of standing corporate scrutiny. The corporate sector does have some trouble accommodating the inevitable variability that grain farming has however this is more of a mindset hurdle than an insurmountable problem. The reality is that grain farms will continue to get larger and the grain farming sector needs investment by the corporate sector.

Corporate farms or large family farms require employed management and staff. Demand for well qualified management personnel will increase. Machinery operators are increasingly becoming harder to source. For too long our industry has lacked the promotion necessary to attract people in at the school leaver age. I note the ‘Kondinin Group’ is doing some good work in this area.

Research and Development breakthroughs of the past 25 years

R&D carried out year-in year-out has provided incremental gains for grain growers over many decades. There are several stand-out breakthroughs over the last 25 years that have provided us with the platform for quantum leaps forward.

Lupins

The adoption of lupins as a rotational crop in the 1980’s was the catalyst for cropping area on our farm to expand from a maximum 50% towards 100%. Sub clover based pastures in rotation with wheat were replaced with the lupin/wheat rotation. Through the mid to late 80’s lupins and wheat grown in a tight rotation was very profitable for us, however as lupins were grown on the same paddocks for the second and third time, disease pressure increased significantly and consequently yields dropped.
Canola

In the early to mid 90’s Canola was the new crop that provided an extension to the rotation necessary to manage disease and weed issues related to tight rotations. Canola for some has come and gone, however we have continued to grow canola successfully for 10 years now. Canola requires close management and adequate nutrition and can also create nutritional issues for subsequent crops. Through some very timely R&D being carried out we now have a good understanding of the nutrition issues and in fact we now have a much better understanding of the nutritional requirements of all crops in the rotation.

No-till

Late in the 90’s and more particularly in this decade the increased adoption of the No-till farming techniques has been a major contributor to increased yields and returns. Whilst we had been direct-drilling crops and maintaining at least some stubble for several years, no-till adoption has allowed us to maintain more stubble in the system. The key benefit to us of no-till is timeliness of seeding. Seasonal breaks in our district are often typified by patchy light falls of rain and the ability of the no-till system to access the moisture and to leave furrows capable of harvesting moisture from rainfall subsequent to seeding, have provided great benefits to timeliness of crop establishment. Use of chemicals such as Trifluralin at relatively high rates is also possible with no-till.

GPS technology

In this decade we are seeing huge interest in GPS technology and precision agriculture. GPS technology has given us to date:

- GPS Mapping
- GPS Guidance
- Auto-steer capability
- Controlled traffic farming
- Yield mapping
- Variable rate cropping

I am a little concerned that the main beneficiaries of the adoption of some of this technology may not necessarily be the farmers although I do concede that there are big benefits available over time.

Research and Development challenges of the next 25 years

Sustainability for the individual farmer is more about being profitable year in year out than about the environment we farm in. By producing good reliable profits farmers will have the financial capacity and the will to better care for environmental issues.

There are only two ways to increase profits in any business—either by increasing income or reducing costs or in fact a combination of both. To maintain the profitability of grain growing we will need to see continual R&D breakthroughs that have similar impact to those of the last 25 years.
Where is the next breakthrough coming from?

**Enterprise mix**

Crop farmers are faced with decisions on what are sustainable rotations and do livestock have a place in the system. Livestock profits are regarded as the poor relation of the farming enterprise in the cropping belt. Sheep enterprises are now more about meat production than wool production. Cross bred lambs produced in winter, weaned onto high quality stubbles in summer and finished on a feedlot and marketed in May/June as one year old prime lambs are making $70 to $80 net. There are some reasonable profits to be made from the sheep enterprise if there is some pasture in the rotation. Similar profits are probably available with a cattle enterprise, if the property has the infrastructure in place. There is some merit in having some pasture as a part of a sustainable rotation with herbicide resistance and disease issues challenging tight crop rotations.

Generally speaking there has been huge investment over the years in infrastructure on farms to accommodate livestock and if the decision is made to move completely out of a livestock enterprise, this infrastructure quickly deteriorates to the point where it is difficult to get enthusiastic about re-establishing it.

**Herbicide resistance**

Herbicide resistance management is a big cost to us each year. We see herbicide resistance continuing to develop. We will need to continue to modify our practices to manage herbicide resistance. WAHRI are doing great work here in WA and I sincerely hope the funding and accommodating bodies concerned will ensure their work continues.

**Crop/pasture nutrition**

More and better targeted R&D is definitely required in the area of crop and pasture nutrition. The results of the R&D need to show clearly the economic benefits of the options. Farmers have limited funds to invest in their crop and need to do cost/benefit analysis on the various crop/pasture inputs that compete for the investment. Fertiliser companies are doing considerable amounts of R&D and are generally giving very honest and responsible recommendations, however these often need some independent ratification.

**GE technology**

This technology truly offers great hope for our industry to take quantum leaps forward. The potential for engineered input traits for crops to help us reduce costs or stay in front of agronomic challenges such as herbicide resistance, or in fact grow crops on saline land with the benefits of gaining productivity and reducing water table levels is real. In fact growing viable crops on saline land would provide a productive remedy to the problem. The potential for output traits to add value to our grains is also real.

Unfortunately special interest groups have been so effective with their misinformed propaganda campaigns and governments around Australia have been spineless in not standing up against these groups, that we have in recent weeks seen multi-national investment retreat from Australia. I must ask the pertinent question; how strongly have the GRDC and the state Departments of Agriculture argued the case for the industry? Of course the challenge now is to get the R&D programs back on track and to attract the multi-national investment back to Australia.
Summary

The Landscape in 2030

- In 2030 there will be half the number of farmers that there are today
- It follows that farms will be twice the size they are today
- Large family farms will be the most efficient units
- There will be more corporate farm operations with enterprise diversity and geographical diversity
- There will be excellent opportunities for well trained managers and other key staff
- Salary packages for key staff will be twice what they are today in real terms and in the case of top quality managers possibly three times what they are today
- There will be larger regional centres and many small towns will die
- In the more remote farming areas farms will operate on a ‘fly-in/fly-out’ basis
- GM crops will be common
- Automated/remote control machines operating on tramline systems will be common
- Extensive burning of paddocks will be prohibited
- Livestock will be run intensively and crop residues utilised as feed by removal from paddocks
- Large capacity on-farm grain storage will be common
- There will be significantly more crop segregation and direct marketing by groups of growers and large individual corporate farms
- Corporate farms will employ their own agronomic support teams and conduct their own research programs
- Farm support services such as administration support will be far more available
- R&D will be far more commercialised and derive income through the value chain

Research and Development priorities

There must be a strong focus and effort to always search for the next breakthrough technology. Incremental production increases while important to industry sustainability will not be sufficient to drive the industry forward. Selecting the right research areas to fund with the limited industry/public funds, which areas to leave to the commercial sector and which areas that need joint funding will be critical.

Crop farming is an exciting industry. There are always challenges, great rewards and occasionally big disappointments. That is the nature of our game.
2.5 Pushing the Research and Development frontier: an environmentalist perspective on innovation for landscape resilience

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Abstract

Broadacre agriculture has undoubtedly created a prosperity that is the envy of much of the world, but as a result the natural systems upon which Australian civilisation ultimately depends are paying a heavy toll. ACF wants to see people on the land, making a decent livelihood and looking after the country—for all of its values—a thousand years from now and beyond. One of the most profound and exciting challenges facing all Australians is to transform our farming sector from a destroyer of biodiversity, to a major contributor to nature conservation, landscape health and hopeful rural futures. The challenge is daunting for all concerned—farmers and their communities, environmental advocates and consumers, policy makers and politicians, scientists and science communicators. As climate change, salinisation and globalisation unfold over coming decades; successful biodiversity conservation in broadacre landscapes rests with our efforts to build ecological, cultural and socio-economic resilience. Science and policy should focus on understanding, developing and promoting effective 'ecoagriculture' principles and strategies: Preventing further habitat destruction, enhancing habitat values and restoring ecological connectivity, minimising agricultural pollution, modifying soil and water management, developing farming systems that mimic natural systems, and making the most of opportunities for community development and income diversification associated with biodiversity assets. Research is also needed to develop practical information systems and tools for community, catchment and property-level decision-making, and to institutionalise adaptive and participatory management. A transition to landscape health demands a collaborative effort between the ecological, agronomic, social, economic and engineering fields. Arguably, the transition has begun, but the prospects of success remain uncertain: To really make a lasting difference requires a commitment to change grounded in a frank acknowledgment of the unsustainability of today’s broadacre agricultural landscapes, and a search for courage and some common ground amongst governments, businesses and civil society.
An Environmentalist Perspective on Innovation for Landscape Resilience

Corey Watts
Sustainable Rural Landscapes Campaigner
Future Broadacre Agricultural Landscapes
Conference & Workshop
Joondalup, WA, 15th-17th June 2004

Landscape Meanings

- One way of thinking about landscapes is as places human culture and wild nature share in a ‘dynamic patchwork quilt,’ which is woven by ecological, economic, political, cultural and social threads, and is which known through our cultural and personal experience.

- May be best not to try to pin down what landscapes are, but landscapes are affected by real bio-physical processes that we must come to grips with.
Drivers of Ecological Change

- Decline of Soil Health
- Decline of Wetland & Waterways Health
- Decline of Biodiversity, Ecological Connectivity & Ecosystem Services
- Climate Change
- ‘Globalisation’ – socio-economic & demographic changes

Australia’s broadacre agricultural landscapes are some of the most ecologically stressed in the country

Threatening Processes in the Avon

- Habitat fragmentation
- Grazing pressure from domestic stock, rabbits and kangaroos
- Foxes and cats
- Exotic weeds
- Changed fire regimes
- Pathogens
- Secondary salinisation
- Poisons, esp. agricultural pesticides

(NLWRA 2002)
Landscapes in Decline

Habitat loss & fragmentation
DRYLAND SALINITY

CLIMATE CHANGE

Biodiversity Loss & Ecosystem Services Decline

‘Ecoagriculture’ – Principles & Strategies

Land-use systems designed to produce both human food and ecosystem services, including habitat for wild biodiversity

(McNeely & Scherr 2003)

1. Preventing further habitat destruction
2. Enhancing habitat values & restoring ecological connectivity
3. Minimising agricultural pollution
4. Modifying soil & water management
5. Developing farming systems and land-uses that mimic natural systems
6. Community development & income diversification via biodiversity conservation
Linking Farms to Landscapes – R&D Priorities

- Ecosystem management – developing challenging yet achievable targets, and linking property management to regional-catchment priorities
- Understanding the drivers of change – biophysical, socio-economic & demographic – esp. climate!
- Information systems tailored to inform various decision-making needs
- Methodologies for adaptive & participatory management
- Sustainability indicators & biodiversity metrics tailored to different needs.
- Aligning the private and public good – developing a sustainable mosaic of new industries
- Understanding identity in the context of globalisation

Beyond R&D – Science Isn’t Enough

- Scientists must engage in decision-making processes
- Frank acknowledgement of the problems & a genuine commitment to change
- Search for mutual respect and common ground between stakeholders

We all love Australia’s broad, striking country; the bush, the coastline, the rivers and plains. Australia is blessed... We all enjoy the environmental benefits that our ancient continent provides like the high quality food and wine that we eat and drink, clean water, holidays and fishing trips. It’s our national identity, captured on postcards and in picture books.

(NFF & ACF 2000)
I served my apprenticeship with CSBP and Farmers Ltd at the North Fremantle super phosphate works as a lead burner. Through my trade I met and talked with numerous people with connections to land. I also had the opportunity to speak with chemists about the products being manufactured.

As a Nyungar man growing up in the Country and later in the metropolitan area I learnt a lot from my father Fred Collard Jnr, grandparents Tom (Yelakitj) Bennell, Fred Collard Snr, my grandmothers Muriel and Jane, uncles, aunts and lots of Nyungar Birdiyias in the ways of the land.

As a young boy through to manhood I observed and assisted my people in the processes of clearing land by cutting down bush with axes, leaving the wood to dry off and later burn the timber.

We walked through the mallee when the chains and rollers had gone through, we picked and heaped the roots, at night we burnt the roots, all to satisfy the settlers and graziers need for cleared land.

Pop Tom was a very smart man when it came to clearing the land as he had the expertise of his elders who had taught him where to clear, where to leave trees and bush and where to clear the timber.

In this time we lived at Boyagin Valley the home of the Pech family with whom Pop Tom worked and cleared land for many years, this farm is a pristine example of how clearing should be done as the creeks and gullies are still today thickly wooded and grassed. Ken Pech who is a well known farmer told me that when he purchased South Stirling Downs and it was cleared he could recall every word pop Tom told him in relation to clearing, this property is also a fine example.

I have travelled far and wide in my employment over a number of years, I at times wonder when I see properties that have severe erosion problem, because all the timber and bush land has been cleared and nothing is left to hold the soil.

Creeks and gullies have become mini gorges because there is nothing to hold the soil in place.

Large land tracts that become even more barren when the winds and the rains come, creating even worse soil conditions.

Of more recent times travelling rural areas in my role as Manager of Indigenous Affairs I once again took a keen interest in the land and did not like what I observed with the enemy now salinity which came with all the above issues.

I am not an expert, but I remember clearly the old people saying, ‘in twenty years time salt gunna be a big problem because they wouldn’t listen to us Nyungars.’

Mr. Harry Whittington of Brookton listened to the Nyungars and he spent many years perfecting the contour bank, I saw his old farm in Brookton become salt free where he contoured the fields.

Recently I was asked to plant 10,000 trees for a land development in Beaconsfield site on the slopes of a landfill.

I went and studied the trees that were being planted along the roads in the metro and the country, all I saw being planted were wattle after wattle tree, every now and again there would be a few she-oaks, ti trees.
I contacted my cousin Phil Collard at the Mungart Nursery in Kondinin and advised him that I wished to purchase 10000 plants all of native variety (Table 2.6.1).

Table 2.6.1. Inventory of plants. 10,000 plants all native Australian seedling plants @ 60 cents each to be purchased from Mallee Aboriginal Corporation Kondinin.

<table>
<thead>
<tr>
<th>Plants</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mallee</td>
<td>1000</td>
</tr>
<tr>
<td>Jam trees</td>
<td>1000</td>
</tr>
<tr>
<td>Kangaroo paws</td>
<td>500</td>
</tr>
<tr>
<td>She-oak</td>
<td>500</td>
</tr>
<tr>
<td>Wattle (all varieties)</td>
<td>2500</td>
</tr>
<tr>
<td>Banksias</td>
<td>500</td>
</tr>
<tr>
<td>White Gums</td>
<td>100</td>
</tr>
<tr>
<td>Black Butt</td>
<td>20</td>
</tr>
<tr>
<td>Quandongs (when ready)</td>
<td>200</td>
</tr>
<tr>
<td>Tjarra</td>
<td>20</td>
</tr>
<tr>
<td>Peppermint trees</td>
<td>500</td>
</tr>
<tr>
<td>Bardie trees</td>
<td>1000</td>
</tr>
<tr>
<td>Red gums</td>
<td>20</td>
</tr>
<tr>
<td>Local varieties</td>
<td>500</td>
</tr>
<tr>
<td>Ti trees</td>
<td>500</td>
</tr>
<tr>
<td>Bottle brush (Pink and Red)</td>
<td>1000</td>
</tr>
<tr>
<td>Other varieties</td>
<td>500</td>
</tr>
<tr>
<td>Native grasses to be scattered over entire site</td>
<td>2 bags of seeds</td>
</tr>
</tbody>
</table>

We planted 7000 of these using the strawberry jams and wattles as the host plants for quandong and sandalwood, I inspected these plants and found that the jams have grown over two feet in three months.

**Where are we now?**

I believe that we are in a very vulnerable position with people looking outside their farms, their children do not want to struggle with the good and bad seasons, the land has been good to us, but we have to become better land strategists, we have to look outside the box to be successful, people have not got a lot of time to go to university to become an accredited scholar.

Problems confronting us now:

- Erosion
- Salinity
- Bad seasons
- Climbing fuel prices
- Fluctuating land prices
- Non consistent seasons
- Some poor land management
• Some poor planning by early settlers in clearing of the land
• Lack of expertise in dealing with vast range of issues at hand
• Lack of understanding of these issues by people who are offering expertise
• Lack of coordination in dealing with these on going concerns
• Lack of coordination in identifying the issues confronting landowners
• Structured approach in dealing with the issues
• Structured educational programs that can be undertaken in regional and rural regions
• Sons and daughters who want to go and live elsewhere

Aboriginal owned properties are a good example of this, with government agencies coming and going in dribs and drabs leaving the Aboriginal people in a daze, becoming confused.

**Where do we want to be?**

Looking at all the above issues we would like to be very seriously on top off all these issues.

• We cannot control the weather patterns.
• We cannot control the fuel patterns.
• We can get on top of the salinity, and soil erosion issues by being a bit more particular in what plants we want to plant and grow on our land.
• Do not wait plant now.
• Plant trees and plants that will bring in an income, native food species are on the most wanted list for jams etc.
• We have to develop up programs that will assist the agriculturist to deal with the early settlers problems of poor planning by correcting the cause.
• Coordinate educational programs that will assist with development of land managers (TAFE).
• Early identification of issues that will assist land managers.
• Very clear and structured approach to deal with these issues.
• Subsidies to address the tree planting issues.
• Develop up strong internet sites for the land managers in their regions as a group so that hundreds of hours are not wasted in talking, mail sent in group packages identifying an issue, resolutions and everything else, no need for mass mail outs, email messaging sent in moments.
• Other diverse farming of native species.

As a Nyungar I found the Internet to be my best mate.

Consult local Nyungar elders or other Aboriginal people within your area, seek their input as to how their family may have assisted with the early clearing, their advice may assist you in identifying and dealing with local issues such as trees and shrubs that may have grown their at one time or another.
To get there

We need to get serious with all, agencies to address the needs of the land managers, education delivered in and around the rural areas, TAFE is in every town, they are crying out for people to come to courses, why cannot they come to your office.

Regular meetings to discuss local needs and opportunities, become strong lobbyists, change policies that are deficient.

What is detrimental or negative; remove these.

What is positive becomes more beneficial to us, weigh up planning using the positives with better planning.
2.7 Families in the grain country—neutered or nurtured?

Neil Young
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My personal story is typical of many farming families. From many generations of farmers, and in my generation all my brothers went farming, to the current generation probably having no farmers. This is not sad personally, as they are simply going to where the best prospects for them are, but it will have a long term effect on the farming community.

I am not here to talk about WANTFA. If I was I would tell you it has around 1300 members, which is equivalent to 20% of the broadacre farmers. It formed out of frustration at soil erosion, and a determination that such erosion did not have to happen. It has been the critical link in developing No-Till sowing so that in 12 years WA has gone from under 1% of its crop sown with no-till to the present where around 75% of the crop is planted with minimal soil disturbance. The biggest single tangible benefit of this change to the farmers has been increased reliability of establishment, and at the same time the environmental benefits of preventing erosion and improving soil structure have been windfall gains. A consequence of this change is that farmers have lifted their agronomic skills, and accordingly lifted their grain output under all conditions. There are possibly people in this room who showed no-till could not work in WA, for apparently very good reasons, however the farmers were determined it had to work—and it has.

Let’s look at our basic resource—the people. The WA grainbelt is populated by well educated, confident and resourceful people. They are used to dealing with complex decisions and adapting to changing circumstances. Technological innovations are generally welcomed and their potential is quickly grasped.

Conversely it is a tremendously lonely place for some young people who feel obligated, for whatever reason, to live in the grainbelt. The collapse of communities hits them hardest.

The social structure has already changed from that with which I grew up—eg, absentee owners, who drive in/drive out from a city base. This leads to a need to rethink the concept of community eg, volunteer fire brigades no longer function when no one is in residence.

The provision of services will be even more critical yet more expensive per head due to lower population eg, current deterioration in relative standards of internet access.

Other social structure changes are showing up, with female farmers becoming more apparent—it is no longer the preserve of men only.

Young women now have an expectation that they will maintain a career, just as men do, and not just play a support role. This is making it harder for young men in isolated areas to establish partnerships. ‘The wife’ is no longer willing to forget her own aspirations and become general assistant to whatever ‘the husband’ chooses to do.

The big question revolves around the source of the World food supply? From where will it come? Will Australia still be a key player? The answer to that will direct the need for research, and the way in which it will be paid for.

Looking at commercial pressures, 30 years will be much closer to the end of oil supply, so energy efficiency will be much higher priority. The days of cheap urea and diesel will be over, shipping costs higher, so that wheat grown in WA will be more expensive to land in consumer ports.
Thirty years will also have salinity impact at its peak—the after effects of current agriculture systems still be flowing through, with new technology not yet having a big impact. The CRC on Plant Based Mgt of Dryland Salinity will hopefully be shining in the afterglow of its success.

Business pressure on family farms will be the same as on the corporate, yet responses will be different. Families accept lower hurdle rates of return, with many prepared to operate at nil or even negative returns for lifestyle reasons. This lifestyle value will diminish as communities crumble, leading to an accelerated rate of departure by the farm owners.

Conversely, areas with a high aesthetic or social value will have an increasing population, fed by both lifestylers and off site service providers—eg, accountants, computer managers.

It could mean broadacre, low value production, eg, wheat has already ceased in many parts, especially those with high freight costs. They may be abandoned to agriculture, perhaps having reverted to low cost grazing operations, or perhaps being managed for environmental benefits, which the community as a whole may be willing to pay for.

In agriculture, compliance requirements will change the framework in which we live—more time will be spent on proving appropriate methods of production have been used in order to retain market access. It will be great if the present pioneering EMS work leads to a model that is readily used, of direct benefit to the producer, and not just a bureaucratic quagmire, which becomes meaningless. These trends will lead to more outsourcing (eg, in the same way as GST compliance) so that farmers have to accept expert knowledge more readily. This will change the decision point in the business structure.

There will be a different skill mix within rural community, eg, compliance contractors, just as we now have contract agronomists.

Farmers will be using socially acceptable farming systems—i.e., burning of residue and erosion will not be happening—either through own choice, or through urban political pressure.

Australia will be more regulated, in response to political pressure from the suburbs, making it harder and more expensive to produce in Australia than in other countries. This means substitution will happen, with low cost countries replacing us. However their costs will only be kept lower if sustainability is ignored, so that the market will effectively transfer production to non sustainable systems and countries. You may not like such an effect, but you can’t ignore it.

Technology advances will continue to be made, in things we don’t even know about yet, eg, who predicted yield mapping and auto steering 30 years ago in 1974? Better chemical application technology would be readily adopted as a contribution toward cost control, and so if anyone is looking for a fruitful area of research please consider this.

The drive to greater efficiency will mean tramlining/controlled traffic is universally adopted. This in turn will have created a major landscape change—the end of parkland clearing, replaced with obstacle free paddocks, and trees lined up in hedges along the boundary.

The grainbelt's domination by wheat will be reduced as new crops are introduced that provide agronomic benefits to the farming system. This will be driven by cost, just as the South Americans began investigating smart crop rotations in an effort to drive down their production costs and preserve their land from erosion. Perhaps these will be spinoffs from the Salinity CRC, but I hope the potential value is recognised and such crops are specifically sought after. Remember we must remain commercially competitive, and if the opposition has a way of reducing costs we must follow suit. Or risk being squeezed out of the game.

Let me talk again about the capital base of the farming community—its people. Currently the farming industry is not recruiting many of the best and brightest of the school leavers—instead they are heading for the bright lights of business world. In the longterm this will be a serious loss to the intellectual capacity of the farming industry. Without smart, innovative people, much of the research will be wasted as it will not be adopted. Please give some thought as to how that can be avoided.
Finally, for something completely different, dementia will be a far more obvious issue as the population ages. Ronald Reagan’s death has highlighted a very real issue for our whole community. At a local level, I was involved in getting a new Nursing Home wing built in Kojonup. A little research showed that around 25% of those over 80 years of age, and around 50% of those in Nursing Homes are affected by this problem, yet the Health Dept would not act on its own statistics and build accordingly. After some pushing and shoving, and a little intimidation, we had our new wing built in such a way that it is Dementia friendly—but no paperwork anywhere mentions it as such in case it sets a precedent for other communities! The wing works wonderfully, we actually have around 60% of residents with dementia, and staff have gone from hating the prospect of caring for the loonies to being very relaxed and comfortable about the whole task.

The message here is to do your homework, understand the issues, and get on with the job as you see fit. You will be appreciated eventually, even if you are not recognised in the short term.
2.8 Managing rising energy costs

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Abstract

If Australian agriculture is to remain productive and profitable in the future, it must be prepared for the inflationary impact rising energy prices will have on the chief input nitrogen fertilizer. The current situation where wheat and other cereal crops dominate the agricultural landscape will be a historical fact when oil and gas prices rise to permanently awkward levels. In short there is not enough investment in cropping systems that require far less energy investment in production. Research and development is too focussed on cereals and canola but the real focus should be on legumes such as lupins. Preparing industry for a future where nitrogen fertilizer is not needed is a must. A future where protein and oil can be produced without nitrogen inputs.

Agriculture and its dependency on oil and gas

The great majority of farmers do not realize the huge exposure their costs of production have to the price of oil and gas. Whilst a rising oil price is acknowledged to precipitate a proportional rise in diesel fuel costs, the more significant and definitely more dangerous impact is on the cost of fertilizer. This is not surprising when you consider that natural gas accounts for 90% of the variable cost of ammonia production, a necessary precursor in the production of nitrogenous fertilizer like urea. In simple terms it takes the energy from approximately one litre of oil to produce one kilogram of urea.

Cereal and canola production rely on massive amounts of nitrogen fertilizer and this is not much of an issue when nitrogen is cheap. Given it is produced from a non renewable energy source, the grains industry should be seeking to prepare itself for this inevitable growing cost. How can we do this? That is the real challenge industry must address for successful long term profitability planning.

Creating a profitable legume

The impact of a rising gas price on agriculture has recently been seen in the US grains industry and provides us with an excellent example of how a production system can successfully adapt. US gas prices are currently around eight times more expensive than those in the Middle East at around US$5.25/gigajoule. This cost has been as high as US$13.00/gigajoule over the past few years. In fact these high gas prices have dramatically capped anhydrous ammonia production in the US and forced most nitrogen requirements to be sourced from the international market.

In short American farmers now have nitrogen, which is more expensive than what it was in the past. Farmers are managing this cost impost by growing less corn, a hungry consumer of nitrogen, and growing more soybeans, a crop requiring no nitrogen inputs on the farmer’s behalf. Soybeans are an excellent crop because not only are they high in protein, but they are also high in oil—a nitrogen fixing oilseed.
Australia is not well suited to the growing of soybeans but farmers can successfully grow lupins. The problem here is that the profitability of growing lupins is far less than growing cereals. Lupin values are significantly lower than those enjoyed by soybeans and this is principally because the oil percentage of our narrow leaf lupin is around 6% compared to 18% in soy. Clearly, the goal for plant breeders should be to significantly increase oil levels and in doing so increase the value of lupins.

Yields are generally half those of cereal crops, hence input requirements are significantly lower than crops such as wheat. Freight costs could be better managed with half the grain (i.e. lupin yields compared to wheat) ideally worth twice as much, using the soybean price as a guiding indicator. Producing a higher valued grain also would enable the Australian grains industry to back away from the unstable markets commonly associated with cereals, such as in the Middle East. This will allow marketing efforts to be targeted at closer and safer premium markets such as China and Japan.

**Are there other cropping options?**

Another interesting cropping option we are exploring on our farm at Calingiri is in Australian Sandalwood (*Santalum spicatum*). This hemiparasitic tree produces a bountiful crop of nuts beginning at around age four. It requires a nitrogen fixing host tree in the form of an acacia generally and obtains all nitrogen requirements from this host. The nuts contain 60% oil and around 18% protein and would be well suited to solvent based processing such as that done with the soybean.

The great advantage of this system is its inherently low requirement for nutrient input. The system is perennial so has a once only establishment period and soil becomes virtually erosion proof. The tree is drought hardy and well adapted to the Wheatbelt having few insect and disease issues. The capacity for machine harvesting exists with technology already used in the macadamia nut industry. The potential here is for this industry to grow as a dryland version of the palm oil sector, which predominates through the tropics.

**Energy markets for agriculture**

Whilst rising energy prices will likely continue to shape the evolution of agriculture, the energy market itself will also present opportunities. At some point in the inflationary trend of fossil fuel prices, fuels and lubricants made from plant produced oils will become cost competitive with non renewables. So all of a sudden not only is agriculture supplying food to the world, but also energy. The soybean industry in the US is enjoying the development of the soy oil biodiesel market and helping the farming sector in the Midwest of the US to in some part secure domestic energy needs.

**Concluding remarks**

The goal of sustainability in agriculture really needs to be viewed in the context of energy. Working against the forces of nature in farming is only possible with the availability of cheap energy as all inputs are generally fossil fuel based. It is fair to say that the only way to make truly sustainable moves forward in grain production is to seek ways in which the production of food components such as oil and protein are independent as much as possible from energy needs.
3. Realistic futures?

3.1 The Avon River Basin in 2050: scenario planning in the Western Australian wheatbelt

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Abstract

Scenario planning was used to identify issues and drivers of change, which are relevant to community efforts to improve regional prospects in the Western Australian Wheatbelt. The region, some 20 million ha in area, is under pressure to respond to a variety of environmental (salinity, erosion, acidification, biodiversity decline), economic (declining agricultural terms of trade), and social forces (rural decline, isolation). Regional strategic plans have been increasingly seen as the means of achieving sustainability in the face of these challenges, but until recently have dealt with timeframes of up to a decade into the future. Systematic futures-based research has been used in various regions to avoid reliance on business-as-usual as the default strategy, and to identify opportunities and challenges not presently apparent. The Avon River Basin, the central region of the wheatbelt, was selected as the geographic focus of the project, and the time horizon was set at 2050. The project was developed by a group of 40 stakeholders from the basin with expertise and strategic interests across a wide range of economic, social and environmental themes. Through a series of workshops the stakeholders identified critical issues and their attendant drivers, then documented relevant past trends. Four regional scenarios, Saline Growth, Green Prosperity, Grain and Drain, and Landcare Bounty, were developed based on positive and negative combinations of two clusters of uncertain and important drivers—environmental change and access to new markets. The four scenarios had some similarities, which related to the important and certain drivers—plant industries, infrastructure, land, alternate fuels, education and demographics. However each scenario was differentiated by specific characteristics that related to the particular combination of the environmental change and new markets and industries and the scenario developers’ response to them. Common opportunities, threats and critical success factors for the ARB region out to 2050 were also identified. Findings from the process were the tendency of the stakeholders to strive for positive outcomes despite negative initial conditions. This resulted in four scenarios that were superficially similar due to the inertia associated with limited opportunities for change in the region. The triple-bottom line outcomes for the Avon River Basin in 2050 were estimated to be in the range of 4.9 to 9.7 Million tonnes of wheat (currently 4.0), 46 000 to 66 000 people (currently 43 000), and 10–30% of farmland salinised (currently 6).

Additional keywords: Water for a Healthy Country, grainbelt, community planning
Introduction

The WA Wheatbelt, a region of some 20 million ha, is under immense pressure to respond to a variety of environmental (salinity, erosion, acidification, biodiversity decline), economic (declining agricultural terms of trade), and social forces (rural decline, isolation), many of which have emerged over the past 50 years. Regional strategic plans addressing economic, social and environmental issues are being developed by local and state governments, regional natural resource management groups and individual industries (Weigall 1996; Grains Research and Development Corporation 2004; Avon Catchment Council 2004). Systematic futures-based research has been used in various regions to avoid reliance on business-as-usual as the default strategy, and to identify opportunities and challenges not presently apparent. Scenario planning was used to investigate the issues and drivers of change that are relevant to community efforts to improve regional prospects in the WA wheatbelt.

A set of plausible futures for the WA Wheatbelt was developed using scenario planning, a structured approach by which companies, regions and nations can learn about the uncertainty in the key driving forces that influence their goals, plans and strategies (Schwartz 1996; de Jouvenel 2000; Schwartz et al. 2000).

The Avon River Basin 2050 (ARB2050) project aimed to:

- develop an understanding of the critical issues and attendant drivers of change that may be relevant to community efforts to improve the regional prospects for present and future generations of the Avon River Basin between now and 2050.

Scenario planning, involving regional stakeholders, was used to address this aim. Stakeholders identified key drivers and elements that must be common to all future robust strategies for the regions, identified opportunities and challenges not apparent from current trends, and contributed to the development of a ‘future-aware’ culture in the region.

Improving regional prospects was defined as any regional configuration that improves the triple-bottom line, although it may not necessarily represent optimal/maximal settings of economy, society and environment. Regional prospects might be advanced by a combination of improved income, investment, rearrangement of assets to improve benefits, efficiencies and outputs, increased participation in or control of decision-making processes that impact the region, and expanded capacity to be more resilient to changes and decisions over which there is little control within the ARB. Prospects can also be improved through appreciation of the links with other regions, nations and the global economy and development of a regional identity through branding.

Location

The Avon River Basin in the central wheatbelt of WA, an area twice the size of Tasmania that produces nearly 20% of Australia’s wheat crop, was selected as the geographic focus of the project (Figure 3.1.1). The time horizon was from the present, taken to be 2000 for rounding purposes, until 2050. A river basin was selected as the boundary because of the importance of water and salinity management to the region’s future. Key environmental, economic and social trends and current states are summarised below.
Environment

The Basin comprises three water catchments, the Avon, Yilgarn and Lockhart, and is about 120,000km$^2$ in area, or twice the size of Tasmania. From west to east, rainfall reduces from 750mm to 200mm per year. Through the upper part of the catchment, which remains extensively vegetated, chains of salt lakes connect up in extremely wet years (Viney and Sivapalan 2001). Since 1900, some 80,000km$^2$ of native vegetation has been cleared for agriculture in the lower reaches (Avon Catchment Council 2004). Long sections of the lower Avon were retrained in the 1950s (Water and Rivers Commission and Avon River Management Authority 1999). Secondary salinity was first noticed about 1897, but remediation was limited until the early 1980s. Today 10% of agricultural land is affected by salinity, predicted to grow to 30% by 2050, while two-thirds require some treatment for soil acidity (Avon Catchment Council 2004). The lower Avon exports 360 gigalitres of salty water into the Swan River annually (Viney and Sivapalan 2001), influencing the health of Perth’s estuary. Since 2000, the Avon Catchment Council has had the task of coordinating landscape management in the Basin (Avon Catchment Council 2004). The south-west of WA, including the Basin, has been identified as one of 25 global biodiversity hotspots due to its high degree of endemism undergoing exceptional threat (Myers et al. 2001).
Economy

Agricultural production in the Basin was valued at $1.4 billion in 2000, of which over 70% was exported (Wheatbelt Development Commission 2001). Production is dominated by rain-fed crops, mostly wheat, with lupins, oats and barley, together with wool and meat production from sheep and cattle. Value-adding and diversification is increasing in the form of tree crops (e.g. oil mallees for biomass harvest, olive oil, and sandalwood), aquaculture and flour milling (The West Australian 2003). Non-agricultural sectors include eco- and indigenous tourism, air sports and air training, and mining of gold, nickel and iron ore. Mean annual economic growth between 1996 and 2001 is estimated to have been 4.4% (URS Australia 2003).

Society

There are 43 local governments and some 150 communities across the Basin. Many social indicators have declined since 1950, driven by farm amalgamation and drift to coastal cities (Avon Catchment Council 2004). Over the past two decades, population has decreased 8% to 43 000. Some 40% of the population reside in only four towns—Northam, York, Toodyay and Merredin. The former three lie within the western fringe of the Basin, which is a large part of the Avon Arc. A recent State Government study predicts a rise in the population of the Basin by 2031 as Perth’s population expands into the Avon Arc encouraged by better connections to Perth through expanding commuter train services (Government of Western Australia 2002). The Basin covers the traditional country of the Ballardong, Galimaia and Nyaginyagi groups (Tindale 1974). Aboriginal people are today a growing proportion of the Basin’s population, having risen to nearly 5% in 2001 (Australian Bureau of Statistics 1996, 2001).

Method

Project establishment

The Avon River Basin 2050 project was initiated in the first round of the CSIRO Water for a Healthy Country flagship projects in December 2002. A working group was formed with staff from CSIRO, the Avon Catchment Council, the Wheatbelt Development Commission, the Department of Agriculture, Western Australia, and the community through the convenor, Mike McFarlane a landholder at Doodlakine in the central Avon River Basin. Dr Don MacRae of APT Business Services Pty Ltd facilitated the scenario planning process.

Focal question and stakeholders

The Avon River Basin 2050 project was guided by the following question:

- What critical issues and attendant drivers of change are relevant to community efforts to improve the regional prospects for present and future generations of the Avon River Basin to 2050?

This question guided 40 stakeholders, strategic thinkers and investors invited from across the region to represent economic, social and environmental interests. Organisations represented included the Avon Catchment Council, Australian Wheat Board, Bird-Cameron, Conservation and Land Management, Australian Association of Agricultural Consultants, Elders Rural Bank, Environment, Health, Heartland Regional Branding Group, Heartland Regional Tourism Association, Indigenous Land Corporation, Local Government and Regional Development, Merredin Senior High School,
Prior to the first workshop the Working Group identified an initial set of 12 regional drivers and documented trends in these drivers and their critical issues since 1950.

**Historical trends**

Characterisation of past trends and their historical driving forces is a necessary first step in scenario planning. The conditions in the Avon River Basin today (using data from 2000 as the division between past and future) serve two purposes: they act as the common starting point of all four scenarios, and are indicative of many relevant drivers and issues that have developed momentum over the period 1950 to 2000.

Statistical sources are typically used to characterise regional trends. However the boundary of the study area is a surface water basin, while the boundary for collection of economic and social statistics is the Local Government Area (LGA). In contrast, natural resource statistics were compiled for the basin by geospatial extract from larger datasets.

A method was developed to collect and reshape LGA statistical data to fit the ARB boundary using a Geographical Information System (GIS) and a relational database. In the year 2000 there were 43 LGAs fully or partially within the ARB (Figure 3.1.2). The extent of overlap was determined by geospatial analysis using ArcGIS mapping software, and then developed into a table in the database. Changes in LGA status, name and extent were documented in the same table so data from LGAs overlapping the ARB boundary could be apportioned on an area basis. In the period from 1950 to 2000 there were several name changes and boundary modifications, as well as the merging of York Town and Shire, but in essence the number of LGAs remained at 43 throughout. Relevant historical statistics for the 43 LGAs were extracted from a range of sources, including the Statistical Register publications of Western Australia, the publications of the Australian Bureau of Statistics, local histories and a compilation of agricultural production data collated by Department of Agriculture. Many of the relevant data were only available in paper format. Data were extracted on five-year time steps commencing in 1951 in order to synchronise with Census data. In total some 50 000 individual statistics were entered into the relational database. These were summarised to the ARB level by means of Structured Query Language queries on the database tables. Several types of historical data could not be resampled to the ARB boundary but where whole systems extensively overlapped the ARB their trends were used to indicate general ARB trends (eg, water supply services, mobile phone coverage). In the case of demographics, the location of towns with respect to the ARB boundary was taken into consideration when apportioning population.
Historical trends within the ARB occurred within the context of state, national and international trends that may be applicable in considering the future. Not all of these trend contexts can be considered within a scenario planning exercise, no matter how well funded, because they would lead to an unmanageable number of scenarios. In ARB2050 the number of scenarios was limited by making assumptions about global, national, and state trends. Some trends to 2050 seem inevitable or highly likely because of their inherent momentum, absence of any evidence of change, physical constraints, or the unavoidable lag between human action and effect. The stakeholders were clearly interested in futures in which human society is still present in the ARB, so scenarios focussed on war, famine, pandemic or catastrophic asteroid strikes were not considered.

Three workshops

The project was conducted as a series of three workshops, each dealing with a different stage in the scenario planning process (Table 3.1.1). At the Critical Issues Workshop, stakeholders brainstormed a list of additional issues that could impact regional prospects. The new and existing issues were grouped into drivers (eg. land, water, plant industries and marketing the Avon River Basin), and expanded by the addition of details about past trends and future prospects.
Table 3.1.1. ARB2050 Workshop series details. All workshops were held in the Muresk Hall, Curtin University of Technology, near Northam, WA. A total of 53 different individuals attended, representing 36 different organizations.

<table>
<thead>
<tr>
<th>Workshop Title</th>
<th>Duration</th>
<th>Date</th>
<th>Attendees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Issues</td>
<td>Half day</td>
<td>17 October 2003</td>
<td>38</td>
</tr>
<tr>
<td>Scenarios Creation</td>
<td>One day</td>
<td>20 February 2004</td>
<td>37</td>
</tr>
<tr>
<td>Strategies Response</td>
<td>One day</td>
<td>26 March 2004</td>
<td>30</td>
</tr>
</tbody>
</table>

Before the Scenario Creation Workshop, an overseer for each scenario driver revised the issues list and then ranked them in order of importance. Stakeholders were then asked to score at least two of the 22 scenario drivers for their importance and uncertainty, as follows:

- **Importance**: how significant is the likely impact (positive or negative) of the Scenario Driver on the region?
  - 1 = least Important  up to  10 = most Important

- **Uncertainty**: how well understood is the impact of the Scenario Driver on the region?
  - 1 = least Uncertainty  up to  10 = most Uncertainty

At least one score of 10 and one score of 1 were required for importance and for uncertainty, and any number between 1 and 10 could be assigned to the remaining drivers. Most stakeholders ranked all 22 drivers in this way. The average importance and uncertainty scores for each driver were calculated and plotted (Figure 3.1.3).
The stakeholders then analysed the uncertainty-importance graph to identify two clusters of the most uncertain drivers (top right-hand quadrant of Figure 3.1.3). Positive/open/high and negative/closed/low combinations of these clusters became the end points of two axes, that when intersected at right angles defined the boundaries of four scenarios. A third cluster, the most important and most certain drivers, was identified from the graph to act as the common core of all four scenarios. Each stakeholder was assigned to a scenario syndicate, with the aim of providing each syndicate with a wide range of skills and knowledge about the ARB. For the remainder of the Scenarios Creation Workshop the syndicate groups explored relationships between drivers by constructing feedback loops and influence diagrams, then developed creative story lines to link together possible chains of future events. An initial set of scenario indicators was also developed.

Prior to the Strategies Response Workshop the syndicates further developed their scenarios. Attention was placed on ensuring the scenarios’ adherence to the parameters of its quadrant of the uncertainty-importance graph. At this third workshop each syndicate analysed their scenarios for opportunities, threats and critical success factors. In plenary the stakeholders identified common opportunities, threats and critical success factors. The final plenary session examined the regional strategies of four working group organizations, and scored the strategic elements for their relevance to the ARB scenarios.

**Context and framework**

The outcomes of the project fall into three categories that are described in the sections that follow: context and framework, the four scenarios, and common strategic elements. The first category, context and framework, refers to the characterisation of historical trends (the 50 most recent years), assumptions about future trends that form the context for ARB2050 scenarios, and the critical drivers that were selected by the stakeholders.

**Historical trends from 1950 to 2000**

By 1950, most of the arable land within the Avon River Basin had been alienated for agriculture, extending from the western margins in the Avon Valley to the Rabbit Proof fence where rainfall is about 250–300mm per annum. Land clearing was in full swing, and at the same time messages about soil and water conservation, and water supply issues were appearing in the *Northam Advocate* newspaper, and in the Department of Agriculture WA journal. It was a time of small tractors, fair average price for wheat, of pounds, shillings and pence currency. Migrant camps in places such as Northam and Cunderdin were home to immigrants who were ‘The New Australians’. Indigenous people were not counted in the Census, were busy helping although several were achieving prominence in sports such as football. Television, electricity distribution and water supply extensions were being planned.

Changes over the next 50 years occurred on many fronts, of which three key trends are representative. Average wheat yields rose from 0.9t/ha to 1.8t/ha. Population reached a maximum of 60 000 in 1956, then declined to 43 000 by 2001, and in the same period the proportion aged 45 or older rose from 21% to 36% of the population. The last two decades have seen a marked decrease in the rate of population loss, in part due to a greater rise in Avon ARC shire populations than losses in the eastern wheatbelt. In contrast, since the mid 1980s the Indigenous population has risen in absolute numbers to 1700 and in relative proportion to 4.9%. The proportion of salt-affected farmland increased from 2% to nearly 6% between 1950 and 2000. An estimated 400 plant species are at risk of extinction due to salinity (Keighery et al. 2001).
Future trend assumptions

Global trends

Globally, the four scenarios were assumed as having unfolded in a future of developed nations continuing the push for globalisation, even though there are great uncertainties in the final endpoint. The ARB can still seize opportunities to develop and supply world-class products, or to evolve a social culture and lifestyle the envy of others, but global forces set prices and make the rules (Australian Business Foundation 2000). It seems likely that world population will continue to rise throughout the period to 2050 to about 9 billion people (Cocks 2003), and that ARB population will represent a declining share of that total. Within the timeframe in question, it was assumed that there will always be a market for ARB agricultural products. Despite efforts to decarbonise and dematerialise the global economy, total energy and material consumption is predicted to rise until at least until 2050 when global population may peak (Harper 2000). Current reserves of fossil fuel supply are seen as likely to be insufficient, leading to a push for alternative fuels well before 2050. The global biosphere impact most relevant to the ARB futures is greenhouse gas emissions due to continued rise in resource use by developing countries. This is likely to lead to a rise in carbon trading markets and instruments, or at least ongoing attempts to establish them.

Australian trends

The Australia of the ARB2050 scenarios was assumed to be a competitive nation ready to engage with the world to varying degrees. Regardless of whether it is a Commonwealth or Republic in 2050, it remains one nation on its own continent. It was assumed that the ARB’s voluntary/involuntary participation in, and compliance with, national programs and international conventions would continue to be driven by both direct and indirect funding (Cocks 2003).

Western Australia trends

The ARB scenarios were based on the assumption that the Basin remained within the state of Western Australia (WA). WA will participate in attempts to diversify Australia from resource-based dependency towards a knowledge-and-services economy that will be the mark of developed nations in 2050 (Western Australian Technology and Industry Advisory Council 2000). The state will most likely remain the arbiter of inter-regional issues, and continue to administer funding on regional infrastructure and social programs. The evolution of Perth into a coastopolis seems almost certain by 2030 (Government of Western Australia 2002), with ongoing positive and negative effects on the ARB through to 2050. The historically strong positive correlation between demographics and levels of regional resources and services should continue. They will increase or decrease in line with the economic fortunes of the region, as reflected broadly in the number of residents. Equity of resource allocation compared to more populous coastal areas of the state and nation is less certain. The Avon ARC will figure in all the ARB scenarios to some degree. The rate of population increase in western ARB shires, the mix, wealth, skills and diversity of people that move there, and the effect on traditional production systems of the area will be an element of all four ARB2050 scenarios. The development of the Avon ARC population will enhance links with Perth, both in the daily interaction with workers commuting from the ARB, and the generation of Perth residents who now have relatives and friends in the Avon ARC (Government of Western Australia 2001).
Critical drivers

There would be few surprises if future scenarios were developed around drivers that were judged to be both important and relatively certain, such as those that underpin the dominant activities in the Basin today (Plant industries, Animal industries, Land and Infrastructure). Such scenarios would read like variants of business-as-usual, for which many ARB enterprises already have robust strategies.

Of more value to the region would be plausible scenarios shaped by the more uncertain and important drivers. They offer an opportunity to test the robustness of current strategies against future uncertainties. Relative to how they are today, each of the two clusters of drivers in the high uncertainty / high importance quadrant (top right quadrant of Figure 14.3) could develop towards the high/positive/open or low/negative/protectionist ends of their range in the future. These two clusters of drivers were arranged along two axes to form four quadrants—the four ARB 2050 scenarios.

The two scenario-shaping clusters that emerged from the importance-uncertainty graph were:

- Environmental change: Climate, Policy and Governance, Water, and Biodiversity.
- New industry and Markets: New Large-Scale Industries, Manufacturing and Other Industries, Policy and Governance, Emerging Industries, and Biodiversity.

Scenario syndicates were provided with a simple graphic that defined the parameters of their scenario (Figure 3.1.4).

![Figure 3.1.4. ARB2050 scenario axes and names.](image)

During the Scenario Creation Workshop and subsequently, each syndicate re-checked their developing scenario against the scenario parameters.

Important and certain drivers

The stakeholders identified a third cluster—the important and certain drivers. Regardless of how the uncertain driver clusters proceed between now and 2050, the following drivers are likely to be key elements in the ARB’s future, and would be present in all four scenarios: Plant industries, Infrastructure, Land, Alternate Fuels, Education, and Demographics.

Scenario descriptions, during their development by the syndicates, were checked to ensure that they contained references to each of the six important and certain drivers.
For three drivers that were representative of the triple-bottom line—wheat production (economic), population (social) and saline farmland (environmental)—scenarios were checked against extrapolations of their future trends (Figure 3.1.5).

![Graphs showing past and future trends of three key Avon River Basin indicators: economic (wheat production), social (population), and environmental (extent of saline farmland).](image)

**WHEAT HARVEST**

**POPULATION**

**SALINE FARMLAND**

Figure 3.1.5. Past and future trends of three key Avon River Basin indicators: economic (wheat production), social (population), and environmental (extent of saline farmland). Historical trends 1950–2000 shown as a single black line. Plausible range of future trends 2000–2050 shown as a grey shaded area.

**Four scenarios**

Each syndicate developed their scenario in narrative and graphical terms. Each scenario is described below in terms of the overall progress by 2050. A ‘future history’ provides the flavour of each scenario. Aspects of economic, environmental and social trends and outcomes for each scenario over the next half-century are summarised.
Saline growth (Scenario 1)

In 2050, in a warmer, drier world, the Basin is a mix of vibrant diversified and sustainable zones around major centres, value-adding and specialist enterprise sites, surrounded by a broad expanse of more sparsely populated broadacre farming making a steady income from grains. The region has diversified its economic base: agricultural industries have incorporated more perennial plants that also drive value-added industries. There are expanding inland fisheries, indigenous eco-tourism enterprises, a world-class resort hotel, a university focussing on disciplines associated with the industries, culture and environment of the region. The remarkable turn-around in the Basin, from an area that was experiencing a constant decline in population and the threatened closure of many smaller towns by 2004 to a slow but inexorably rising population enjoying enhanced social conditions and infrastructure and significantly increased industrial diversification. But a triple-bottom line that accounts for an improving environmental situation has remained out of our grasp, a failure of the global community to act on key issues and the inherent lag between global climate change and remedial action.

Economy

Farming remains profitable due to greater economies of scale (farm amalgamation, improved productivity, plant breeding, new market opportunities for traditional commodities), and is sustained in spite of climate change by adding new integrated tree processing industries based on extensive native woody perennial plantings (up to 10% of ARB area). This leads to a range of exportable products including activated carbon, eucalyptus oils, biofuels and grid-fed electrical energy. Tree plantings improve biodiversity, but are offset by losses due to environmental degradation.

Environment

Climate declined by the maximum of its predicted future ranges—the annual average daily maximum temperature increased by 3 to 6°C across the Basin. Biodiversity losses occurred across the ARB at 75% of levels predicted in 2004. This is caused in part by the spread of salinity to 30% of the Basin’s area, a lack of support and investment in the National Action Plan on Salinity (NAP) developed in 2003/04 and a failure of state/national/global initiatives to address some of the major problems. Native species plantings for new industry feedstock assist survival for some Basin species at risk, but they at best match in area (but not diversity) the losses of remnant vegetation, endemic and indigenous flora and fauna. It was left to an external philanthropist to build a biodiversity ark in the Avon ARC, as a way of storing some of the plant diversity of the region for some future time.

Society

Population increased to about 56 000 in 2050, despite a decline in farm population, additional rural residents distributed across the Basin in towns near new industry sites, and a rise in the population of the Avon ARC. The ARC parts of the Basin did not grow as quickly as expected until after 2025 when the impacts of climate change (especially sea-level rise) drove migration from Perth. A number of smaller towns were lost, but infrastructure in several larger towns was developed to ensure their ability to service the new integrated tree processing complexes. Indigenous people are a growing cohort of the Basin’s population, and improved access to education led to increased employment opportunities.

Green prosperity (Scenario 2)

In 2050 the world is only a little warmer and drier. Through half a century of concerted policy and governance efforts to achieve a more sustainable triple bottom line, the Avon River Basin experienced a remarkable turnaround: from a declining resource base in 2000 to a diverse sustainable region in 2050.
Markets for the ARB’s diverse range of products were found in the sophisticated trading blocks of the 2020s and their successors, the decarbonated and dematerialised open global economy of 2050. Some smaller towns were lost in the relentless march of farm amalgamation, and a number were saved and even enhanced by the new industries dotted across the landscape. Although indigenous people are the growing cohort of the Basin’s population, health and educational disadvantages are not eliminated until almost 2030. Ownership, access to and use of land and enterprises such as ecotourism promoted indigenous culture and socio-economic development. In a post-fossil fuel global economy alternate fuels (biofuels) are a necessary element and the ARB manufactures, consumes and exports its own in 2050.

Economy

Agriculture is enhanced by the slower-than-expected rate of climate change, rising atmospheric CO₂ sequestered by new industrial processing of extensive native woody perennial plantings (up to 10% of ARB). This leads to a range of products including activated carbon, eucalyptus oils and grid-fed electrical energy. Alternate fuel is supplied by bioenergy plants running on the same principle. Farming remains profitable due to greater economies of scale (farm amalgamation, improved productivity, plant breeding, and new market opportunities for traditional commodities).

Environment

The NAP and its successors were successfully implemented over several decades, through a range of support and investment from inside and outside the Basin. Combined with state, national and international policy shifts, climate change kept to the minimum of ranges predicted in 2000. The annual average daily maximum temperature increased by only 1°C across the Basin. Biodiversity losses were far fewer than the current level of prediction, an outcome of salinity stabilisation to 15% of the Basin’s area by 2030, and then reduced to 10% in 2050. Widespread replanting of suitable native species addressed several environmental problems including biodiversity retention, and supplied feedstock to new large-scale industry.

Society

Population increases from 45 000 in 2001 to nearly 66 000 in 2050, despite losses from farm amalgamation, additional rural residents employed in the new industries, and a rise in the population of the Avon ARC and nearby areas. Widespread investment in saving rural towns is based on a strategy to save the larger centres, but there are public funds put into some smaller towns to support new places of employment close to tree planting and harvesting zones. Perth took no greater interest in the ARB; environmental conditions in 2050 improved the quality of flows from the Avon to the Swan Estuary, while there was no significant increase in the size of flood events delivered downstream by the Avon.

Grain and drain (Scenario 3)

The future options for the ARB in 2000 were clouded by many triple-bottom line uncertainties of a world intent on globalisation. The region has held onto its agricultural industries in spite of the challenges of nearly five decades of declining environment. Diversification outside agriculture was considered too risky and never really got started. The physical markets for industrial tree crop products failed to eventuate, while markets for ecosystem services (such as provision of fresh water and amenity) lacked the necessary policy and governance kick-start. In 2050 the region produced double the cereal harvest of 2000, and as such continues to make a contribution to the WA and Australian economies (Agriculture is about 3% of GDP now and is likely to be less than 1% by 2050). However, the region is much poorer socially. As the average temperature climbed slowly and rainfall declined, people left. They were going anyway as phases of farm amalgamation made many small rural towns unviable.
As a result, traditional agricultural industries remained the dominant activity, and continued to grow in productivity. The drying trend of the 1980’s and 1990’s continued, while water quality fell due to salinity and increasing drainage; both of these added to the threats to biodiversity. Attempts to rationalize governance structures were defeated in referenda. This is a future that feels like an old couch—hard at times but comfortably familiar.

Economy

Agriculture maintained its dominance of the basin’s production due to greater economies of scale through farm amalgamation, improved productivity, new market opportunities for traditional commodities. By 2050 total cereal harvest had doubled to 8.1 million tonnes. New markets and technologies for plant-based energy and industrials failed to emerge, comprised by unmanageable risks and alternative products. Annual infrastructure repair costs for salinity damage are reduced by the unplanned drainage system but still costs $500 million per annum.

Environment

As the decades passed, two factors continued to increase pressure on native vegetation and rivers. Climate change reached the hottest and driest of the ranges predicted for 2050: the annual average daily maximum temperature increased by 3 to 6°C across the Basin by 2050. The spread of salinity reached 30% of the Basin’s area. The world recognized the region as a global biodiversity hotspot (based on the large number of plant and reptile species found nowhere else) but did not act and losses were extensive. This was compounded by a lack of support and investment in the region’s 2004 NAP and a failure of state/national/global initiatives to address major problems.

Society

Farm amalgamation and fly-in-fly-out farming reduced the number of farm businesses by half, causing many small towns to die. Population is stable at or near the present 45 000 in 2050. The rise in the Avon ARC population by 2025 was not as high as predicted, as it was merely warmer and drier. By 2050 the impacts of climate change, and sea level rise in particular, saw further migration from the coastal megacity of Perth. Indigenous people continue to be a growing cohort of the Basin’s population, and reduce the ageing effect of the shrinking non-indigenous community. Inequities in income and services between cities and inland towns widen.

Landcare bounty (Scenario 4)

This is the story of the ARB reaching a sustainable state (some define sustainable as triple-bottom line performance) in 2050 built on local agricultural and Landcare expertise. In 2000 solutions to the ARB’s challenges were not entirely obvious, with a range of environmental, social and economic challenges mounting up. The regional implications of global climate models, 1 to 5°C temperature rises and 20% to 60% rainfall decline by 2050, never went much beyond the lower end of the range. As systems knowledge improved, so did the forecasting, and concerted action reduced the human contribution to global climate change. Risk management systems got fancier, commitment to hard-won ‘green’ sustainable credentials strengthened, and the Basin’s farmers could still grow crops and herd animals to market at a profit. All through the first half of the 21st century the ARB was driven by two slogans that bolstered state, national and global action—‘Think global, act local’ and ‘Partner or Perish’. Our planning and commitment to the Basin paid off in developing sustainable agriculture, and it helped to retain and even grow, our population. We remained in step with national and global trends through the partnerships we made and kept.
Economy

Agriculture remained the dominant basin industry due to greater economies of scale through farm amalgamation, improved productivity, the prevailing mix of policy, new market opportunities for traditional commodities and the failure of new markets for plant-based energy and industrial products to emerge. Extensive woody perennial plantings of native species across 10% of the arable area in the ARB improved the sustainability of farming and the environment.

Environment

An impressive concert of state/national/global initiatives evolved to address the major environmental problems including salinity, biodiversity loss, climate change/variability and greenhouse gas emissions. Climate change only reached the minimum of predicted future ranges—an increase in annual average daily maximum temperature of 1 to 2°C across the Basin to 2050. Pressure on native vegetation and rivers stabilized, and the decline in surface water quality was not significant. Biodiversity losses occurred across the ARB at less than the level predicted in 2004.

Society

Population rose by twenty four percent over the half-century, to 52 000 in 2050. Farm amalgamation and fly-in-fly-out farming reduced the number of farm businesses by half, but the reduction in the rate of environmental decline contributed to healthy rise in the Avon ARC population. Indigenous people remained a growing cohort of the Basin’s population, in contrast to non-indigenous residents. The net result was a decrease in the historical ageing trend. Small towns were lost, but not as many as predicted. Inequities in income and services between cities and inland towns widened, and the demographic gradient between Perth and the ARB could not be shifted. The rising Avon ARC population brought new links to Perth, both in the daily interaction with workers commuting from the ARB, and a generation of Perthsites who now have relatives and friends in the Avon ARC. Development in the Avon ARC triggered a new echo of development in adjacent areas to the east, cementing the population rise for the long term.

Common strategic elements

The first step in developing strategic responses to the ARB2050 scenarios formed the basis of the last step of the project. During the Strategic Response Workshop each syndicate brainstormed lists of the opportunity, threat and critical success factors relevant to their scenario. In plenary, these scenario-specific strategic elements were distilled into a set of common opportunities, threats and critical success factors for the ARB region out to 2050. The final plenary session examined the regional strategies of four working group organizations, and scored the strategic elements for their relevance to the ARB scenarios.

Opportunities

The following six common opportunities were judged to be likely to contribute to improving regional prospects in most of the ARB2050 scenarios.

- Inwards migration
- NRM technologies
- Service industry spin offs
- Clean-green
• Trading on positive safe lifestyle—sustainable livelihoods
• Animal-based farming futures

**Threats**

Common threats arising from all or most scenarios would be critical to meet in improving regional prospects.

- Infrastructure decline
- Diseases biosecurity
- Dependence on grain
- Government policy—not aspirational
- Lack of political influence
- Lack of regional effectiveness of government (all levels)
- Losing out to other regions
- Releasing investment capital for change, especially distribution of farmer wealth
- Lack of human capacity to change

**Critical success factors**

The stakeholders identified five common factors arising from all or most scenarios that would be critical for improving regional prospects.

- Quality of governance
- R&D targeted—sustained
- Infrastructure (resource for implementation of change NB linked to education and training below)
- Capacity to change (education and training)
- International choices favourable

**Strategic elements**

Stakeholders rated elements of the 39 key regional strategies of the four working group organizations, shown in Table 3.1.2, according to their relevance to the ARB scenarios.
<table>
<thead>
<tr>
<th>Strategy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valley floor management</td>
<td>Biodiversity conservation</td>
</tr>
<tr>
<td>River and tributaries restoration</td>
<td>Address sectors of disadvantage</td>
</tr>
<tr>
<td>Manage negative impacts of heavy haulage by measures such as increase in rail’s share.</td>
<td>New industries based on comparative advantages, downstream process, diversification.</td>
</tr>
<tr>
<td>Water use and allocation</td>
<td>Capacity for implementation</td>
</tr>
<tr>
<td>Tourism development</td>
<td>Community capacity</td>
</tr>
<tr>
<td>Cleaner production encouraged</td>
<td>Demonstration landscapes</td>
</tr>
<tr>
<td>Legislative framework and policy development</td>
<td>Development of plausible ARB scenarios to 2050.</td>
</tr>
<tr>
<td>Build partnerships with leaders for new industries</td>
<td>An increase in the populations and social amenity of rural towns.</td>
</tr>
<tr>
<td>Educate and inform political representatives.</td>
<td>Find ways to develop and maintain infrastructure and service levels that promote economic growth</td>
</tr>
<tr>
<td>Get increased government priority by selling region’s economic export efficiencies.</td>
<td></td>
</tr>
<tr>
<td>Partnerships</td>
<td>Local government partnership</td>
</tr>
<tr>
<td>Market region’s economic impact, both external and internal</td>
<td>Integrated drainage, surface water and groundwater management</td>
</tr>
<tr>
<td>Effective and efficient public transport within region and between region and Perth</td>
<td>Protection of $100m of infrastructure assets and $50m p.a. recovered production threatened by salinity.</td>
</tr>
<tr>
<td>Increased road network safety and effectiveness</td>
<td>Public infrastructure corridor</td>
</tr>
<tr>
<td>Seek out unique strategic advantages</td>
<td>Regional and local planning framework</td>
</tr>
<tr>
<td>Sustainable industry extension</td>
<td>Rural towns program</td>
</tr>
<tr>
<td>Tree crops</td>
<td>Sustainable agricultural industry development</td>
</tr>
<tr>
<td>Political commitment to better servicing.</td>
<td>Consolidate and increase rail’s share of region’s freight task</td>
</tr>
<tr>
<td>Redefine minimum service level.</td>
<td></td>
</tr>
<tr>
<td>Support emerging hay processing industry by investigating transportations</td>
<td>80% increase in protection of the remnant biodiversity threatened by salinity.</td>
</tr>
<tr>
<td>Continue to improve region’s road network</td>
<td>Institutional and governance framework</td>
</tr>
<tr>
<td>Wetlands and lakes restoration</td>
<td></td>
</tr>
</tbody>
</table>

‘Sustainable agricultural industry development’ rated highest followed by the next two highest ‘Find ways to develop and maintain infrastructure and service levels that promote economic growth’ and ‘Water use and allocation’.

‘Tourism development rated second lowest and ‘Support emerging hay processing industry by investigating transportations’ rated lowest.
Discussion

Regional scenario building

Building rural regional scenarios was found to be one of the more challenging forms of scenario learning. Coverage of drivers and issues across the triple bottom line focus of ARB2050 required the invitation of a wide range of regional stakeholders, with little duplication in terms of organisational representation. This wide spread across themes required stakeholder substitution and the invitation of proxies at times of non-availability of initial invitees. However, stakeholders that were knowledgeable across several areas, particularly in plant industries and nature conservation, mitigated this problem. Unlike single organization or single endeavour scenario planning, the resources and priorities of stakeholder organizations ultimately dictated participation in project activities at workshop events or between them. Seasonal factors and the annual farming calendar affected the availability of stakeholders to contribute, particularly between workshop events.

Solutions to these challenges could include extension of the project timeline to two years, and increase the number of participants and project staff.

A further interesting difference with single-organization scenario planning was the inherent loyalty and enthusiasm of regional stakeholders. This was particularly evident during the syndicate work. Each syndicate viewed the challenges and difficulties of their scenario settings as an opportunity to creatively solve the problem.

Communication of the final scenarios is the most challenging aspect of the ARB2050 project, and one that is ongoing. In regional scenario planning, the quality of the scenario outputs is always uncertain, despite best intentions. Two concerns occupied the working group throughout ‘Will the regional stakeholders, with their broad range of skills and varying levels of time and resources to commit to the project, be able to agree on the issues, and resolve the debate over which are the critical clusters?’ and ‘Will participation in the process challenge each stakeholder’s preferred future, whether documented or simply aspirational. Ultimately these concerns were mitigated by the pragmatic actions of the stakeholders, who saw the value to the region in producing a complete set of scenarios, despite the concerns they may have had about the emphasis on particular trends or issues.

The shared set of important and certain drivers at the core of all four scenarios also brought communication challenges. At the whole-of-region scale the core set of drivers that are shared by all scenarios can make it difficult for scenario users to readily distinguish between the final scenario descriptions. Schematic illustrations of the ARB in 2050 pose interpretation challenges because any oblique aerial view of the region in each scenario shows a similar pattern in the landscape yet, as with other aspects of human endeavour, the important subtleties are in the detail. These are probably best presented through narratives describing the overall nature of each scenario and aspects of the triple bottom line highlighting the details.

Research agendas beyond scenarios

By its inherent dealing in future unknowns, uncertainties and strategies, scenario planning points the way forward for research that will be highly relevant to improving regional prospects in the Avon River Basin. The ARB’s research focus could be a mix of commissioning new research at the region and sub-region scale and maintaining a watching brief on relevant research developed outside the region. In both research categories, ongoing research monitoring should track developments in the set of core drivers i.e. Plant industries, Infrastructure, Land, Alternate Fuels, Education, and Demographics.

Opposite ends of the New Markets Relevant axis represent the presence or absence of new markets, and thus require different types of research. At the positive/open end of the axis (Scenarios 1 and 2) relevant research could focus on new large-scale industry based on woody perennials, including modelling of environmental benefits of a range of tree planting and site configurations, the links
between integrated tree processing and biofuel production, and any unknowns that emerge from the ongoing Narrogin Bioenergy Pilot Plant (Enecon P/L 2001; Bartle and Shea 2002). Similarly at the negative/closed end of the axis (Scenarios 3 and 4) where new markets are not relevant, relevant research could focus on improving productivity of agricultural systems, supply chain improvements and the future implications of the encroachment of corporate agriculture.

In contrast, the Environmental Change axis is a continuum of future environmental conditions, from minimal decline at one end (Scenarios 2 and 4) to the maximum decline predictions at the other (Scenarios 1 and 3). Thus research needs are essentially the same for all four scenarios. Relevant research agendas are already well established for climate by the Indian Ocean Climate Initiative (IOCI) initiative, for biodiversity by CALM, CSIRO and WA universities, and for water by the State Water Plan, Water and Rivers Commission, and CSIRO’s Water for Healthy Country flagship. Topics include interdecadal variability, finer-scaled models of climate change on biodiversity, people, industry and water, more efficient farm water systems, rural town water, the identification of thresholds, and state and national policy settings relevant to reducing degradation trends.

For all scenarios, future linkages between economic change and socio-cultural development require investigation, otherwise short- and medium-term decisions could be impacted by a lack of options. The challenges experienced in characterising historical trends during the ARB2050 project demonstrate that further investment is required in collecting together data on past trends and developing information systems that can support research.

ARB2050 also contained a ‘generating investments’ element that ran in parallel to the main scenario building activity. From an initial set of ideas, a top-10 of preliminary investment initiatives was selected. Following the elaboration of these ideas into a set of 10 one-page briefs, the stakeholders determined their preferred investment initiative was the initiation of the development of the grainbelt Futures CRC. This initiative is essentially a research-based centre that could bring together a number of the research themes described above. The CRC’s research focus will be on sustainable business and community outcomes for the Australian grainbelt, with three provisional research focal areas of the development of integrated business systems for the grainbelt, infrastructure provision and regional/community adaptation, by bringing together technologies, expertise, resources, infrastructure and investment in new ways.

**Conclusion: The way forward**

Scenarios provide regions with plausible futures, rather than predictions. What use then is an exercise such as ARB2050 in improving regional prospects, if the future will probably contain elements of all four scenarios as well as many uncertainties? Over the next fifty years the ARB will undergo considerable change in all manner of things important to its residents. The surprising nature of many changes since 1950 is proof enough that life in 2050 will be sufficiently different as to surprise those of us who live through the next half a century. Conversely, the project revealed many trends and core drivers that will remain certain and important throughout the next fifty years. They are the cornerstones of the ARB’s future, the daily business that must necessarily be done well and excellently. Over time this task will increasingly fall to the generation of the youngest ARB2050 stakeholders, four students from Years 10 and 11 at Merredin High School. Should the region’s prospects be stimulated by exercises such as ARB2050, there is every possibility that a greater number of their generation will still reside and prosper in the region in 2050.

Benefits from the ARB2050 scenarios will be generated if a more future aware culture persists among the region’s strategic thinkers and investors, and if the project encourages them to build or revise strategies that are more robust in the widest possible range of potential futures. Equally important will be the attraction of substantial new investment in the region, for which the grainbelt Futures CRC outlined above could play a significant role.
References


URS Australia 2003, *Indicators of Regional Development in Western Australia*, Department of Local Government and Regional Development, Perth, WA.


3.2 Scenario planning for the Australian grains industry

Dr Michael Dunlop
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PowerPoint presentation

Scenario planning for the Australian Grains Industry

Michael Dunlop
michael.dunlop@csiro.au

Future Broadacre Agricultural Landscapes
Joondalup, June 2004
A 140 year view

Crops and sown pasture

Area (Mha)


Sown pasture
Crops

Three 50 year scenarios

Australian Stocks and Flows Framework

Population
International Travel
Labour
Transport
Consumables
Infrastructure
Processing & Assembly
Recycling
Material/Energy Transformation
International Trade

Agriculture
Forestry
Fisheries
Mining
Biodiversity
Land Resource
Water Resource
Air Resource

quantities required
quantities produced

Three 50 year scenarios
Building the scenarios

- Current trends
- Recent forecasts (ABARE, CIE, IFPRI)
- Past trends and rapid changes
  - Cotton area +10% pa for last 30 years
  - Oilseed area +23% pa for last 10 years
  - Wine exports +350% in 10 years (1990s)
  - Beef cattle +100% in 10 years (late 1960s)
  - Sheep -30% in 5 years (early 1990s)
  - Irrigation water +75% in 13 yr (1983-97)

- Drivers of change
- Scenario narratives
- Model them in ASFF
- Analyse the consequences

Drivers of change

- Demand: domestic and global
- Trade access: physical, political
- Marketing, product development
- Technology, farming systems, intensification
- Agricultural productivity: t/ha, $/$
- Cost price squeeze
- Regional development
- Urbanisation, population growth
- “Non-market” values: ecosystem services
- NRM issues: understanding, expectations
- Climate change
Water, water everywhere

Dryland agriculture scenario

• Investment in dryland agriculture
• Expand northern agriculture
• Slowing in land degradation
• Decrease in irrigation
• Increase in river health
Agriculture’s % economic contribution

![Graph showing the economic contribution of agriculture](image)

- Exports
- Employment
- Gross domestic product
- GDP
Introducing scenarios

• Possible futures … not predictions
• Not options between which one should choose
• Rather, ask:
  – What should I do if this future occurred?
  – What would be necessary to increase the ups and decrease the downs of each scenario?
**Water, water everywhere**

- Expand agriculture in the north
- Major investment in dryland agriculture
  - Increasing use of water
  - Shift to better watered areas
- Land degradation
  - Slowing rate, but …
  - Still serious and expanding
- Decrease in irrigation water use
- Many increases in river health

**Brave new regions**

- Reduction in area farmed
- Reinvent agricultural systems
  - Minimal impact, perennials
  - High value crop products
  - Most productive and resilient locations
  - A range of novel “landscape” products and services
- Significant increase in river and landscape health
- Expansion of new industries

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**Total area of crops and pasture**

1. Change is inevitable: status quo = change, but it will be different.

- **Water, water everywhere**
  - 30 Mha
- **Brave new regions**
  - 35 yr doubling

*Millions hectares*

**History**
2. Maintaining the resource base: fertility, weeds, acid’n, disease

3. Trade-off between production & environment: salinity, biodiversity
Water use

High WUE crops, perennials, revegetation, agroforestry

Less run off:
- Farm dams ?
  - Stock and domestic use
- Stream flow ?
  - Irrigation and other uses
  - Dilution flows
  - Biodiversity

Less recharge:
- Impact, timing ?

Climate change and variability

Climate change:
- Agronomy
- Varieties
- Land use change
- Carbon sequestration
- Biofuel
- Biodiversity
- Water resources

Climate variability:
- Risk management
- Increased yields and profits
- Adapting to climate change
A smaller grains sector?

- Higher value grain products
- Income from landscape management
  - Carbon credits
  - Biodiversity credits
  - Clean water
  - Tourism
  - Intellectual property
- Off farm income
- Non-rural industries

7. New products and services
Social and economic links

Farmers

Grains industry

Regional community & economy

8. Rural communities and regional economies

Future issues: Region and R&D

1. Change is inevitable ... and different from past
2. Maintaining the resource base
3. Trade-off: agriculture & the environment
4. Competition for water
5. Climate change and variability
6. Cheap oil
7. New products and services
8. Regional communities and economies

9. Coordination and Integration
3.3 The power of the group

Ian G McClelland
Birchip Cropping Group—Wimmera Farming Systems, ammcclelland@bigpond.com

‘What’s important to people is to be able to do and be.’
Amartya Sen.
Nobel Laureate in Economics

Introduction

Farmer groups have made an important contribution to the prosperity of regional towns across Australia. Broadly speaking, they may be split into two types, those with the specific aim of increasing productivity and those with a broader focus. These groups concern themselves with the welfare of the community as a whole. The Birchip Cropping Group (BCG) regards itself as one of the latter, as is reflected in its mission of ‘improving profit and viability of Mallee and Wimmera communities.’

The BCG was formed in 1992, the first of the farmer groups in the grains industry to do so. It is currently the biggest in number of staff and in the breadth of its projects. There are now more than thirty groups around the country active in taking control of their own destiny. They undertake independent agronomic, economic and community research, provide training and identify future needs.

The agricultural community now accepts the farm group as having a local infrastructure, providing a means of communication and information exchange, and acting as a co-operative research partner and a pathway into the future for innovation and change. The members of different groups know of and mix with each other, share ideas and expertise, produce joint publications. They have developed a network that stimulates interest across Australia and has influence.

Farmer agronomic needs and interests have a significant profile as a result.

Much is written and spoken about the value of the individual, the intrinsic worth of what he or she has to say and think, and the necessity of being oneself. Equally, however, it is true that each individual, in isolation and without support, is often disinclined or lacks the confidence and the impetus to act.

Farmers are, by definition, isolated one from the other. They work their ground, tend their animals and have in the past operated almost by instinct and on the basis of information handed down from generation to generation. There has existed an innate reluctance to share information, to divulge failures and to admit to successes. (Note the verbs: in the country, success is something to which one ‘admits’: such is the degree of false modesty, which is expected by one’s neighbours).

The BCG seeks to provide individual farmers with the means to communicate—with each other, with researchers, with government, with industry and with consultants. It urges farmers to determine their own destiny, find their own solutions, and make things happen.

It provides information, a forum for discussion and the opportunity for interchange of ideas—not those that are ‘tried and true,’ but those at the forefront of agricultural thinking in Australia and, indeed, the world.
In isolation, most farmers would not be inclined, or able, to access such information. As part of a community of agriculturalists, they are able to do so.

This is the Power of the Group.

The Birchip Cropping Group (BCG) was formed when a group of farmers, who had come to know and trust each other, decided to do something for themselves and for their small community which they perceived as being in decline. The success of their initial activities created a momentum, which grew to a point at which a cultural change in the way information was delivered and received, was achieved and in the way successes and failures were shared. The desire for new information and technologies grew and a melting pot of ideas and opinions was created.

The BCG became a focus for the researches of a whole range of outside co-operators. This occurred because there existed an enthusiastic, welcoming, interested farming community which wanted to help, was hungry for new, applicable, relevant information and was always prepared to share its knowledge with others. Importantly, in return, researchers became aware of farmers’ problems, were able to understand their priorities and as a result to refocus their research and delivery.

In the beginning, the BCG created its own unit, which undertook mainly applied farmer research. In the first few years, its work centred on chemical rates and tolerances, new crops, on sowing rates, dates and row spacing and on the many fertilizer combinations. Over the years, this work has become more sophisticated and the hundreds of trials and demonstrations focus on matters such as fungicides, resistant weeds, agronomic packages, economic analysis, comparisons of farming systems, soil characterisation, crop modelling and linking production with the environment.

As was initially the case, farmers are still surveyed to discover what work needs to be done if they are to be able to make better decisions. The BCG prides itself on its mix of deference to practical farmer demand, awareness of the next generation of agricultural opportunities and a passion to embrace blue sky dreams.

Group members like to think of themselves as Community Agricultural Innovators.

Most of the BCG work is classic replicated trial work done on its own or in collaboration with our co-operators. However, it is important to note that some of the work done by the BCG is demonstration only: the trials are not based on ‘scientific’ replication. Typical examples include farmer paddock demonstrations focused on varieties and chemical practices. Ideas need to be shown: they may be discussed and adopted by those most interested. Reiterated ‘proof’ is not necessary. Farmers are encouraged to walk into the sites, remove plants, dig holes and generally mess up. Sometimes demonstrations can offer ideas that need further work to verify.

The trial work constitutes only half the effort required: equal energy is spent delivering the information to as many farmers and interested personnel as possible. The old adage ‘the more you give the more you receive’ has been gratifyingly demonstrated at Birchip. As more information is given away, and sometimes forced onto farmers, the more money and support is given to the group by sponsors and funding bodies to give more information away … a simple formula for success.

At a practical level, gimmicks and marketing techniques are used to entice and attract both the converted and the sceptical to the many activities run throughout the year. Once the audience is there, it has been our policy from the very start to deliver our information in as professional and palatable a form as possible. Our information has to compete with work, sport, social activities, family matters and farmers’ natural apathy. In order to attract farmers’ attention, activities must be seen to be fun, to be well run, and to have outcomes that can be clearly directed to the benefit of farms, the environment, the community and the general lifestyle.

One of the many benefits of farmer groups lies in the variety of information emanating from a diverse range of people. The fortnightly BCG fax bulletin disseminates the knowledge of consultants, researchers, industry and farmers, interrelating and contributing to the timely information about important agronomic happenings in the region and about what should be done on members’ farms tomorrow.
Essential to the success of the group is the mutual respect and perceived importance of all the players. Everyone understands the other’s part in the supply chain of information and interpretation. The blend of experience and theory reaches a balance. Ideas and feedback work in both directions. In this two way exchange, researchers are able to see the practical relevance of their work and farmers learn to appreciate projects that previously may have been dismissed as ‘airy fairy’, academic irrelevancies.

Farm groups like the BCG have an important role to play in providing specific information for a region. For many, it is the link between the broader agricultural community and their own enterprises. Information is not necessarily farm specific: recommendations to individual farmers are not at this stage given. Nor is the information relevant nationally; every region has its own problems and challenges. Consultants need not fear for their jobs, nor researchers for the survival of their projects. Each has its place.

The farm group is the perfect platform or launching pad for ideas and new technologies. Its activities provide a great stage for experts to stand up and be heard, considered and appreciated. Agriculture, like sport, has its heroes, elder statesmen and favourites who have won their place because of their work, ability to speak and their relevance to farmers’ profitability. Their contributions can be a positive way of attracting new people into the industry and giving all participants the impetus to try a little harder.

One of the modern demands of government and funding bodies is the attention to attribution of credit for advances in agriculture. Naturally, as a result, all the players are keen to receive due recognition. Some organisations are prepared even to sacrifice some of their good will in order to gain the necessary credit to qualify them as beneficiaries of future funding arrangements. Although accountability is necessary and desirable, so too is spreading the credit over all the participants who together contribute to progress.

The BCG is grateful for the help of the many people who have contributed to the plethora of ideas and recommendations that have emerged over the last twelve years and recognizes that they have been indispensable. However, in many instances, recognizing the validity of the total package is more important than rewarding the individual who may have been responsible for its creation.

The BCG has played a unique role in research and extension in the Mallee and Wimmera region.

**What sets the BCG apart from other organisations?**

- No other organization has succeeded in drawing together—or perhaps has even tried—the range of agricultural and agri-business players engaged in providing answers to farmers’ questions and supporting them in their ambitions. All levels in the industry are involved.
- Independent and unbiased information given by farmers for farmers without any strings attached is accepted enthusiastically.
- The BCG primary focus is on practical agronomy, on what works and on what is profitable in the paddock. It addresses real problems and issues in a way that farmers can deal with.
- Much of the learning is done in the paddock. Diagnostic schools in spraying technologies and fungicides are examples.
- New communication tools are tried and experimented with. All learning styles are catered for.
- Indicators and guidelines for environmental sustainability are continually sought; the group is conscious of the role that the environment plays in community lifestyle, market opportunities and production maximisation.
The imperative of growing better crops through the application of detailed knowledge is the constant focus of the group, as exemplified by APSIM and Yield Prophet.

**Major agronomic achievements of the BCG over the past twelve years have been in the following areas**

- Competitive crops. The manipulation of sowing rates and dates, row spacing and plant nutrition that improve plant vigour has resulted in crops competing with weeds producing higher yields with better quality specifications.
- Herbicides. Work on herbicide crop tolerances, spray technology systems, herbicide rates and uses and chemical group rotations.
- New crops and varieties. Introduction and development of agronomic packages for new crops like canola and lentils and new varieties of conventional crops.
- Soils. Identifying and understanding different soil types and water dynamics. The BCG was able to play a major part in making sub soil limitations a focus for national research. Considerable changes in agronomic practice has resulted.
- Nutrition. Exhaustive and detailed work on fertilizer application rates, types, timing of application and placement, to find the most economic and risk averse use of fertilizers, especially Phosphorous and Nitrogen.
- Chemical resistance. Developing strategies that prevent or reduce herbicide resistance by changing farm practice and rotations. Included is the role of sheep in the resistance cycle.
- Farming systems. A long term trial comparing four farming systems or philosophies. The aim is to compare each system against a number of sustainable indicators that help farmers make fundamental decisions on their own farm.

**The future**

The saying ‘The more you know the more you want to know ‘has real relevance for the future. In some cases the questions are the same but the answers are different. A great many new ideas and areas of research have to be undertaken and the BCG believes that the following new research and extension areas are priorities for the future.

- Precision agriculture. This work will involve making variable rate technology work profitability. The practical adoption of GPS guidance systems and use of inter-row management systems will be central issues.
- New crops. The one silver bullet that can have the biggest impact on farm profitability in the future is new varieties. With the help of gene technology the possibilities are endless. Whatever happens at the development end, groups like BCG will be important players in the road testing and acceptance of any new crops and varieties.
- Making conservation pay. This is an important and growing area of research. The opportunity of securing safe food status in the market place, of preventing and solving the environmental problems of a catchment and building a place where communities want to live and enjoy their surroundings make conservation a profitable proposition of the future.
• Livestock systems. The humble sheep still has for many a place in the farming system. Recent years have seen an increase in the importance of meat at the expense of wool. Central to the profitability of sheep is the stocking rate and the nutrition of the animal. Grazing and supplementary feeding practices still need considerable work.

• Best management systems. Understanding how all the single issues of farming fit together to allow best management decisions to be made. Being able to integrate sustainability and profit with continual improvement. Increasing knowledge and understanding of how things work and developing new farm management skills will continue to be core tasks of the BCG.

• Commercial services arm. The need for independent skilled advice has created an opportunity for the formation of a commercial arm, which offers commercial services to individual farmers. Added to this, the franchise rights to commercialise the APSIM production model to farmers across Australia will be an exciting extension to the BCG core business.

• Sustainable communities. Fundamental to the viability of the region is the capacity to maintain and build a vibrant, educated, happy, prosperous community that offers opportunities of work and pleasure for everyone. The BCG will look at any opportunity that fulfils these aims.
3.4 Closing address

Hon Kim Chance MLC
Minister for Agriculture, Forestry and Fisheries

Thank you for the invitation to be here today and can I firstly commend the organisers for their proactive approach to research and development issues.

The food and agriculture sector’s pre-eminent position as one of the State’s major economic drivers has been achieved through a long and impressive record of achieving productivity improvements, largely as a result of the application of new technologies and management practices.

Much of this growth results from an extensive research and development infrastructure that provides new knowledge and innovation, the keys to sustained economic growth.

Opportunities for future growth of the agriculture sector are significant. Population growth in the Asia-Pacific region combined with the changing patterns of food consumption associated with rising levels of income, will drive up international demand for a widening array of quality ‘western’ foods.

However, forces such as globalisation, consumer and community expectations, energy supply, climate change, land resource condition and changing social values and structures will shape these opportunities.

In the global economy, increased competition and the associated pressure on commodity prices is contributing to a long term decline in the terms of trade of Australian farm businesses.

In the face of declining terms of trade, many farm businesses have improved their productivity by adopting new technologies and management practices, increasing the scale of their operations and diversifying their business into more valuable products.

Western Australian farmers have been particularly successful at achieving productivity improvements, with total factor productivity much higher than for Australia as a whole.

During the last two decades their productivity has increased at least 4% per year compared to 3% for Australia, mainly as a result of innovation in the grains industry.

The attitudes and aspirations of consumers in relation to the food they eat are rapidly changing. They are increasingly interested in animal welfare and the condition of environmental assets and are prepared to use their purchasing power to pursue these objectives.

In general, the community is also increasingly understanding and supportive of the development and application of ‘duty of care’ and ‘land stewardship’ concepts in the use and management of land, water and biodiversity in rural landscapes.

Energy availability is likely to be another big challenge in the years ahead. There are indications that the world’s oil wells will find it difficult to keep up with increasing demand.

To address the inevitable increase in fuel prices, the State Government has established an extensive plan for transport which includes more freight to rail, new rural trains, switching to natural gas and increased fuel efficiency in the government’s vehicle fleet.

The Department of Agriculture has taken a lead role in government by successfully implementing greening initiatives, and winning the ‘Certificate of Energy Best Practice—Vehicle Fleet’ last year.

The Department’s commitment to environmental stewardship and leadership within the Western Australian public sector is widely recognised, and has helped to set the benchmark for other sectors.
In regional areas, it will be important to look at how agriculture will cope with increasing oil prices. Farm businesses will be exposed to many economic consequences as a result of the diminishing oil reserves and associated increased prices of petroleum products.

Although fuel accounts for only about 7% of the costs of broadacre agriculture, it is indirectly linked to oil-based products and services such as chemicals and fertilisers.

In addition, the reliance on road, rail and shipping services by regional communities and businesses will see the cost of production increase and the transport sector exposed to diminishing profit margins.

Over the last two decades farming in Western Australia has become much more reliant on petroleum products than in the past. The profitability of crops versus livestock has led to many farmers devoting greater emphasis to cropping.

As each hectare of crop requires more input of petroleum products than each hectare of pasture, the swing into cropping has increased the reliance on fossil fuels in most farm businesses.

However, the adoption of new management practices is reducing the fuel costs of cropping. Herbicides and improved tractor and tillage equipment has reduced the amount of trafficking and fuel needed to establish crops.

Controlled traffic systems and precision agriculture can further reduce fuel costs and increase fertiliser use efficiencies.

There is also a need to look at the sustainable harvesting of energy from the sun, wind and vegetation.

Energy from vegetation, or bio-fuels, could help meet energy needs, but the ramifications of loss of grain producing land to bio-fuel production and the energy costs incurred in growing and processing a bio-fuel crop need to be considered.

The question to ask is whether there is scope for a regional bio-fuel energy production industry alongside traditional broadacre farming.

Since the 1970s, average rainfall has been 10–20% less per year than for the preceding 50 years. Research done by the Indian Ocean Climate Initiative suggests the enhanced greenhouse effect is at least partly responsible for this.

Better understanding of climatic variation and how to best respond to it is probably one of the most important projects that the Government can undertake to assist farmers.

The State Government decided late last year to give a further $500,000 boost to this work, and over the next 3 years the Department of Agriculture will carry out significant climate forecasting research, and develop improved management strategies for the agricultural and pastoral regions of the State.

Management strategies will become increasingly critical to producers. CSIRO climate projections indicate warmer and drier conditions in the State’s grainbelt, with average temperatures rising 0.4 – 2 °C by 2030, and 20% less autumn and winter rain, exacerbated by higher evaporation rates.

This is likely to affect agriculture in WA greatly, leading to later breaking and shorter seasons, altered crop development patterns, and reduced grain protein levels.

Reduced frost incidence but increased heat damage during grain filling, increased risks from pests and weeds, and farm water shortages are also likely.

Clearly a significant research effort is needed to identify the likely impacts of climate change projections and how the industry should adapt to them.

Western Australia has the largest area of moderately acidic surface soils, estimated to be 7 – 19 million ha, and 0.2 – 4.8 million ha are thought to be affected by subsurface acidity. Use of
ammonium fertilisers and leaching of nitrate make the sandy soils of our grainbelt prone to acidification.

Agricultural trends and other pressures have resulted in the depopulation of rural areas. Farms are now larger, more complex to manage and more dependent on purchased technologies. Labour saving machinery has reduced labour needs, in turn impacting on rural businesses.

It is difficult to build vibrant communities when the aggregate demand for rural labour declines and there are few off-setting local employment opportunities.

The challenge exists to develop rural industries that maintain or revitalise rural communities through new, diversified regional industries and value adding opportunities.

Clearly, some significant issues are looming for agriculture in the grainbelt. Therefore, this conference is timely.

Understanding, and responding, to the issues is critical to build an economically, environmentally and socially sustainable agriculture sector, and realise the opportunities that will no doubt emerge in the future.

New approaches are needed, such as improving management practices, developing new industries, and exploring innovative technologies. A strong and visionary research foundation in this State will be crucial.

The challenge for tomorrow’s workshop will be to identify where research and development attention should be focused to underpin the evolution of a more sustainable grainbelt out to the year 2030.

This will not be an easy task, particularly with the myriad of economic, social, environmental and governance forces from global to regional levels impacting on industry, added to the complex and often uncertain relationships outside and within the grainbelt.

Nonetheless, it is important that a shared vision and framework is created to guide investments in research and development so they are efficiently and effectively targeted to making a real difference to the State’s sustainability.

With the significant lead times needed for much foundation research, it is imperative that opportunities are identified and responded to earlier rather than later, ensuring Western Australia is positioned to take advantage of opportunities and gain a leadership position.

The horizon vision of this conference, out to the year 2030, is particularly important. A robust vision requires a diversity of opinion to be aired and encapsulated, so it is reassuring to see the partnership of the most significant agricultural research and development organisations in Western Australia contributing to the success of this conference.

For improved efficiency and effectiveness within research and development, it is important all organisations involved become a cohesive group of interdependent bodies dedicated to building strong strategic alliances.

As you know, the State is currently creating the Integrated Agricultural Research Institute, which will provide the means to progress many of the outcomes of this conference and workshop.

The Institute will provide Western Australia with an enhanced agricultural research capability, and provide links to many national and international projects that may contain valuable lessons and knowledge that may be applied in this State.

I would like to thank you for contributing to and participating in this conference, and to wish you well with the workshop tomorrow.

The organisers have taken a brave and innovative approach to get the most out of this opportunity and I am sure it will be justified by the results.
4.1 TalkBook

TalkBook™:
Determining how R&D can help enhance
the sustainability of future
broadacre agricultural landscapes
in south-western Western Australia

The TalkBook is a first order product emerging from a facilitated design conversation. Its purpose is to capture the essence, the flow and the key ideas of the conversation for use in later thinking, conversation and communication about the topic of conversation.

It is not meant to be a definitive and complete record of conversation, nor is it the point of the conversation - think of it as a by-product.

The most important 'product' of a conversation is not a document but the building of shared understanding and vision that is carried in the hearts and minds of the people who took part...
Workshop attendees

**Participants**

Val Alder (Murdoch University)
John Bartle (CALM)
Richard Bell (Murdoch University)
Greg Bender (Australian Wool Innovation)
David Bowran (Department of Agriculture)
Rob Delane (Department of Agriculture)
Miles Dracup (Department of Agriculture)
Mike Ewing (UWA)
Bob Grant (CBH)
Richard Harper (FPC)
Stephen Hopper (Kings Park)
Sam Howard (Beyer Crop Science)
Mike Jones (Murdoch University)
Ross Kingwell (Department of Agriculture)
Ted Lefroy (CSIRO)
Barbara Morrell (Avon Catchment Council)
Roy Murray-Prior (Curtin University)
Wendy Newman (Wheatbelt Development Commission)

Peter O’Connell (Syngenta)
Dave Pethick (Murdoch University)
Mick Poole (CSIRO)
Steve Powles (UWA)
Alistar Robertson (UWA)
Graeme Robertson (Muresk)
Kadambot Siddique (UWA)
Geoff Smith (COGGO)
Andris Stelbovics (Murdoch University)
Rene Van Berkel (Curtin University)
Ken Wallace (CALM)
Corey Watts (ACF)
Cameron Weeks (Mingenew-Irwin Group)
Stuart Witham (Landmark)
Neil Young (Kojonup)

**Observers**

Pauline Gazey (Department of Agriculture)
Michelle McManus (Sustainable Consulting)
Setting the Scene

We started by reiterating the purpose of our workshop:

- To answer the question:
  
  - How can R&D help enhance the future economic prosperity, vitality of communities and environmental quality of broadacre agricultural landscapes in the south-west of Western Australia?

Craig then explained the process for the day. The key questions we will address are:

- Where are we now?
- Where do we want to be?
- How do we get there?
- What do we do next?

We introduced ourselves and reflected on insights from the two-day conference:

- We need to move beyond the traditional paradigm of $ vs $ & $.
- However we lack a clear framework to do so!
- We are a homogenous group — few women, few young people.
- Biodiversity is a complex but emerging and pressing issue.
- Productivity gains have had a huge positive impact on the agriculture industry in WA.
- We need to think big and long-term, and plan together more effectively.
- Energy shapes as a significant emerging issue.
- Rural communities are under pressure, however they are also very resilient.
- Partnerships will become increasingly important.
- We need to be careful about 'walk-in, walk-out' research — involvement is preferable to sponsorship.
- This conference and workshop is timely.
- R&D providers are getting left behind.
- One group's profit = another group's input cost.
- $M is an emotive issue.
Craig explained some of the theory behind the approach to today’s workshop.

- The ancient Greek’s designed two roads to truth.
  - The ‘logic’ road was intended for use in situations where ‘the answer cannot be other than what it is’ (e.g. 1+1 always =2).
  - The ‘rhetoric’ road was intended for use in situations where ‘the answer can be other than what it is’ (e.g. should Australia have entered the war with Iraq?... it depends).
  - The second road was intended for use in matters such as law and running a democracy.
    - As such, it is well suited to many modern-day challenges (or so-called ‘wicked problems’).

- We will use a second road approach today based on conversation.
  - The conversation will be framed around the Thinking Wave™.
  - The conversation will be tracked on an electronic whiteboard (EWB).
  - A TalkBook™ will be produced as a record of our conversation.
  - Craig will subsequently prepare a BlueSheet™ - a one-page summary of our argument for moving forward after the workshop.

- There are three important voices in any conversation.
  - Intent (provided by the respective R&D CEO’s or equivalents in today’s workshop). 
  - Experience (provided by today’s workshop participants and inputs from the conference).
  - Design (not specifically selected, but likely to emerge during the course of the workshop).

- Our sandpit (i.e. the area in which we will focus today) is ‘R&D in the WA grainbelt region’
Where are we now?

We commenced the day’s work by considering our overriding challenge and opportunity:

- The challenge:
  
  “The future of R&D is in question”.
  (Various speakers on days 1 & 2)

- The opportunity:
  
  “We have a once-in-a-generation opportunity”
  (Steve Pohl – Conclussion of day 2)

Each participant then chose a picture card to explain what the users of ‘R&D WA’ are likely to expect from today’s workshop:

- Healthy 2-way dialogue between researchers and users.
- Imagination and deep thinking.
- Outcomes which are simple and beyond self-serving.
- A big question mark.
- Prosperity in due course.
- Leadership.
- Partnerships.
- A pathway through the woods (with due respect to people and nature).
- A viable future.
- Diversity.
- Competitive advantage.
We decided that the users of R&D are not necessarily the beneficiaries.

- Users include:
  - Farmers.
    - Drivers (e.g. Birchip, Mingenew-Lawrenson groups).
    - Incidental (e.g. individual farmers).
    - Indifferent (i.e. most farmers).
  - Researchers.
    - Peer-to-peer.
    - Planners & policy makers.
  - Agri-companies.
  - Community at large.
    - Via media.
    - Informed consumers.
  - Those that don’t know yet.
    - e.g. pharmaceutical companies.

- Beneficiaries include:
  - Funders.
  - International customers (of downstream products).
  - Farmers (if their profits increase).
  - The natural environment.

The following model started to emerge:
Craig tabled a draft BlueSheet™ for future broadacre agricultural landscapes in WA based on input from days 1 and 2.

- A number of additions and modifications were made:
  - External environment.
    - Add ‘input market uncertainty/global risk’.
    - Add ‘State government commitment to R&D and to agriculture’.
  - WA grainbelt.
    - Add ‘changing patterns of land ownership’.
  - Issues:
    - Add ‘no clear integrated focus on R&D’.
    - Add ‘role of R&D not well understood or valued’.
    - Add ‘dysfunctional family circumstances’.
  - But:
    - Add ‘Biodiversity hotspot of global significance’.
    - Add ‘social capital’.
  - Amend ⑥ to start ‘Give everyone and everything the chance to prosper’.
  - Amend ⑦.
    - Make ‘TBL’ a separate point.
    - Add ‘focused’
    - Add ‘big breakthroughs’ as new research area.

- The question was asked ... ‘Is this too politically correct?’
  - Perhaps so, but we agreed that it was nonetheless an accurate reflection of what we heard during the conference.

- A full-size version of the updated BlueSheet derived from days 1 and 2 is appended to the end of this TalkBook.
Where are we now?

After morning tea, we thought about what is good about WA R&D at present:

- High quality work and people.
- Diverse & intellectually rich.
- Has made significant historical contributions to productivity gains – source of pride.
- Numerous other achievements.
- Increasing end-user demand.
- Proactive pursuit of environmental and social objectives.
- Good ideas get funded.
- Longer-term, outward-looking focus.
- Cooperative approach, partnerships, good stakeholder input.
- Collegiate and social endeavour framework.
- GRDC has been very supportive.
- Good basic infrastructure.
- High adoption rate.
- Good extension work.
- High quality dryland research.
Where are we now?

We then thought about what is not so good about WA R&D at present:
- We tend to be intellectually isolated.
- Inadequate funding for blue-sky research.
- Overall planning is sub-optimal.
- We take an incremental approach to change ("suck it' not "look further").
- Bipolar demographics & experience (young adults leaving).
- Unhealthy competition for funding.
- Poor marketing.
- Few partnerships with private enterprise.
- Disconnect between biodiversity and production.
- Silos and fragmented initiatives.
- Not enough good people — below critical mass.
- Funder capture — narrow funding base.
- Short-term funding vs. long-term needs.
- Low social focus.
- Weak business and supply chain focus.
- Imbalance between production and rest of value chain.
- Limited career structure for young scientists.
- Patchy scientific coverage.
- Lack of state Science & Technology policy.
- Commercial pressures → IP issues → restricted info flow.
- Commercial pressures leading to narrowing focus.
- Nullabor as a barrier (to people, funding and lobbying activities).
- NRM funding doesn't match the scale of the challenge.
- NRM ‘amateurs' being asked to do what the ‘professionals' haven't been able to.
Where do we want to be?

Each participant used some quiet time to imagine being the CEO of ‘Integrated R&D WA’ in 2015 charged with preparing a speech after receiving a UN award for outstanding contribution to the world. Our ideas and thoughts are outlined below.

- Change driven by necessity.
  - Key features.
    - ↓ production.
    - ↑ value-add.
    - Celebration of biodiversity hotspot.
    - Strong integration.
    - Independent advice.
    - New funding sources.
    - Support for learning communities.
    - Prosperity for all.

- Dramatically changed research planning.
  - Split portfolio
    - < 60% applied
    - > 20% blue sky
    - > 20% technology assessment and policy research.
  - Collaborative priority-setting.
  - Management matrix
    - Enterprises × value chain
  - Triple-bottom line stretch targets.

- Sustaining the icon (i.e. the Swan River)
  - Based on a major step change.
  - Utilised and captured the collective imagination.
  - "Weetbix Challenge" — delivering weetbix to the world, inviting the world to our table.
  - Avon catchment as a global case study.
  - Collaboration between all agencies, departments & universities.
    - Funded by a 2% investment contribution from users.
    - City/Country challenge – barometer of progress on the freeway.
    - ↑ consultation, transparency & involvement.

R&D's role in future
broadacre agricultural landscapes
in south-western Western Australia
Where do we want to be?

Our ideas and thoughts (continued)...

- Our successes have delivered sustainable outcomes.
- Strong engagement, both internally and externally.
- Ongoing learning for all.
- Ambassadors set up globally.
- A strong focus from 'policy to practice'.
- Practical tools at all scales.
- Deliberately stretch our thinking.
- Strong science communication.
  - Informed by the arts and media expertise.
  - Accessible by indigenous people.
- Capitalise on our strengths.
  - Biodiversity.
  - Talented people.
- Think long term and avoid 'silver bullets'.
- Integrated focus.
  - Goals.
  - Actions.
- Focus on fundamental human needs.
  - Biodiversity and economics as means to the end.
- Flexible thinking.
  - People.
  - Funding & investors.

- Outcome focused.
  - Champions as the pivot.
  - Eliminate academic snobbery.
  - Team based.
  - No guaranteed budgets (merit based).
  - No departments.
  - Minimal bureaucracy.
- Underpinned by education.
  - e.g. agricultural curriculum in city schools.
  - Source of future scientists.
  - Source of future champions.
  - Understanding and appreciation amongst stakeholders.
Our ideas and thoughts (continued)...

- We value diversity.
  - Production.
  - Biodiversity conservation.
  - City/country perspectives.
- Strong focus on partnerships and communication.
- We will need a ‘ball bearing factory’ to fund our ideas.
- Significant stakeholder input into strategic planning.
- Downstream processing as a cash cow (e.g. flour mill, noodle factory).
- Outward looking, but with strong internal focus.
- Strong focus on renewable energy.
  - Wind.
  - Solar.
  - Biofuels.
- Increased focus on ‘food’ products.
- Emergence of boutique products.
- Landholders as investors – food, fibre & energy.
- One central R&D campus.
- Strong genomics focus.
- Increased knowledge base around big environmental issues.
  - Climate change.
  - Salinity.
Where do we want to be?

Our ideas and thoughts (continued)...

- Ruthless refocusing of our efforts and attention.
  - Listen to constituent aspirations.
  - Value creativity and imagination.
  - Think strategically.
  - Think laterally.
  - Get in front of game.
- Sustainability as our highest order mission.
- Different mix of R&D staff.
  - \( \uparrow \) social scientists.
  - \( \uparrow \) food scientists.
  - \( \uparrow \) health scientists.
- Collaborative culture.
  - Focus more about excellence than competition.
  - Beyond gender and equity.
- 25% of budget invested in regional NRM work.
- Rolling 5 year strategic plan.
- Develop new profitable varieties.
  - Source of new industrial products.
- Adapt a 'spoke & wheel' model.
  - A virtual R&D institution.
  - Staff spend proportion of time on the ground in the region.
Where do we want to be?

Our ideas and thoughts (continued)...

- Develop a wheatbelt CRC.
  - Broad-based objectives.
    - Double wheat production.
    - Double livestock production.
    - Preserve 80% of current biodiversity.
- Create organic R&D structure & processes.
  - Inclusive management style.
  - Engage & encourage the marginalized:
    - Youth.
    - Women.
- Strong health & education focus.
  - Schools adopt farms.
  - Tie-in aged care and land conservation activities.
- Resolve environment and production conflict.
  - Involve the community.
  - Establish an international consultancy.
    - Make a difference in Africa.
    - Source of income.
Where do we want to be?

After lunch we reviewed and agreed a summary of our desired future... in principle.

**Purpose:**
To develop a science & technology platform to deliver sustainable solutions to underpin the future...
- Economic prosperity
- Vitality of communities
- Environmental quality
  of broadacre agricultural landscapes in south-west WA.

**Beneficiaries/benefits:**
- **Current researchers**
  - Make a difference, be valued.
- **Future researchers**
  - Meaningful, challenging and rewarding career path.
- **‘Broadacre’ farmers**
  - High profits, pride, learning, ownership.
- **Other ‘broadacre’ residents**
  - Pride, viable future.
- **Consumers**
  - Safe affordable food, innovative new products.
- **Investors**
  - Good return on investment.
- **Government policy makers**
  - Clear & widely-supported direction.
- **Minority groups**
  - Recognition & opportunity to make a meaningful contribution.
- **Tourists**
  - Pleasant & memorable experience.
- **Public good**
  - Protection and celebration of natural environment (particularly biodiversity), attractive place to visit.

**Key enablers:**
- Integrated focus, function & structure.
- Partnerships:
  - Across sectors.
  - Across geographical entities.
  - Across disciplines.
  - Along the value chain.
Craig told the story of Lawson, Wentworth and Blaxland crossing the Blue Mountains (a different way of ‘doing’) and of Captain Cook’s journey to Australia (made possible by the ‘creation’ of long-distance ocean-faring craft).

We then shared our ideas about how we might move WA R&D from the present situation to our desired future.

- Develop a coherent and aligned R&D strategy for the broadacre agricultural landscape.
- Create a focused education system to help produce future R&D staff.
- Develop an integrated and broad-based suite of R&D programs.
  - Integrated landscape systems.
  - Risk management.
  - Sustainable agricultural systems.
  - Biodiversity patterns and processes.
  - Social and cultural policy and processes.
  - Quality in products.
- Develop regional research champions.
- Catalyze greater private investment funding.
  - Introduce incentives.
  - Introduce accreditation criteria.
- Establish a cross-sectoral corporate governing structure.
  - e.g. food, fibre and energy institute.
  - Mechanism to review project & funding proposals.
How do we get there?

Our ideas for moving forward (continued) ...

- Develop a different business model.
  - Perhaps a Food, Fibre & Energy Institute?
  - Various end-users (i.e. industry, landholders & government) as Board members?
  - Users as shareholders?
- Develop a consensus framework/vision.
  - Regular updates.
  - Ability to adapt to changing context.
- Shift more decision-making power to the region.
  - Allocation of funding.
  - Setting of priorities.
- Establish one institute in a major regional centre.
- Identify and nurture young R&D champions.
- Increase R&D funding.
  - Environmental lotto (variation on existing lotto)
- Develop a stronger business focus.
- Move beyond individual discipline focuses.
- Increase "blue-sky" funding and activity.
- Collaborate from 'concept to conclusion' (see model to the right).
  - Increase 'foraging distance' of all sectors.
  - Broaden size of common 'middle ground'.
  - Paradigm of ecosystem management.
How do we get there?

We then ranked our ideas via a basic poll.

- The most prospective ideas were:
  - Establish a single integrated organisational entity.
  - Better understand the systems impacting on the broadacre agricultural landscape (social and environmental aspects in particular).
  - Attract additional R&D funding.
  - Develop a consensus vision/framework.
  - Develop a process for collaboration from 'concept to conclusion'.
  - Develop a process to integrate various existing strategies.

- We still haven't identified a 'eureka' breakthrough idea.
  - There is general acknowledgement of strong 'inter-relatedness' between $\Delta$, $\beta$, and $\\gamma$.
  - If we are serious about a balanced portfolio, this will have big implications.
    - The people in the room today do not represent a balanced portfolio.
    - Historically, we haven't known 'what we don't know'.

- The key question to have emerged today is:
  - 'What can we do to be more co-operative and integrative?'
What do we do next?

We ended the workshop by considering our next steps.

- Future direction sits somewhere between 'R&D push' and 'user pull'.
  - This will necessitate engagement of regional stakeholders.
  - They can help validate our ongoing thinking.
  - Their ownership will be important.
  - They will share the benefits.
- Structure is only part of the future solution.
  - Function should inform structure, not vice versa.
- We should be pleased that each conference/workshop participant has had a worthwhile experience.
  - Is that enough?
  - There is an opportunity to achieve much more!!
- We agreed the following actions:

1. Draft outputs from this workshop.
2. Distribute workshop outputs to all participants.
3. Convene a follow-up meeting of the FBAL steering group & reference group.
   - Invite some R&D users from today's workshop.
4. Share outcomes from the follow-up meeting with all workshop participants.

Craig Salt by 1/7/04
Miles Dracup by 8/7/04
Miles Dracup by 29/7/04
Miles Dracup by 12/8/04
Emerging argument for future broadacre agricultural landscapes in WA
– from days 1 & 2 conference

A Where are we now?

External environment
• Population growth, globalisation, climate change, biodiversity loss, community pressure (safe food, clean & green), coastalisation, terms of trade, changing markets.
• Technology, input market uncertainty, global risk, state govt commitment to R&D & agriculture.

WA grainbelt
• Global biodiversity hotspot, relatively diverse landuse, productivity, most farms profitable, agricultural contribution to economy.

Issues
• Perceptions of agriculture
• Environmental impacts (salinity, erosion, acidification, biodiversity loss).
• Aging & shifting population, labour supply, drive-in / drive-out, dysfunctional families.
• Difficult to balance economic, social & environmental aspirations.
• Services & infrastructure not meeting expectations.
• GM an emotive issue.
• Country/city divide.
• Energy costs, water supply.
• Climate change (droughts, summer heat).
• No clear integrated R&D focus.
• Role of R&D not well understood or valued.

B Where do we want to be?

C What do we do to get there?

R&D can help FBAL in WA move forward.

To do so, WA R&D must be:
• Flexible.
• Integrated.
• Cross-disciplinary.
• Triple-bottom-line in focus.
• Collaborative.
• Efficient.
• High leverage.
• Inclusive.
• Well planned with a long-term focus.
• Relationship-based.
• Holistic.
• Passionate.
• Focused.

Possible scenarios:
1. Grain & drain
2. Green & grow
3. Saline prosperity
4. Landcare productivity

Possible new research areas include:
• Bush tucker/medicine.
• More differentiated food (further down the value chain).
• Eco-agriculture.
• Mechanisms for engaging with Joe Average.
• Bio-fuels.
• Helping to make conservation pay.
• Big breakthroughs.

Other suggestions include:
• Greater commercial sector involvement.
• Forge closer working relationships between researchers, farmers & industry.

D How do we make this happen?

Start exploring this during our day 3 workshop.
4.2 BlueSheet

R&D for the future broadacre agricultural landscapes of southwest WA

A

Where are we now?

- **Global**: Globalisation, changing markets, increasing community expectations & pressure (e.g., stewardship, GMO, increasing NGO influence), climate change, declining terms of trade, increasing energy costs.
- **WA**: Production vs environmental & social considerations, niche vs bulk commodity drive, little value-adding, land degradation, 'coastalisation,' declining regional services & infrastructure, rural communities in decline, changing land use patterns, biodiversity loss, country-city divide.

R&D in WA

- Review & consolidation process for agriculture underway, many players (universities, state govt agencies, CSIRO, farming groups, businesses).

Issues

- Fragmentation (function, structure, focus), uncertain future for R&D, disconnect between researchers & funders/users, tendency to 'suck harder' rather than 'look further', unhealthy competition, geographic isolation, funders values dictate research priorities, poor R&D marketing, short-term funding vs long-term needs, IP reducing info flow, NRM funds moving to community/catchment management groups, limited supply-chain focus, sub-optimal decision-making processes.

But...

- Some strong historical productivity gains, high adoption rate for good ideas, high calibre people doing quality work, southwest WA a global biodiversity hotspot, 2004/05 a once-in-a-generation opportunity.

Focusing question

How can we enhance the future economic prosperity, vitality of communities & environmental quality of broadacre agricultural landscapes in southwest WA?

B

Where do we want to be?

- Regional impact, global recognition
  - Healthy economy
  - Healthy environment
  - Healthy communities
  - Valuable R&D

- Investors
  - Good ROI
- Customers
  - Profit, knowledge, sustainable resource base
- Residents
  - Viable future, sense of place
- Governments
  - Clear direction, aligned constituents

D

How do we make this happen?

1. Distribute FBAL workshop outcomes June 2004
2. Convene follow-up meeting of FBAL steering & reference groups July 2004
3. Communicate outcomes September 2004

C

What do we do to get there?

Our strategic journey

Move from a highly fragmented Funder-focused R&D model to an Integrated User-focused business model

- 2004
  - Review & consolidation process for agriculture underway
  - Many players
  - Fragmentation
  - Issues
  - But...
- 2007
  - Mobilise key stakeholders
  - Form broad-based strategic leadership group (including users)
  - Map & understand existing sub-strategies within region
  - Develop coherent high-order strategy
- 2010
  - Increase user influence
  - Encourage users to become 'shareholders'
  - More user-focused R&D
  - Strategic Conversation System™

Key attributes

- Holistic
- Integrated
- Balanced
- Flexible
- Collaborative & inclusive
- Innovative & creative
- High leverage
- Long-term thinking
- Customer-focused
- Ongoing learning

Strategic Conversation System™

used by sustainable consulting
in collaboration with
HOW to ‘READ’ this STRATEGIC FRAMEWORK

We have framed this strategy around a Design Conversation methodology developed by Tony Golsby-Smith of 2nd Road Thinking Systems. There are two key elements to this system:

1. Dialogue sessions to generate the ideas.
2. The ABCD™ model to structure the Strategic Thinking. The ABCD™ model is a one page thinking format.

Captures the present situation according to 4 areas
- Our Environment
- The System in Focus
- Our Key Challenges
- A Focusing Question

Challenge

Captures our goals in 2 key areas
- Our Mission or contribution to the system
- A Vision of our desired outcome.

Captures the key themes for strategic action.
Each becomes a ‘strategic project’

Captures the implementation imperatives. Includes
- Plans
- Change management
- Key alliances
# 5. List of participants

**Attended the conference and workshop**

- **Prof Valerie Alder** - Murdoch University
- **Mr John Bartle** - Department of Conservation and Land Management
- **Assoc Prof Richard Bell** - Murdoch University
- **Mr Greg Bender** - Australian Wool Innovation
- **Dr David Bowran** - Department of Agriculture Western Australia
- **Mr Rob Delane** - Department of Agriculture Western Australia
- **Dr Miles Dracup** - Department of Agriculture Western Australia
- **Assoc Prof Mike Ewing** - The University of Western Australia
- **Mr Bob Grant** - Co-operative Bulk Handling
- **Dr Richard Harper** - Forest Products Commission Western Australia
- **Dr Steve Hopper** - Botanic Gardens and Parks Authority
- **Mr Sam Howard** - Bayer CropScience
- **Prof Mike Jones** - Murdoch University
- **Dr Ross Kingwell** - Department of Agriculture Western Australia
- **Dr Ted Lefroy** - CSIRO Sustainable Ecosystems
- **Mrs Barbara Morrell** - Avon Catchment Council
- **Dr Roy Murray-Prior** - Curtin University of Technology
- **Ms Wendy Newman** - Wheatbelt Development Commission
- **Mr Peter O'Connell** - Syngenta
- **Assoc Prof Dave Pethick** - Murdoch University
- **Mr Mick Poole** - CSIRO Centre for Environment and Life Science
- **Prof Steve Powles** - The University of Western Australia
- **Prof Alistar Robertson** - The University of Western Australia
- **Prof Graeme Robertson** - Curtin University of Technology
- **Mr Craig Salt** - Sustainable Consulting
- **Prof Kadambot Siddique** - The University of Western Australia
- **Mr Geoff Smith** - Council of Grain Grower Organisations Ltd
- **Prof Andris Stelbovics** - Murdoch University
- **Prof Rene Van Berkel** - Curtin University of Technology
Mr Ken Wallace  Department of Conservation and Land Management
Mr Corey Watts  Australian Conservation foundation
Mr Cameron Weeks  Grower Group Alliance
Mr Stuart Witham  Landmark
Mr Neil Young  grainbelt farmer

Attended the conference only

Mr Dale Baker  Grains Research and Development Corporation
Ms Caroline Bath-Jacobson  Murdoch University
Mr Cameron Beeck  The University of Western Australia
Mr Mike Buckton  Forest Products Commission Western Australia
Mr Brendon Cant  Brendon Cant & Associates
The Hon Kim Chance  Minister for Agriculture, Government of Western Australia
Mr Neville Collard  Nyungar Heritage Consultant
Mr Brad Collis  Ground Cover
Mr Hendy Cowan  Former Deputy Premier of Western Australia
Dr Michael Dunlop  CSIRO Sustainable Ecosystems
Mr Aaron Edmonds  Earth Farm Australia
Dr James Fisher  Department of Agriculture Western Australia
Ms Tracy Gillam  Farm Weekly
Ms Susan Hall  Brendon Cant & Associates
Mr Chris Henderson  grainbelt farmer
Mr Gary Hepworth  Curtin University of Technology
Prof Peter Kenyon  Curtin University of Technology
Dr Caroline Lemerle  Rural Industries Research and Development Corporation
Prof David Lindsay  The University of Western Australia
Mr Ian Longson  Department of Agriculture Western Australia
Dr David Masters  CSIRO Livestock Industries
Mr Ian McClelland  Birchip Cropping Group
Prof Doug McEachern  The University of Western Australia
Mr Mike McFarlane  Avon River Basin 2050 Working Group
Dr Fiona McKenzie  Curtin University of Technology
Ms Natalie Moore  Australian Institute of Agricultural Science and Technology
Prof Peter Newman  Murdoch University
Dr Michael O'Connor  CSIRO Sustainable Ecosystems
Prof David Pannell  The University of Western Australia
Mr Eddy Pol  CSBP Ltd
Dr Chris Preston  University of Adelaide
Prof Rick Roush  University of California
Mr John Ruprecht  Department of Environment
Dr Megan Ryan  The University of Western Australia
Mr David Singe  Wheatbelt Development Commission
Prof Daniela Stehlik  Curtin University of Technology
Dr Mark Sweetingham  Department of Agriculture Western Australia
Mr Crawford Taylor  Rabobank
Dr Neil Turner  CSIRO Plant Industry
Mr Grant Woodhams  Woodhams Publishing