

AUSTRALIAN AGRICULTURE: REDESIGNING FOR RESILIENCE¹

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Australian agriculture needs to redesign itself in a way that ensures resilience of both the industry and ecosystems on which it depends. The Australian agriculture industry has undergone decades of belt tightening and pressure to perform. Survival has required increasing precision and productivity. Under the weight of such demands, it has been easy to overlook a threat to agriculture that is more silent and insidious – the eroding natural resource base of the farm and accumulating impacts at the catchment scale. Fortunately, what looms as a threat can also be turned into an opportunity.

Agriculture is inherently an ecological enterprise, dependent entirely on ecosystem processes and functions for its success. It is possible to build agro-ecosystems that generate wealth from food and fibre and have the flows of water, nutrient and carbon matched to the hydro-geochemical cycles of this ancient continent. To do this, however, requires a fundamental redesign of agriculture in the landscape. This is Australian agriculture's great challenge.

Redesigning Australian agriculture for resilience requires the following ten steps:

1. become landscape literate
2. cure the drought delusion
3. pay for ecosystem services
4. remove hidden subsidies
5. replan the paddock
6. build new industries, not just new crops
7. use native flora and fauna
8. create new partnerships and knowledge
9. unlock tools for change
10. put the whole package to the test

1. Become landscape literate

The first step in building healthy agro-ecosystems is to become landscape literate. This will require a paradigm shift by research institutions, rural communities, funding agencies and governments. It means rethinking the many scientific and technical services provided to the agricultural sector, recognising that the ecosystem processes on each and every farm will be different. In this endeavour there are no experts - only students.

For too long we have looked outward for lessons on how to manage the land, ignoring what is under our noses. Becoming landscape literate requires more than understanding the yields of crops and livestock. It means being cognisant of landscape process and function: how it behaves, how it is changing and the affect of current land uses.

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At the end of the day, becoming landscape literate requires a decision and commitment to do so. Many farmers are stuck on a treadmill of high input – high intensity farming, with bank overdrafts and degraded paddocks eating into their capital. Rather than funding fellowships that allow for travel overseas to study new agricultural techniques, we need fellowships that give landholders the time and breathing space to conduct a study tour of their own back paddocks.

Scientific and technological innovation in laboratory and field experiments will continue to play an important role in the development of sustainable farming. However, innovation achieves little without application and experimentation at the farm level and an understanding how actions at that level integrate into the ecological and hydrological function of the landscape.

2. Cure the drought delusion

Australians are normally a sceptical bunch, yet when it comes to waiting for the next rain cloud, logic is replaced by longing. A twenty year dry period, with one or two wet years in between, does not meet the definition of drought. Believing it to be so lures us into growing things in areas where the nature of Australia makes it inadvisable to do so, hazarding salinity, soil and water degradation, loss of habitat and species. It is time we accepted that there are droughts, and then there are dry climates. Sustainable agriculture must be able to cope with decade long dry sequences, as those we saw in the 1900-15's, 1930-40's, and which are being repeated again in the first decade of the 21st century. This is part of living on the Australian continent. There is every indication that climate change will make these dry sequences more frequent and more severe in south eastern Australia. Whilst irrigation has an important place in a sustainable future, it cannot in any way drought proof the country. As long as long dry sequences continue to occur, regional communities will be placed at risk whenever water allocations fail.

For agriculture to be resilient, it needs to evolve to accommodate these sequences. Farmers in dry climates need to accept that a “good” season is not the norm and plan accordingly. There will always be the extreme events that can't be planned for. For the rest, efforts should be directed at redesigning the farm to suit a drier climate, not creating a system that has to be shut down and seek government assistance whenever the rain gauge is empty. The smartest business move a farmer can make is to attain a more realistic and pragmatic appreciation of the character of our continent instead of one superimposed by our alien cultural origins. We need to rethink our fundamental values of water and landscape and our relationship to them.

3. Pay for ecosystem services

A key function of agriculture in the future will be to manage the landscape, its rivers, wetlands and estuaries, in ways that produce ecosystem services for our whole society. The agricultural community can no longer be expected to produce cheap, clean food and fibre, as well as provide a free service to maintain all the essential ecological functions of the landscape. This service should be recognised as a fundamental part of our economy, and paid accordingly (for example CarbonSMART (2008)).

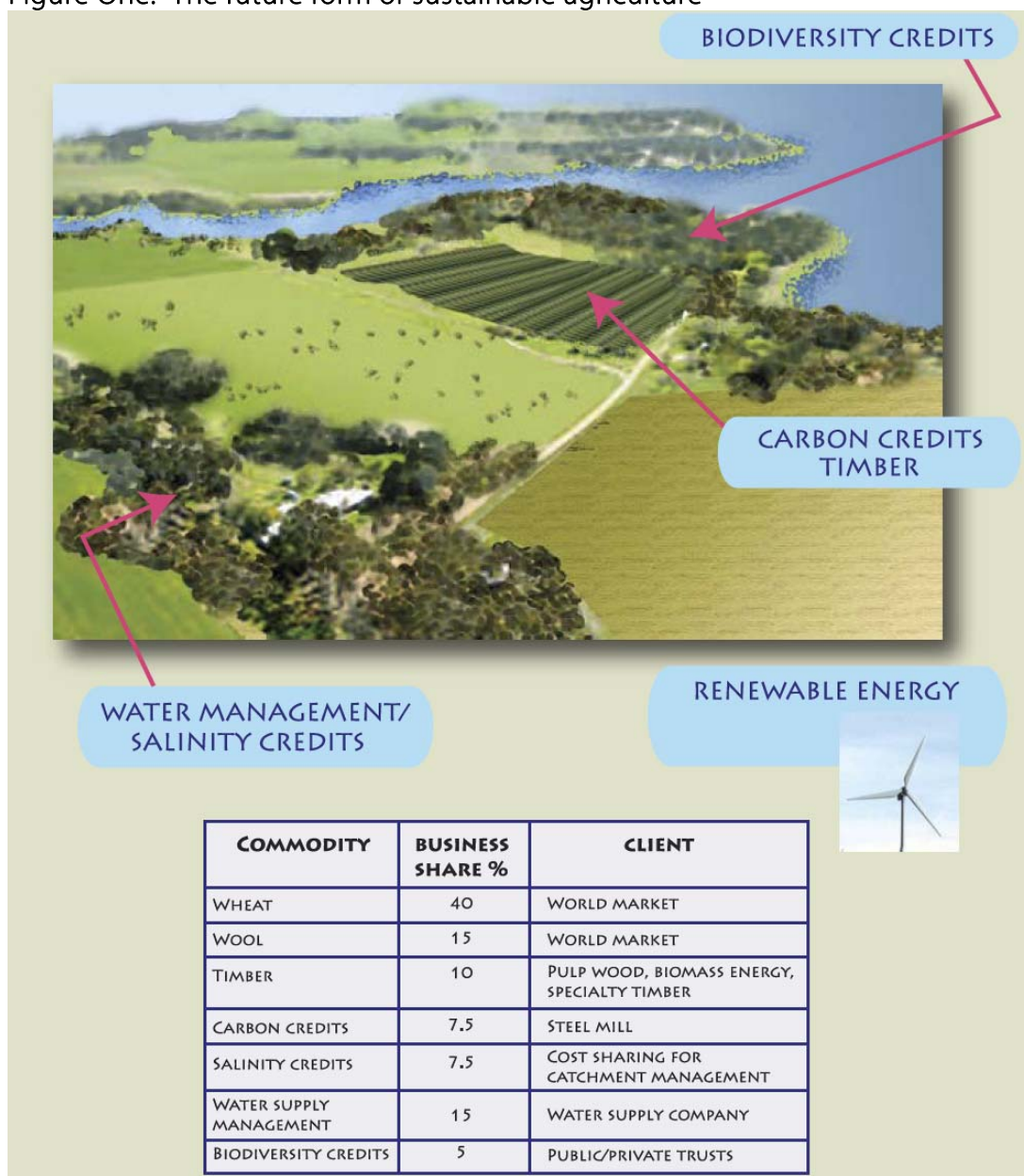
Sustainable agriculture requires a mosaic of new and old agricultural enterprises that yield food and fibre coupled with native ecosystems that provide a suite of ecosystem services which are given a present day value. Currently, future generations are footing

the bill. In *Blueprint for a Living Continent*, the Wentworth Group (2002) argued that we must establish new economic systems to:

“Pay farmers for environmental services (clean water, fresh air, healthy soils). Where we expect farmers to maintain land in a certain way that is above their duty of care, we should pay them to provide those services on behalf of the rest of Australia.”

For this to be realised new markets for ecosystem services are needed. As these markets develop, we can expect an increasing proportion of farm income will derive from the management of healthy landscapes, rivers, wetlands and estuaries, the production of clean water and the sequestration of carbon dioxide. Today, farmers are seen simply as the providers of food and fibre. Tomorrow they will be seen as the custodians and managers of the life support systems for society as a whole.

Figure One: The future form of sustainable agriculture



(Image Credit: Johanson, D., Wentworth Group of Concerned Scientists *unpublished* - Modified from Wayt Gibbs (2005)).

4. Remove hidden subsidies

The cost of our food rarely has priced in the cost of maintaining and improving the natural resource base from which it is produced. This is a clear indicator of market failure. The Wentworth Group (2002) argues that we must find ways to:

“Incorporate into the cost of food, fibre and water the hidden subsidies currently borne by the environment, to assist farmers to farm sustainably and profitably in this country”.

Hidden subsidies must be addressed in order to provide a driver for sustainable agriculture. If environmental degradation is free to consumers at the same time as environmental protection and repair is costly for producers, then there is no incentive for producers to invest in environmental best practice. There are a range of options to correct this.

Food and fibre have an ecological footprint. Consumers need to know what that is. Currently they do not. We need a regulatory framework so that markets must price in the cost of maintaining the environment and the quality of the resource base. We cannot legally market food that is contaminated. Why can we market food that is produced in ways that continue to damage the natural resources and environment? We argue for a regulatory framework in Australia that ensures that all food reaching the consumer is produced in ways that minimise the damage to natural resources and the environment. Environmental management systems such as the Australian Landcare Management System (Gleeson, 2006) and proper labelling of food and its footprint are first steps and are currently maturing. But this alone is not sufficient. A regulatory framework is required that establishes that, for food and fibre to be marketed, it must have been produced by means which meet an Australian standard for sustainable food or fibre products. Such a standard must apply to both Australian grown and imported products. It is currently difficult to market food and fibre commodities on world markets where costs to minimise impacts on the environment are part of the price. This will change and Australia can be a driver and advocate of that change. We foreshadow a major re-thinking of these issues within global markets as the footprint of food and the carbon footprint of all we do becomes factored into commodity prices into the future.

The consumer is leading the demand for such a system. Emerging concerns with “food miles” are just the beginning. The analysis contained within the ‘Australian Sustainable Agriculture Standard’ must be comprehensive and include whole life cycle analysis of energy, water, land and biodiversity inputs into production. This has to be done if we are to provide consumers with the true footprint and thus the true cost of the food and fibre they consume. Unless markets have a strong call and drive for food and fibre products to be produced according to such a standard, the cost of continued degradation of natural resources will not be paid by the consumer but will remain a hidden subsidy that eats into our environmental assets.

Incentives also play an important role in removing hidden subsidies. Incentive based approach, such as labelling, can reward the grower and supplier for best practice. For example, certification at the farm gate could be linked to the tax system, enabling product labelling, tax rebates or other incentive mechanisms.

5. Replan the paddock

Even our best farming practices have not been designed, at the outset, to operate in harmony with the Australian ecosystems in which they are cast. Rather than encouraging farmers to spend time and money fencing off remnant vegetation that has no hope of surviving, we need to stand back and take stock of what is really needed on a catchment scale. Adoption of a catchment or landscape approach would mean decisions are designed to ensure that underlying biophysical processes can support the environmental, economic and social values that society identifies for that landscape. In a landscape approach, vegetation is not managed for its own sake, but as a key tool for ensuring biophysical landscape processes and resources continue to function well. Strategic revegetation, conservation and rehabilitation can address multiple outcomes such as improved biodiversity, soil health and water quality (Natural Resources Commission, 2007). This may mean redrawing paddock boundaries, figuring out what sort of species and structural complexity is necessary and if and where regeneration of remnant vegetation can be beneficial (Williams and Saunders, 2003). It means being honest about what is already lost and not throwing good money after bad.

The whole landscape can be connected and integrated by linking property vegetation planning into spatially robust catchment vegetation plans. The balance between different types of land uses will vary for different catchments, size of catchments and position in the landscape. Devising the optimal placement of these land uses requires a deep understanding of landscape processes and functions, particularly salt storage and groundwater flow, and an understanding of the distribution and abundance of flora and fauna. Farmers will need access to the best information available and basic things like good maps of landscape properties. In replanning the lay out of paddocks, they could choose to incorporate a range of options, such as:

- New commercially driven tree production systems and/or novel tree species for large areas of current crop and pasture zones;
- New farming systems comprising innovative mixes of all the best current annual and perennial plants, the best agronomy, companion plantings, rotations and combinations; and,
- New forms of cereals, pulses, oilseeds and forages selected or bred for characteristics that substantially reduce deep drainage and nitrogen leakage.

It is a great irony that in Australian agriculture, where the shortage of both water and nutrients greatly restricts yield, it is the loss of both precious water and nutrient beneath crops and pastures that is the fundamental cause of problems such as salinity and acidification (Williams, 2005). If we can work together to develop systems that complement rather than compete with natural processes, they may be both more productive and more ecologically sustainable. We can turn what is wasted into wealth.

6. Build new industries, not just new crops

We must address agricultural production as an agro-ecosystem that is part of the larger-scale ecosystem and landscape processes. This is a big ask. The redesign of plant production systems for Australian landscapes is an imperative. We need new crop and forage species that are bred for their ability to flourish in our ancient landscapes. They need to be partnered with a strategy for building new industries and fostering prospective land uses, delivering economic as well as ecological benefits.

New trade arrangements may become attractive on a catchment basis. For example, where the transaction costs of carbon trading on a farm-by-farm basis may be excessive, a catchment based co-operative arrangement may deliver economies of scale and a competitive advantage. Developments in this area are now taking place, for example, through schemes which combines many sites into one large pool (CarbonSMART, 2008). The move to producing unfamiliar commodities also needs to be accompanied by efforts in marketing. Demand will need to be created. Producers won't grow products that no one wants. Fortunately, innovation is already underway in Australia in the development of new industries that were previously not imagined (Robins, 2007).

7. Use native flora and fauna

For Australian agriculture to build productive, sustainable farming systems, we will need to develop new innovative land uses. Native flora and fauna will need to form an increasing part of rural production. This will restore crucial elements of biodiversity to the landscape and optimise the ecosystem services provided by biodiversity. Bush foods, native wildflowers, essential and other oils for pharmaceutical or industrial chemicals all have untapped potential. These possibilities are no longer 'pipe dreams'. It is encouraging to see innovative emerging industries that are producing and marketing a wide range of products based on Australian native flora and fauna (CSIRO, 2008). To do this in ways that retains ecological function and improves the natural resource base because the flora and fauna have evolved with the landscape is challenging but it is happening.

8. Create new partnerships and knowledge

A new partnership is needed if we are to find solutions to the biophysical problems posed by building a resilient agriculture. The solutions are scientifically demanding. Remember there are no experts – only students. Rural communities in Australia are facing radical environmental, social and economic changes (Rogers & Jones, 2006). A new way of doing science is required that involves landholders working with biophysical scientists, conservation biologists, sociologists and economists to build new systems.

Many current management issues are the result of failure to research and develop farming systems and integrate them with the ecological, hydrological and biogeochemical processes operating in the landscape. Making land use change compulsory, or designating new land classifications from the top down won't take us closer to being landscape literate. More effective are bottom-up approaches that emphasise resilience, resource management and governance (Walker et al., 2006). A new partnership is needed - one where the line between the landholder and scientist is blurred - and the scientific and technical skills needed to innovate become embedded in the regional culture. It is essential to build and maintain the capacity of regional communities if they are to support landholders, scientists, economists and social scientists. This will require adequate investment in education, knowledge generation and innovation.

9. Unlock the tools of change

In an industry where inputs are increasingly expensive and climates continually variable, survival requires precision. To redesign their paddocks, farmers need to access new land assessment tools to measure, model and predict the flows of water, nutrient, and carbon. They will then be able to predict, model and map the best location for trees, other

perennial plants, high-value annuals, and native vegetation. This would greatly facilitate the identification and re-assignment of land so that on some parts of the landscape, productivity is greatly enhanced and other parts are removed from production to provide a range of ecosystem services and protect the native biota.

To make this possible, accessing landscape relevant information need to become less a 'mission impossible' and more fruitful. Access to data needs to be seamless and configured to capture the opportunities of new and emerging technologies. At present, there are no central points of advice that combines the wisdom of different agencies and departments. Regional bodies such as Catchment Management Authorities are fulfilling this role as best they can, but it isn't easy. There is an urgent need for decentralised but integrated information services that are relevant at a catchment scale. The many agencies that undertake research into agriculture and land use will need to increase co-operation to allow this to happen. Thinking and working together at all scales from paddock to catchment, landscape to the plate are needed; without the old divisions between disciplines and departments.

The capacity of regional natural resource management entities will need strengthening as a regional delivery model is fundamental to effective action. The government-community interface presented by these bodies must be nurtured by government agencies.

10. Put the whole package to the test

We can continue to play around the edges, funding feel-good projects but avoiding the hard stuff, or we can bite the bullet and tackle the problem at its core. The truth is there are serious deficiencies and problems with our scientific understanding of Australian ecosystems. We do not know how to embed agriculture within the natural limits of our landscapes. At present, our approach is ad hoc.

There are 56 natural resource management regions in Australia. One landholder in each region could volunteer their farm for an intensive make-over. It would need to be a working farm and, when the make-over is complete, continue to be a viable functioning farm. A team can be assembled for each make-over, with the farmer an equal player in the team. Everything would be put to the test – paddock layout, land uses, vegetation, the lot. If it works, it provides a model of what is possible within a region, and at what cost. If it doesn't, we can stop preaching solutions that won't work and stop solving one problem by creating another. Where a model farm already exists in a region, support should be provided to the farmer to enable them to communicate their experiences and findings.

It is not only possible, it is essential.

It is possible to redesign agriculture in Australia in such a way that ensures resilience of both the industry and ecosystems on which it depends. To do this requires more than fiddling at the edges with the current system. It requires a commitment from everyone in the sector to rethink their approach, to re-envisage the farm, and to re-engage with each other in learning from the landscape itself. This is the challenge as well as the opportunity.

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