

# TEN COMMITMENTS REVISITED

Securing Australia's Future Environment



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## Australian agriculture

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1. Become landscape literate.
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3. Address market failure.
4. Replan the paddock.
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### Introduction

Five years have passed since our 2008 version of this chapter, when we wrote:

*'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 of 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.'*

This call for transformation has been echoed by many others before and since. The good news is that we are making progress, thanks in no small part to the efforts of thousands of farmers, other individuals and organisations who have been working to improve the sustainability of farm systems. The bad news is that we are still fiddling at the edges – not because of the lack of effort, but because we are working within a flawed framework that does not recognise the complexity and interconnectedness of our food and agricultural systems. The farm is not the only site of decision making. Producers, policy makers, retailers, manufacturers and consumers all make decisions that influence the agricultural landscape and the settings in which farmers operate. We have the opportunity for dynamic and innovative renewal of the sector, but farmers alone can't make this happen. There is a need for greater leadership, pragmatism and attention to detail across the food system. Change requires more than idealistic notions or vague policy settings. Until we improve

the foundations, we won't build sustainable and resilient agro-ecosystems. No one wants to see the decline of Australian agriculture or the continuing erosion of natural resources, but right now we are all complicit in making this so.

What looms as a threat can also be turned into an opportunity. In this spirit, we've updated and revised our '10 commitments' to reflect the state of the sector in 2013. Most of the principles remain the same, although we've removed 'cure the drought delusion' because climate variability over the past decade has already delivered this message loud and clear. We've replaced 'removing hidden subsidies' with 'addressing market failure'. We've added 'fostering farmer-driven innovation' because we believe that innovation has an important role to play in the future of Australian agriculture. We hope that you find the following 10 commitments informative and that you choose to be part of the positive transformation of our agricultural and food systems.

### **1. Become landscape literate**

The first step in building healthy agro-ecosystems is to become landscape literate. This 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 what role current land uses play in this. It means a paradigm shift for the many scientific and technical services provided to the agricultural sector, and recognition that the ecosystem processes on each and every farm will be different. The idea is to ensure that plant and animal interactions mimic as closely as possible natural ecosystem processes and functions. Local investigation through observation and adaptive management is a key means of knowledge acquisition. In this endeavour there are no experts – only students.

The good news is that there are an increasing number of programs that provide a basis for this learning, and an increasing number of farmers are alumni. However, many farmers are stuck on a treadmill of high-input-high-intensity farming, with bank overdrafts and degraded paddocks eating into their capital and their options. For too long, we have looked outward for lessons on how to manage the land, in the meantime ignoring what is under our noses. In addition to funding fellowships that allow for travel overseas to study new agricultural techniques, we also need fellowships that give farmers 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, but without application and experimentation at the farm level and understanding how that integrates into the ecological and hydrological function of the landscape, it remains abstract and inapplicable.

### **2. Pay for ecosystem services**

In 2008, we were hopeful. We argued that the agricultural community could no longer be expected to produce cheap, clean food and fibre, as well as provide a free service to maintain all the ecological functions of the landscape that are essential to urban societies. It was our hope that the agriculture of the future would be paid not only for the goods it produces but also for the services delivered through its management of healthy landscapes, rivers, wetlands and estuaries. We still believe that these services need to be paid for and recognised as a fundamental part of the economy. The challenge is how to achieve this – especially in an export-oriented market such as Australia's, where producers are not in a position to pass on these costs to consumers (Hatfield-Dodds *et al.* 2006).

When New South Wales farmers were asked to comment on an illustration similar to our 2008 concept of a 'future farm' (with a mix of production and conservation functions),

the common concern was that there were too many land uses for one farmer to manage, given the current pressures they were under (McKenzie 2014). This is where concepts of aggregation and 'landscape labelling' (Ghazoul *et al.* 2009) may be useful: creating a pool of assets with shared management of marketable ecosystem services. Aggregated or otherwise, services can't be sold if there is no demand. Since 2008, the appetite for environmental funding has waned – which means the market for ecosystem services hasn't grown as hoped. There has been some progress with new publicly and privately funded market-based instruments. However, most are unconnected, state-level, biodiversity offset and banking programs, and conservation tenders or auctions for rivers, wetlands, bushland, soils and woodlands. The new markets we need aren't appearing quickly enough. This is partly an issue of ambiguity of language, novelty of the concept, divergent purposes and lack of underlying demand in both the public and private sector (or maybe no one really cares?). Poorly designed government schemes, with ever-changing rules and short-term funding, also slow progress. It is fair enough to require that any ecosystem services purchased are additional to what would have existed anyway. But stringent contract conditions with unrealistic pricing and timeframes (100 year contracts anyone?) create unreasonable levels of risk for landholders. To bring this concept to mainstream agriculture requires ecosystem services to be an asset rather than a liability. Although experience is providing us with valuable lessons, new insights could be more strongly reflected in design and implementation. Given all these constraints, there has been amazing progress and a strong foundation has been built. Now it is time to take it to the next level.

### **3. Address market failure**

Ecosystem service payments on their own won't change the flawed foundations of our food system. To assist farmers to farm sustainably and profitably in this country, we must also incorporate into the cost of food, fibre, and water the hidden subsidies currently borne by the environment (Wentworth Group 2002). The fact that the cost of our food rarely includes the cost of maintaining and improving the natural resource base from which it is produced is a clear indicator of market failure. This failure must be remedied to provide agriculture with the market pull for sustainably produced food and fibre. Evidence is that, despite a huge push at the production end of agriculture to deliver sustainably produced food, there is currently a very weak market pull for sustainably produced products. This is a global problem, with producers of sustainably certified products everywhere faced with higher production costs and questionable benefits (Bhaskaran *et al.* 2006; Blackman and Rivera 2010).

Although in favour of environmental markets, particularly those incorporating concepts of producer-driven 'landscape labelling', we also recognise that a strong regulatory framework is required that supports the market. We argue for a framework (Williams 2010) that ensures all food reaching consumers in Australia is produced in ways that minimise the damage to the natural resources and environment. Such regulations would provide Australian consumers with a level of confidence that the food and fibre they consume does minimal damage to the ecosystems and landscapes of this planet, in the same way that current regulation provides protection against consuming food contaminated with chemicals, pesticides and harmful organisms. We propose an Australian standard for sustainable agriculture. The 'Australian Sustainable Agriculture Standard' must include whole lifecycle analysis of energy, water, land and biodiversity inputs. It would be more comprehensive than simplistic assessments such as food miles and provide consumers with the true cost of food. In the absence of such a standard, the cost of

continued degradation of natural resources will not be paid by the market, but will remain a hidden subsidy that eats into our environmental assets.

Such a standard must apply to both Australian-grown and imported products. It is currently difficult to promote food and fibre commodities on world markets where costs to the environment are part of the price. We predict this will change and Australia can be a driver and advocate of that change. We could build on Australia's reputation for providing high-quality, safe and nutritious food. A first step could be tackling the inconsistencies in food safety regulations between Australian jurisdictions and the barriers faced by domestic producers compared with imports. Although 90% of fresh food is still locally grown, an increasing proportion of processed food is being imported, particularly fruit, vegetables and seafood (DAFF 2013). By imposing greater domestic regulations without changing the overall foundations of the food system, we simply penalise our own 'clean and green' producers while consumers shop elsewhere. We must be clear that we are not arguing for greater subsidisation of the Australian agricultural industry. It is already one of the least subsidised in the world and the industry underwent a tough transition to get here. It is now one of the most efficient and innovative, and we shouldn't abandon past reforms. We propose that we continue the evolution with an integrated approach to food with a strong market signal and economic pull for sustainable food and fibre production. We don't assume it will be simple but, despite the difficulties, we need such an approach if we are to change the current trajectory of our food and agricultural systems.

#### 4. Replan the paddock

An interesting change is occurring on farms across Australia. Cropping paddocks are getting bigger – facilitating traffic guidance systems for heavy machinery. Grazing paddocks are getting smaller – subdivided to facilitate the rotational grazing of livestock. These changes to paddock layout reflect more than a change in fence lines. They also reflect a broader conceptual shift in farm management (McKenzie 2014). Whether this shift delivers widespread sustainability remains to be seen. Competing forces are shaping the agricultural landscape. Agricultural systems have become increasingly complex, with massive capital investments, changing production technologies, volatile markets and increased regulation (Kingwell 2011). The growing knowledge intensity of agriculture, accompanied by a concentration in human capital, is putting increased pressure on farm managers to maximise investments in knowledge and skills by specialisation and intensification (McKenzie 2014). Specialisation can lead to reduced land-use diversity, while intensification can be a threat to ecological diversity. Where intensification must occur, it should be pursued along the lines of ecological intensification, where more food is produced at the same time as minimising the impact of production on the environment (Hochman *et al.* 2013).

A key opportunity for ecologically efficient intensification exists through the better integration of crop and livestock enterprises on mixed farms, and taking a landscape approach. Rather than encouraging farmers to spend time and money fencing off isolated remnant vegetation that has no hope of surviving, we need to stand back and take stock of what is really needed on a landscape scale. Adoption of a 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 that biophysical landscape processes and resources continue to function well, for

example, through strategic revegetation, conservation and rehabilitation to generate multiple outcomes such as biodiversity, soil health and water quality (Natural Resources Commission 2007). This may mean further 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. 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. It means being honest about what is already lost and not throwing good money after bad.

### **5. Build new industries, not just new crops**

We must consider agricultural production as an agro-ecosystem that is part of larger scale landscape processes. This is a big ask. The redesign of plant production systems for Australian landscapes is an imperative. New crop and forage species that are bred for their ability to flourish in our ancient landscapes will be important. However, these alone won't be enough. A strategy for building new industries and fostering prospective land uses is required: one that can deliver economic as well as ecological benefits. Growing crops that contribute to nutritional wellbeing, not just empty calories, is also a priority in a world faced with the twin challenges of over- and under-nutrition. A strategic approach is increasingly important as farmers require new tools and options to face the economic, social and environmental challenges of coming decades. Options could include:

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

We highlight the need to build new industries, not just new crops, as the move to producing unfamiliar commodities also needs to be accompanied by efforts in processing, marketing and retail. Creating a value chain for a new product can be difficult – and demand will need to be generated. Producers won't grow products that no one wants. Fortunately, innovation is underway in Australia in the development of new industries that were previously not imagined. Emerging industries are providing farmers with more options for tailoring their farm system to suit the local conditions (e.g. health-food plants such as quinoa, chia and stevia; alternative animal products such as buffalo dairy; agroforestry for biofuels; and high value horticultural products such as coffee). We encourage strategic support for these new endeavours.

### **6. Use native flora and fauna in agriculture**

For Australian agriculture to build productive, sustainable farming systems, we will need to restore crucial elements of biodiversity to the landscape. To do this in a viable way, the use of native flora and fauna will need to form an increasing part of rural production. Australia is recognised as one of only 17 'mega-diverse' countries, with a large proportion of our biodiversity being unique to this continent (ABS 2012). However, our only major

commercial native flora crop to date has been macadamias. Surely we can be a bit more creative in how we harness this exceptional diversity?

There are promising prospects for both native flora and fauna. Emerging animal industries such as crocodiles, emus, kangaroos and freshwater crayfish (marron, redclaw and yabby) are increasingly acceptable to consumers. There is also greater awareness of the value of bush foods, such as native nuts, berries, herbs, spices, seeds, fruits and vegetables. And, chances are, you may already have come across products containing desert limes, quandongs, mountain pepper or bush tomatoes. Native wildflowers and essential oils (eucalyptus, tea tree) for pharmaceutical or industrial chemicals are also gaining some market share (Foster 2009). All have untapped potential.

We are hopeful that over time we will see an increasing number of emerging industries that become innovative in the production and marketing of a wide range of products based on Australian native flora and fauna. To do this in ways that retains ecological function and improve the natural resource base is challenging, but it is happening. It should just happen more quickly.

## 7. Foster farmer-driven innovation

Building resilient agricultural systems is scientifically demanding. It also requires new ways of doing science within the imperatives of rural communities facing radical environmental, social and economic changes. It requires innovation. Farmers can be (and are) potential sources and intermediaries of knowledge and innovation. Innovation is not just about frontier research and technology, but also about incremental problem solving and the constant minor adjustments and improvements that farmers make to succeed (Hall 2006). It is an ongoing process, not a one-off change. Yet this process is not well understood at the farm level, nor is it reflected in policy approaches for agricultural innovation.

Knowledge generation and the interactions that allow for knowledge exchange are key processes of innovation. This should be recognised through the more appropriate design of institutional frameworks for building farmer engagement and innovative capacity. Interactive knowledge networks (with farmers, farmer groups, scientists industry, and other actors) should be created (IAASTD 2008). These networks should have linkages to technically relevant information, new learning opportunities, flexibility in process and ongoing evaluation. Traditional extension services could be transformed into knowledge brokerage services, so that independent advice and evaluation is easily accessible. Extension agents could be retrained as network facilitators, whose role includes creating 'space' for stronger interactions and learning across the whole range of actors involved in innovation (McKenzie 2013). Creating such institutions would assist in rejuvenating rural networks and communities and resolving the current crisis in agricultural extension in Australia. Rather than focusing on short-term interventions, more thought is needed on how to create the enabling conditions for effective action and interactions in the long term. These conditions may not result in radical reforms or news headlines, but they will result in incremental learning and ongoing change that build capacity rather than continuously reinvents the wheel.

## 8. Create new partnerships

Redesigning landscapes requires collaboration between scientists and practitioners, 'flexibility in land use and land use planning, and stronger engagement with communities, business and government' (Seabrook *et al.* 2011). For regional communities to have this capacity will require new partnerships that invest in education, knowledge generation and

innovation. Building trust is crucial. And maintaining this trust among partners is a key element of a successful partnership (Killough 2009). Farmers will reciprocate only when governance structures value their input rather than being dismissive or using cooperative strategies against them (Marshall 2008). Farmers' experiences with past attempts at collaboration have not always been positive. There is a lot of scope for improvement, not least in basic communication. Partnerships should facilitate co-design, rather than promote a predetermined agenda. The partnership should not become an end in itself. It should explore the things that farmers identify as useful to them. To facilitate this, the capacity of regional natural resource management entities should be strengthened, not weakened. These organisations are often the government–community interface and need to operate effectively.

Partnerships should involve both the public and private sector. There is scope for both sectors in the provision of generalist and specialist advice, technology, research and collaborative forums. Both have roles in creating progressive practices in alternative grazing and cropping strategies, biological farming, monitoring technologies, cloud computing, online marketing and business benchmarking. The list goes on. What is needed are truly new ways of engaging, based on the concept of multiple pathways for knowledge flows and the flexibility required for emergent networks – where the line between the landholder and professional expert becomes blurred, and new knowledge is created.

## 9. Unlock tools for change

In a sector where inputs are increasingly expensive and climates continually variable, surviving is all about precision. That same precision needs to be applied to biophysical problems on the farm. In redesigning their paddocks, farmers will need the scientific capacity to measure, model and predict the flows of water, nutrient and carbon in their agro-ecosystems and relate these to the flows occurring in the landscape. They will need access to new land assessment tools that allow them to predict, model and map the best location for trees, other perennial plants, high-value annuals and native vegetation. We are starting to see this more and more with the introduction of precision farming, satellite yield mapping, telemetry for livestock monitoring, remote observation and integrated computing solutions. What is still lacking is access to systematically collected data for many components of Australian agricultural landscapes (Attwood *et al.* 2009). Obtaining data at the farm and landscape scale is crucial for identifying interactions among biophysical factors, such as soil erosion and water quality, and socio-economic factors, such as human health, social wellbeing and income, over the short and the long term. Such information would also provide a bridge between farm-level data and national, regional or global monitoring efforts (Sachs *et al.* 2010).

To make this possible, efforts to access landscape-relevant information need to become routine rather than a 'mission impossible'. 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 combine the wisdom of different agencies and departments. Regional bodies are fulfilling this role as best they can, but it isn't easy. There is an urgent need for 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 cooperation to allow this to happen. Thinking and working together at all scales from paddock to plate are needed, without the old divisions between disciplines and departments. This would greatly facilitate the strategic assessment of land uses and priority areas for productivity versus ecosystem preservation.



## 10. Put the whole package to the test

We can continue to fiddle around the edges, funding feel-good projects but avoiding the hard stuff, or we can get serious and tackle the problem at its core. The truth is there are serious deficiencies and problems with our understanding of the ecology of the rehabilitation process in Australian ecosystems and landscapes. We also have a lot to learn when it comes to social and economic considerations as well. We have barely scratched the surface of what is a complex and interconnected system, with linkages from the farm to the fridge. At present, our approach is *ad hoc*. Although there are farmers out there innovating and improving their systems as best as they can, they do so at considerable risk to themselves. As one farmer put it: 'I'm an innovator – that just means you go broke quicker' (McKenzie 2013).

Surely we can do better at putting our best available solutions to the test? There are over 50 natural resource management regions in Australia. If we can't conduct large-scale trials of possible paddock layouts and land management using these existing regional structures, then we should at least work with the farmers who are doing trials on their own farms. Where good practices already exist in a region, support should be provided to the farmers and organisations responsible to enable them to communicate their experiences and findings, as innovation intermediaries, rather than as free exhibits. Knowledge should be valued, not exploited.

## Conclusion

It is still possible to redesign agriculture in Australia in such a way that it ensures the resilience of the industries, communities, ecosystems and overall landscape function on which it ultimately depends. However, it will take a comprehensive policy agenda engaging a progressive industry, empowered community and new models of governance. We need the vision, leadership and holistic framework to encourage more widespread implementation, innovation and imagination. We have caught glimpses of the future over the last 5 years and much has been achieved, but it has been at too small a scale to tip the balance. Transformational change requires a commitment from everyone in the sector to rethink their approach, to re-envisage the food system (not just the farm), and to re-engage with each other in learning from the landscape itself.

## References

- ABS (2012) *Environment – Land and Biodiversity. 1301.0 – Year Book Australia, 2012*. ABS Canberra, <<http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/1301.0~2012~Main%20Features~Land%20and%20biodiversity~278>>.
- Attwood SJ, Park SE, Maron M, Collard SJ, Robinson D, Reardon-Smith KM, *et al.* (2009) Declining birds in Australian agricultural landscapes may benefit from aspects of the European agri-environmental model. *Biological Conservation* **142**, 1981–1991.
- Bhaskaran S, Polonsky M, Cary J, Fernandez S (2006) Environmentally sustainable food production and marketing: Opportunity or hype? *British Food Journal* **108**, 677–690.
- Blackman A, Rivera J (2010) *The Evidence Base for Environmental and Socioeconomic Impacts of “Sustainable” Certification*. RFF DP 10–17. Resources for the Future, Washington DC.
- DAFF (2013) *Australian Food Statistics 2011–12*. Department of Agriculture, Fisheries and Forestry, Canberra.

- Foster M (2009) *Emerging Animal and Plant Industries-their value to Australia*. Rural Industries Research and Development Corporation, Canberra.
- Ghazoul J, Garcia C, Kushalappa CG (2009) Landscape labelling: a concept for next-generational payment for ecosystem service schemes. *Forest Ecology and Management* 258, 1889–1895.
- Hall A (2006) Public-private sector partnerships in an agricultural system of innovation: concepts and challenges. *International Journal of Technology Management and Sustainable Development* 5, 3–20.
- Hatfield-Dodds S, Binning C, Yvanovich B (2006) *Farmer Finance: Final Evaluation. Volume 1 – Policy Findings. Market Based Instrument Pilot ID46*. Greening Australia/CSIRO, Canberra.
- Hochman Z, Carberry PS, Robertson MJ, Gaydon DS, Bell LW, McIntosh PC (2013) Prospects for ecological intensification of Australian agriculture. *European Journal of Agronomy* 44, 109–123.
- IAASTD (2008) *Agriculture at a Crossroads: Executive Summary of the Synthesis Report*. International Assessment of Agricultural Knowledge, Science and Technology for Development. Island Press, Washington DC.
- Killough S (2009) Partnerships for action research. In: *Farmer First Revisited: Innovation for Agricultural Research and Development*. (Eds I Scoones and J Thompson) pp. 153–157. Practical Action Publishing, Rugby, UK.
- Kingwell R (2011) Managing complexity in modern farming. *The Australian Journal of Agricultural and Resource Economics* 55, 12–34.
- Marshall GR (2008) *Community-based, Regional Delivery of Natural Resource Management: Building System-Wide Capacities to Motivate Voluntary Farmer Adoption of Conservation Practices*. Rural Industries Research and Development Corporation, Canberra.
- McKenzie F (2013) Farmer-driven innovation in New South Wales, Australia. *The Australian Geographer* 44, 81–95.
- McKenzie F (2014) Trajectories of change in rural landscapes: the end of the mixed farm? In: *Rural Change in Australia: Population, Economy, Environment*. (Eds J Connell, R Dufty-Jones) Ashgate Publishing Ltd, Farnham, UK.
- Natural Resources Commission (2007) *A Landscape Approach To Vegetation Management*. NSW Natural Resources Commission, Sydney.
- Sachs J, Remans R, Smukler S, Winowiecki L, Andelman SJ, Cassman KG, *et al.* (2010) Monitoring the world's agriculture. *Nature* 466, 558–560.
- Seabrook L, McAlpine C, Bowen ME (2011) Restore, repair or reinvent: options for sustainable landscapes in a changing climate. *Landscape and Urban Planning* 100, 407–410.
- Wentworth Group (2002) *Blueprint for a Living Continent: a Way Forward from the Wentworth Group of Concerned Scientists*. Wentworth Group of Concerned Scientists, Sydney.
- Williams J (2005) *Sustainable Agriculture in Australia: Some Ways Forward. The Farrer Oration for 2005*. NSW Department of Primary Industries, Orange.
- Williams J (2010) *Can We Secure Our Food Whilst Maintaining Our Environment? Sydney Theatre Company 'Wentworth Talks' Series. 28th June 2010*. Wentworth Group of Concerned Scientists, Sydney.