FRAGILITY, HEALTH AND DESIGN: CONCEPTUAL CHALLENGES FOR AUSTRALIAN AGRICULTURE

Ted Lefroy

CSIRO Sustainable Ecosystems, Private Bag WEMBLEY WA 6014

Abstract

This paper examines three conceptual challenges to the development of agriculture for the Australian environment – the claim that Australia's landscapes are fragile, the question of assessing the health of landscapes and the degree to which agricultural landscapes can be designed. It is suggested that the fragility of Australia's landscapes is a cultural rather than geographical description and reflects unmet human expectations rather than inherent properties of the continent. The usefulness of current approaches to measuring landscape health is questioned, particularly those based on the absence of agriculture such as the one adopted by the National Land and Water Resources Audit. On the question of design, it is suggested that governments and markets will have the ultimate say on the shape of Australian agriculture over science-based approaches to design.

Fragility

The term fragile is frequently encountered in debate on the future of Australian agriculture. This may tell us more about people and their expectations than it does about the environment. In art and literature, the Australian landscape is often depicted as harsh, tough or unforgiving but rarely fragile. Through the eyes of one of Australia's best know artists, *"...Australia confronts us with its muscle and its sinew, its structure is exposed"* (Olsen 2002).

The descriptions of many early explorers and settlers record what they hoped to find, rather than the harsher realities that confronted them (Appleyard and Manford 1979; Seddon and Ravine 1986; Lines 1991). They came, as Berry (1972) said of the settlers in North America, "with vision but not with sight, with the vision of former places but not the sight to see where they were". From an evolutionary perspective, Flannery (1997) describes Europeans as the weedy early colonizers of disturbed ground, the descendents of people who followed the receding ice sheets across Europe onto freshly turned soil and then spread out to treat the ecosystems of the world as if they would respond in a similar way to young, fertile European landscapes. Their antipodean descendants seem to have been complaining ever since that the Australian landscape has let them down.

The accusation of fragility is an attempt to shift responsibility for the problems of agriculture from the subject to the object, from unrealistic expectations and inappropriate technology to the landscape itself. As an excuse for the environmental history of Australian agriculture, fragility is as inappropriate as the defense that victims of human abuse are complicit by virtue of their weakness. The term is a cultural rather than a geographic or biological expression and has no meaning as an absolute property of Australian landscapes. A useful step towards developing well adapted land use systems and a sense of belonging might be to stop comparing this environment to somewhere else.

Health

Related to the issue of fragility is the concept of landscape or ecosystem health. The concept of ecosystem health is a contested one within ecology and follows the application of the ecosystem concept to the management of forests, farmland and natural resources in general (Rapport 1995; Russow 1995). The idea of health applied to landscapes or ecosystems has several shortcomings. When naturalness is used as a surrogate for health there is direct conflict with human activity. When applied to communities rather than individuals, it faces serious contradictions.

The National Land and Water Resources National Audit attempted to measure the health of Australia's landscapes using a set of six criteria - the proportion of remaining native vegetation, the connectivity of that vegetation, the presence of exotic weeds, the presence of feral animals, the area affected by secondary salinity and the number of threatened species (NLWRA 2001). These criteria amount to a measure of the absence of agriculture. In other words, naturalness was adopted as a *de facto* measure of health. What does that say about our self-esteem as a culture if our measure of the health of our agricultural landscapes is the absence of human activity?

The environmental movement and environmental ethics in particular has had a positive influence in shaping environmental policy and management over the last thirty years, but as expressed by Tucker (1982) "*…for all the critical acid it provides in improving our institutions, it is ultimately based on a despairing vision. Left long enough, it degenerates into negativism and misanthropy*". Others have also objected to the extension of ethics to non human species "*.. we seem unlikely to make progress in solving these problems if we hold up to ourselves as the mirror of nature a wilderness we ourselves cannot inhabit. To do so is merely to take to a logical extreme the paradox that was built into wilderness from the beginning: if nature dies because we enter it, then the only way to save nature is to kill ourselves*." (Talbot 1998). A measure of landscape health based on the absence of human activity is clearly misanthropic, and like the accusation of fragility contributes nothing to the task of developing well-adapted agriculture.

A second problem with the concept of health is that it makes little sense when applied to ecosystems or landscapes as the health of some organisms depends on the ill health of others (Brennan 2001). Zeide (2001) suggests growth and yield as measures of ecosystem structure and functioning in forestry as they integrate all ecosystem processes, including those unknown to us. The offsite impact of harvested landscapes makes this insufficient as a sole measure and demands some form of analysis to determine the extent to which yield is supported by the import and export of materials and energy. The question of externalities raises the issue of utility, given that not all offsite impacts of human activity are harmful to the long term existence of humans. This suggests that precise and meaningful definitions of health will only be possible when we acknowledge the distinctions we make every day of our lives between those organisms that are useful to humans, those that are harmful and those that are neutral (Zeide 2001). Agriculture cannot exist without that distinction and without the exclusion of harmful organisms, but such a distinction is close to heresy within deep ecology and environmental ethics, movements that are shaping the current debate on ecosystem health.

Geological age, biological productivity and human activity

The map in Figure 1 shows the gross age of Australia's soils. It shows that while Australia might be one continent, it has two distinct geological histories, with that part to the east of the Great Dividing Range being considerably younger than the other. The nutrient status of Australia's soils in terms of their responsiveness to applied nutrients is illustrated in Figure 1 by the first three levels of shading. The darkest areas indicate soils derived from basalts that had their origin in volcanic activity during the Tertiary, between two million and fifty million years ago. Moving from north to south, these areas of tertiary-derived soils can be seen at Atherton, central Queensland, the Darling Downs, Mount Warning in northern New South Wales, Mount Kaputar in the Liverpool Range, the Hunter valley, the Monaro plains and western Victoria. In recent geological time, the eastern edge of the Australian continent has passed over a very active part of the earth's mantle and the result has been dramatically different prospects for agriculture and population than the rest of the continent.

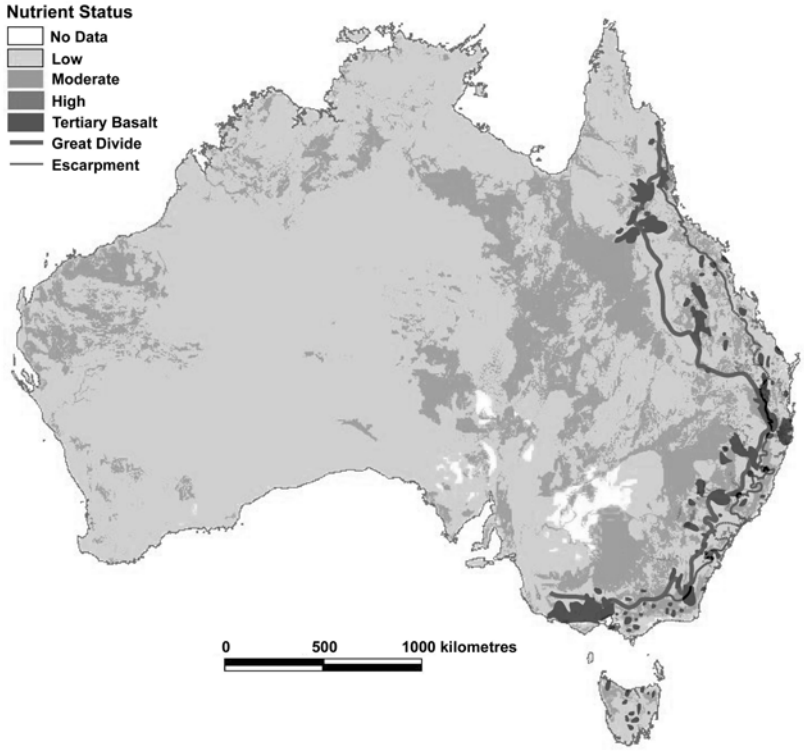

Figure 1 The age of Australia's soils illustrated through the responsiveness of soils to applied macro nutrients (grey shading) and areas of geological activity within the last 100 million years. Source: unpublished data from McKenzie, Jacquier and Gregory, CSIRO Land and Water, 2002.

If we superimpose over that map an image of light pollution as a surrogate measure of human activity, we can see a coincidence between continental age and human population density. The exceptions are interesting. The 1.4 million people living around the Swan River estuary in the south western corner are supported to a greater extent by mining, manufacturing and service industries than by soil fertility through agriculture. Also visible in Figure 2 is the activity on the Northwest Shelf, the Pilbara, Kalgoorlie Goldfields, Broken Hill. The exceptions to the concentration of the population on the geologically younger eastern seaboard are largely mining, some small pockets of agricultural fertility

and in the case of Uluru, tourism, where people come from all over the world come to look at Australia's "… *muscle and its sinew, its structure is exposed"* Olsen (2002).

Figure 2. Light pollution as a surrogate measure of the level of human activity on the Australian continent (http://www.lightpollution.it/download/mondo_ridotto0p25.gif)

Does this amount to saying that geological activity occurring sometime between two million and fifty million years ago determined the physical, social, economic and political nature of Australia? No, but it suggests that it strongly conditioned those features of Australia today.

Australia's geological history has also had a measurable influence on agricultural productivity. Wheat yields are higher on the east coast than the west (Figure 3). However trends in wheat yields in the last 14 years have been more consistent in the west than they have in the east (see the 40-60 kg/ha/yr class in Figure 4). That tells a story about recent gains made by understanding the limitations of infertile sandy soils and adapting to a farming system that, compared to many other parts of the world, approximates hydroponics with water restrictions.

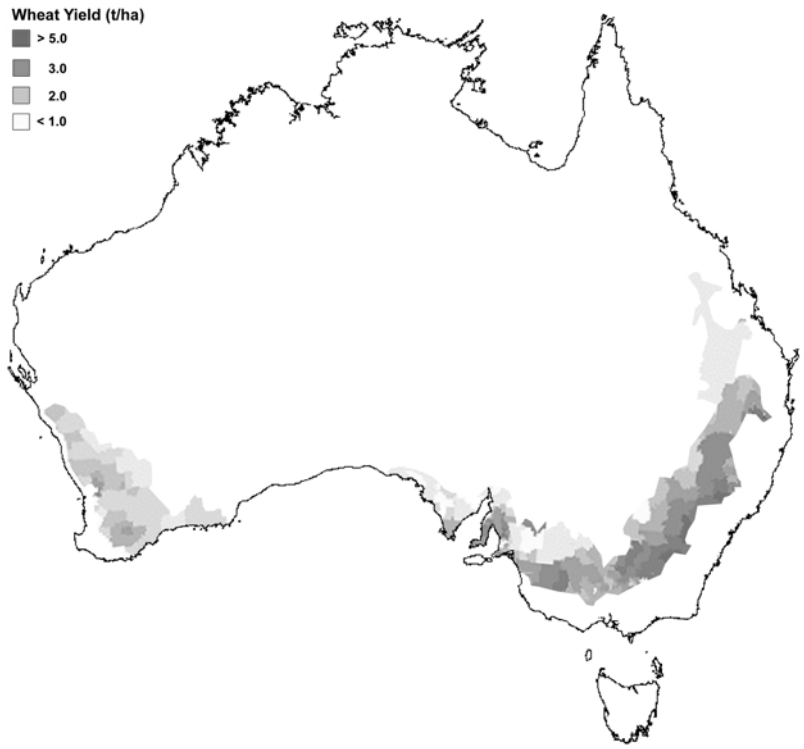

Figure 3. Wheat yield in Australia averaged over the period 1995-2000. Source: NLWRA (2001).

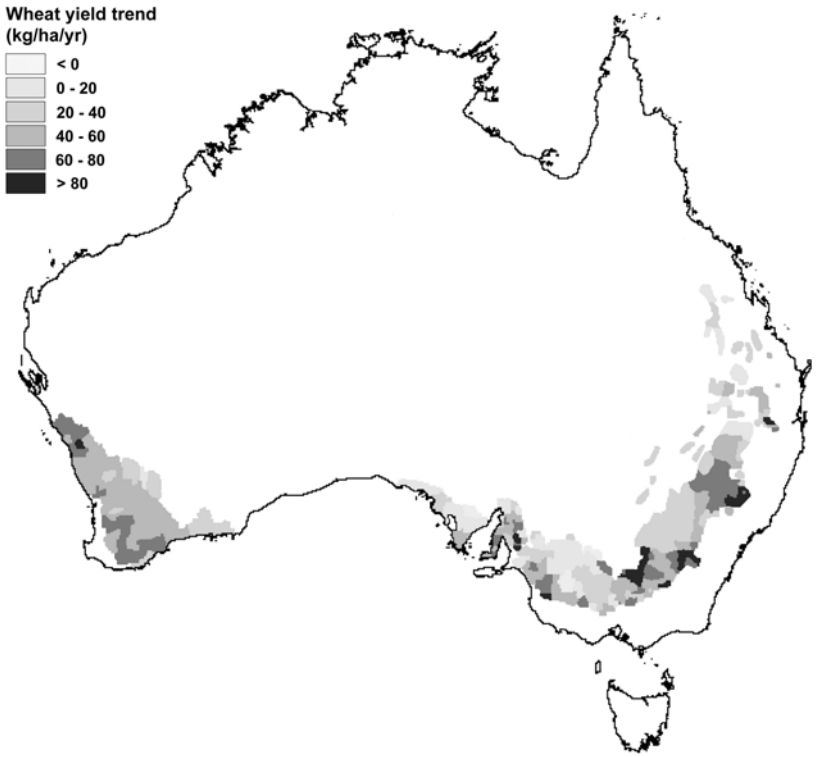

Figure 4. Trend in Australian wheat yields over the period 1995-2000 Source: NLWRA (2001).

If we look at wheat yields in Australia over the last 50 years (Figure 5), the trend line for the first 25 years shows an increase of about 5%. Over the next 25 years the increase is nothing short of dramatic. There are many reasons for this, including the introduction of

herbicides, the introduction of dwarf varieties and improved crop rotations, particularly the introduction of grain legumes and canola.

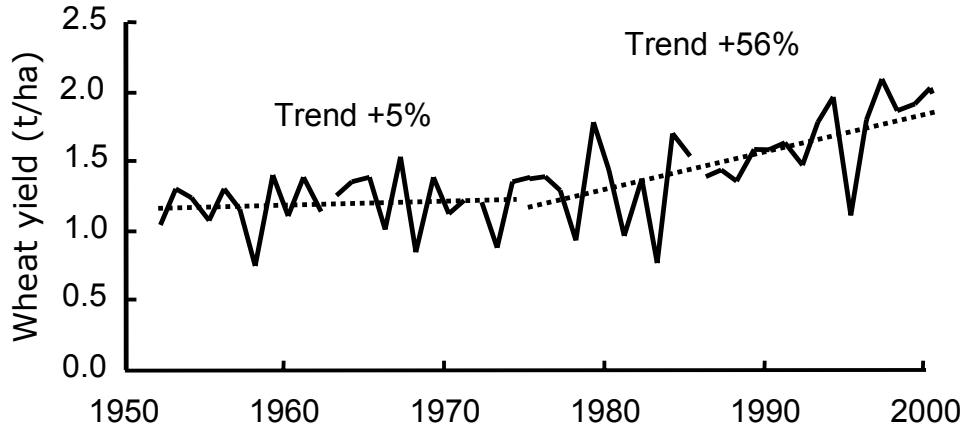

Figure 5. Australian wheat yields 1950-2000. Source: Howden *et al* (1999).

As well as there being two Australias in a physical sense there are also two very different views about Australian agriculture. There is one that sees heroic achievements in adaptation and productivity and there is another that sees this as coming at an unacceptable cost in the form of externalities that don't appear in Figure 5. These externalities include the decline in the quality of natural resources such as land and water, the loss of naturalness at the species, community and landscape levels, and the cost of repairing built infra structure damaged by erosion, flooding and salinity.

In setting aspirational goals for human existence, environmental ethics is increasingly satisfying a need previously met by traditional religion. But it remains in many instances at odds with human interests (Zeide 2001) and the province of the privileged (Tucker 1982; Gibson 2002). The challenge is to develop measures of landscape condition that acknowledge utility as well as naturalness. Utility isn't everything, but to deny it is to invert Maslow's pyramid and deny even the opportunity of a green thought.

Design

The historian Armesto-Fernandez (1998) suggests that all of history is environmental history in that the success of a culture is measured by its success in shaping the environment to suit its needs. In the latter half of the twentieth century, he suggests there was a shift to the recognition that success in the future is going to be determined by a culture's ability to adapt itself to the environment, rather than the reverse.

Interest in re-designing agricultural landscapes (LWA 1998) is not new. In 1950 the Professor of Economic Geography at Princeton, J Russell Smith, published his vision of a re-designed American agriculture *Tree Crops: A Permanent Agriculture*. His thesis was that agriculture started running into problems as soon as people moved out the valley floors and began cultivating the slopes. In the opening chapters he suggests that the few places on Earth where agriculture has persisted sustainably are the valleys of its origins such as the Nile, the Indus and the Euphrates. His solution is what he called two-story agriculture, what is called agroforestry today. The rest of the book is devoted to matching species to regions across continental North America. Little if any of this vision is evident today. A notable Australian agricultural visionary was P A Yeomans with his Keyline farming system (Yeomans 1958). Despite the increasing importance of water management and water use efficiency, and renewed interest in Yeomans during the 1990's through the

Landcare movement, there is little evidence of his influence outside its place of origin in the Kiewa valley in New South Wales. In Western Australia, Parker (1989) and Lefroy *et al* (1992) published conceptual plans for management of the broad flat wheatbelt landscape. The missing ingredients in all four visions were clear commercial drivers. For Smith (1950), Parker (1989) and Lefroy *et al.* (1992), the primary drivers were commercial tree crops that could compete for land with conventional cropping, and in the case of the latter two, the good will of land owners in doing the 'right thing'. In the case of Keyline, the benefits from productivity improvements and increased water harvesting are not sufficiently evident to the outsider.

McCown (2001) suggests that landscapes are not designed or reinvented, but evolve in responses to changes made by governments. The emergence of the Bluegum (*Eucalyptus globulus*) plantation industry in southern Australia is a good example. Environmental fitness and rational planning do not explain the trend in Bluegum plantings in Western Australia over the last decade relative to the other states shown in Figure 6. It was the passing of legislation that allowed separate ownership of trees and land that proved to be the stimulus. Public funds were initially used to prime the pump which eventually became private share farming schemes in which the farmer retains ownership of the land and the plantation company raises the capital to plant and manage the trees through a public prospectus, and pays the land owner an annuity to cover use of the land and a share of the crop. It was therefore a change in property law by government that led to the rapid expansion of this new industry. The landscape that has emerged was not designed by foresters, scientists or landscape planners but is evolving through trial and error as understanding of landscape position, soil suitability, climatic constraints, growth rates and management is refined. The essential difference between design and evolution is that this new land use has been pulled by demand rather than pushed by the logic of rational planning.

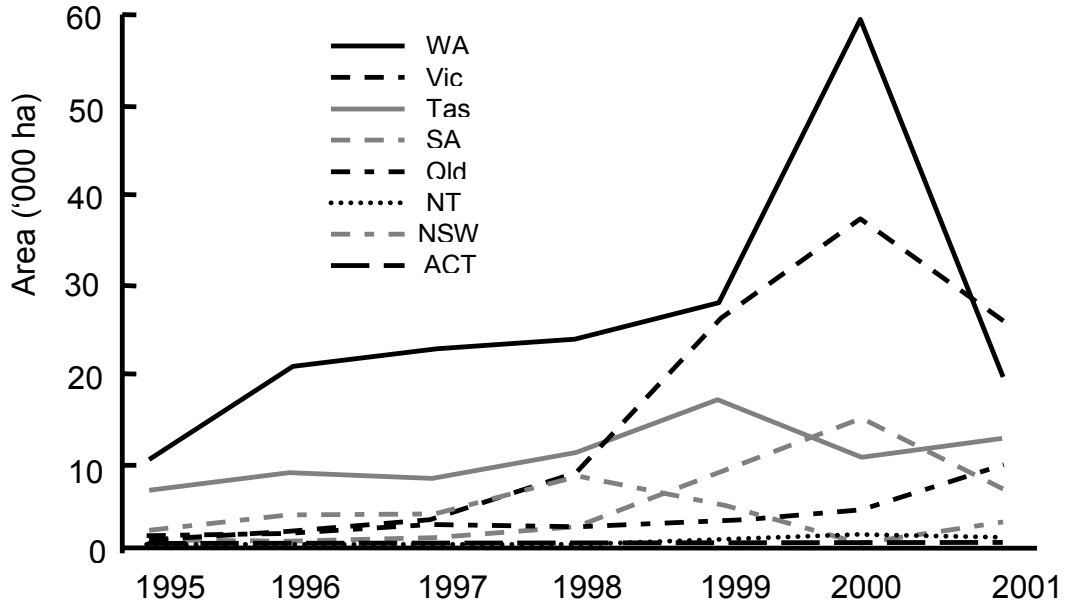

Figure 6. Area planted to hardwood species in Australia each year from 1995 to 2001. Source: Bureau of Rural Sciences (2001).

While governments do undertake a form of design when they regulate land use through statutes and by-laws, their greatest influence in terms of agricultural land use comes in the

form of incentives and disincentives through research and development, tariff protection and regulation.

Conclusion

Australian agriculture faces several major challenges. There is the challenge of reconciling a largely imported technology with the Australian environment, not as we would like that environment to be or how our cultural expectations have lead us to believe it should be, but how it is. There is also a challenge of developing some measure of environmental condition that includes human activity, rather than classing it as an indicator of ill health. And thirdly the evolution of well adapted agricultural systems will require as much emphasis on the development of markets and government policies that foster viable and equitable land use as there is on the application of science to ecologically sound land use.

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