Guiding principles for sustainability

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SUSTAINABILITY means many things to many people. Thus, the challenge is to find a set of guidelines aimed at achieving sustainability that will be relevant to everyone. One set of six guidelines for the integrated management for agricultural production and nature conservation in Australia was developed from the expert knowledge and opinions of farmers and scientists. In effect, the guidelines are practical suggestions which can be translated easily into what farmers and land managers actually do:

1. *Learn to live with this country and its environment* — Most of the problems facing Australian agriculture stem from the attempt to superimpose European-style farming practices on the landscape. This ignores the nature of the Australian environment, with its idiosyncratic rainfall patterns, ancient and nutrient-poor soils, and tremendously variable native vegetation. To achieve true sustainability, we have to learn to farm within the natural system, working with it rather than against it. To do this, we need to understand how the ecosystems present before agricultural development worked and use this knowledge to design agricultural systems which are better able to cope with Australian conditions (Lefroy *et al.* 1999). Tinkering around the edges of current practices will not be enough — we will probably need to radically redesign agricultural systems.

2. *Maintain diversity and keep options open* — The prevailing trend in agriculture has been the simplification of farming systems so that only one or a few species are produced, usually with high subsidy costs in terms of nutrient, energy and pesticide inputs. Extensification, with increasing size of production units, also reduces the overall diversity of the landscape. Current moves to genetically manipulate crops and livestock amplify this trend, with the aim to produce genetically homogeneous organisms. It has been repeatedly argued, and frequently demonstrated, that monocultures and low diversity systems can survive only with high inputs and are inherently susceptible to environmental variability, pests and disease. This can be contrasted with natural ecosystems, where diverse species assemblages occur in complex landscape mosaics. While there has been much debate over whether this natural diversity relates in a meaningful way to ecosystem function, a clear link between diversity and system resilience has been established. Different species perform better under different conditions, or recover better after particular disturbances, and hence the system as a whole may change through time, but nevertheless continue to function.

From an economic perspective, low diversity in the farming enterprise can be a high risk strategy, dependent on a continued and relatively stable market for the selected product. Swings in world markets, free trade agreements and other factors reduce the security of markets for traditional farm products.

All of these observations point to the need for a re-diversification of the farm landscape and enterprise. This means increasing the diversity of crops grown and increasing the diversity of landscape composition and structure. Replacement of perennial species is needed from a hydrological perspective, and can also provide benefits in terms of shelter, pest control and landscape amenity. Part of this diversification may take the form of perennial crops for the production of oils, biofuels and other marketable products. However, the aim should be to use native species where possible, and to avoid solving one problem by creating another, via the introduction of non-native invasive species.

3. *Manage water, energy and nutrient cycles* — The native ecosystems of the agricultural area made good use of most of the rainfall that they received, and the native plants and animals were adapted to the low nutrient status of the soils. Modern agricultural practices have resulted in a very "leaky" system, in which a high proportion of the water arriving in the system is not used effectively, and high levels of nutrient and energy input are required to grow crops. A major aim for sustainable agricultural systems is to plug the leaks by managing the water balance to increase use and decrease water table rise, minimizing external nutrient and energy inputs, and minimizing nutrient losses. The changes needed to achieve this are in parallel with those already discussed, and involve reintroducing diversity into the system and ensuring that nutrients are applied efficiently and taken up before they

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are lost from the system and move into waterways and elsewhere.

4. *Recognize that our environment is one of extremes, and manage within these extremes* — The Australian environment is highly variable, particularly in terms of rainfall, and is characterized by droughts, intense storms and pest outbreaks. Traditionally, these elements have been thought of as periodic inconveniences or disasters, rather than being viewed as a normal part of the system. We need to rethink our perceptions and build recognition of the extremes that are likely to be encountered. This is primarily a process of building resilience into the farming system, so that it is less susceptible to extreme events and conditions. Elements of this include:

   * Prepare for droughts by harvesting and storing water;
   * Prepare for high rainfall storms by building in fail-safe or recovery mechanisms;
   * Prepare for locust plagues and other pests by maintaining diversity and using a range of suitable species; and,
   * Aim for fail-safe and recovery mechanisms (resilience).

5. *Manage according to natural boundaries* — The landscape is made up of variability at numerous scales. Within farms and individual paddocks, soil varies considerably in structure and chemical composition. Farming to soil type can significantly increase yields and efficiency of fertilizer use and uptake. Careful identification of where on farms or within paddocks most of the crop yield comes from can release low productivity areas for other uses, such as revegetation for conservation. At a broader scale, individual farms can be managed within the context of catchment planning to provide benefits in terms of water management and nature conservation. Finally, bioregional planning can act as a basis for setting priorities and guiding local actions. Achieving effective outcomes at all these levels relies on the recognition of natural boundaries and the tailoring of management to each unit recognized within these boundaries.

6. *Aim for social and economic systems which are congruent with achieving these goals* — These guidelines will work only if they are accompanied by a social and economic context which is favourable for the necessary changes to occur. Most of the above guidelines do not provide any new insights — they restate things that we have known for a long time, and yet, they are still rarely applied. A prominent reason for this is that the current economic context does not encourage the type of activities outlined above. A series of economic constraints and perverse incentives lie in the way of sustainable agriculture. The social context of agricultural regions is changing, with declining and ageing rural populations, and reductions in social infrastructure and amenities. Counter to this are the many social groupings arising through Landcare and other initiatives.

REFERENCES

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