The current financial crisis in rural Australia is making it difficult for most farming practices to pay. In this context, farmers can only afford changes which at least maintain short-term profitability. This would seem to preclude changes aimed at improving long-term sustainability.

However, improving sustainability and improving profitability need not be mutually exclusive. There are many refinements which can be made to conventional farming systems which improve profitability, and which are in the better long-term interests of the land. This is not a 'how to' manual of conservation farming—there are other, more technical references specific to particular regions. Throughout the case studies examined thus far and later in this chapter, there are examples of how individuals and groups have made profitable changes to farming practices, such as reducing rangeland stocking rates and improving herd quality, improving perennial pastures and rotational grazing, opportunity cropping on suitable land types and elimination of cropping from unsuitable land types, fine-tuning cropping practices to increase plant water use and crop yields, drainage of waterlogged areas, provision of shelter for stock and crops, and establishment of fodder species to fill autumn feed gaps, allowing higher year-round production. Each of these cases must be appreciated in its own context and the lessons learned interpreted accordingly. General prescriptions are of little value.

Nevertheless, there are some general principles and planning processes which do travel well. In tough times it is even more important to manage resources smarter. Know your land, your enterprise, your farming system, your markets, your industry and, above all, your own strengths and weaknesses. Take time to get in control
of the information most relevant to your business. Be careful to avoid false economies in a rush to cut costs. Good advice is always worth paying for, especially for people under the stress of debt who may be having trouble seeing the wood from the trees. Careful management of financial resources and services, making sure the farm accountant is more than just a tax agent, looking for the best possible re-financing options—these are all common sense strategies at any time, particularly relevant now.

Being prepared to share stress is an important step in dealing with it, which is why groups, whether Landcare groups widening their focus, or farm management discussion groups, have a great deal to offer. Farmers learn most of all from each other, about farm business management as much as any other topic, although it does take a while for mutual trust to develop in a group situation, and skilled facilitation is a big help.

Of course a lot depends on the quality of management. Experienced farmers, agricultural advisers and consultants know well that there is usually quite a gap between the best farmers and the average farmers in a given district, and that the land of poor managers is more likely to be in bad condition than the land of the better and more profitable managers.

But land-conserving practices are as handy as an ashtray on a motorbike unless they are practical, profitable, low risk and reasonably compatible with the farmer's style of farming. It behoves advocates of conservation practices to be aware of the context in which their preferred technology or practice is to be applied, and to be conscious of the limitations (from a farmer's perspective) of measures being advocated.

The following cases illustrate that taking a sustainability perspective does not necessarily mean financial sacrifice. However, when there is no cash available, more emphasis may be put on planning rather than implementation. We begin with a discussion of farm planning processes. There is little to be gained by lamenting the fact that farmers may not be doing much at the moment. We should be focusing on the constraints to land conservation (discussed in Chapter 8) and looking for ways to help farmers to jump off the cost/price squeeze treadmill, rather than just telling them to run a bit faster or give up.

PUTTING IT ALL TOGETHER—THE PLANNING PROCESS

I used to have a farm plan in my head—which was a bloody silly place for it!
Peter Waldron, one of the Potter Farmland Plan demonstration farmers, often uses this line when he is showing visitors around his property, as an introduction to the value of farm planning and of going through an explicit farm planning process.

One of the most significant aspects of Landcare in Australia is the degree to which it is now associated with an emphasis on farm and catchment planning. This association is important for several reasons: Landcare is about more than 'fixing' isolated problems, it concerns the integration of productivity goals with land conservation goals; Landcare is concerned with taking a long-term perspective on the management of natural resources; and Landcare is about 'scaling up' from the individual farm level to tackle problems cooperatively on a district or catchment basis. Each of these challenges demands a planned approach, preferably in a dynamic, ongoing planning process. This planning is one of the most important contributions Landcare is making to help farmers to improve productivity in ways which also enhance the health of their land or, in the arid language of economics, improve income without deprecating natural capital.

It is worth briefly reviewing the evolution of farm planning and its relationship with Landcare.

Farm planning has evolved considerably over the last 40 years in Australian agriculture. It emerged in a formal sense during the 1950s. Soil conservation departments in Victoria and New South Wales introduced farm planning services in 1951 and 1957 respectively. These plans were primarily aimed at soil erosion control and were largely prepared by government staff, using land capability assessment as the basis for plan development. Consequently these early plans focused on physical erosion control works and, to a lesser extent, property layout, water conservation, tillage methods and pasture development.

Also during the 1950s, P.A. Yeomans, a visionary farmer, surveyor and engineer, developed Keyline:

... a set of principles, techniques and systems coordinated into a plan for the development of farm and grazing landscapes ... a master plan for the elaboration of a 'replacement' for the natural or existing landscape. A principal aim of Keyline is to increase both the depth and fertility of the soil so that the soil of farming and grazing land is safe and permanent and capable of continuous improvement ... It includes new cultivation techniques; a method of farm subdivision and layout; planning for
timber and scrub clearing and water conservation and irrigation. All are planned to facilitate or assist in the production of fertile soil.\textsuperscript{131}

Yeomans was ahead of his time in the use of terms such as ‘safe’, ‘permanent’, ‘capable of continuous improvement’, ‘facilitate production of fertile soil’, in attempting to integrate land and water conservation with improved soil fertility, and in recognising the importance of biological activity within soils and the role of remnant vegetation on farms. He also contended that farmers could follow his methods to prepare and implement their own Keyline plans, thus anticipating the critical debate about ownership of the farm planning process by several decades.

Most property planning activity through the 1960s and 1970s was still led by state soil conservation agencies, although farm management consultants began to offer production-oriented planning advice, and plans focusing on surface hydrology became more common in irrigation districts.\textsuperscript{132} Several government agencies broadened their thinking on farm planning from the mid-1980s. The Western Australian Department of Agriculture developed a comprehensive computer-based farm planning package called ‘Landman’, which integrated land management plans with financial management plans and mathematical programming models, to answer ‘what if’ questions to help farmers quickly evaluate the physical and financial impact of any planning decision.\textsuperscript{133} State government agencies in Western Australia, Victoria and Queensland began to develop self-help farm planning courses and resource material in the late 80s.\textsuperscript{134}

The Potter Farmland Plan project ran a series of short courses in whole farm planning starting in 1987, at which groups of farmers, usually from the same district, were guided through the farm planning process together (in their local hall) for half a day per week over six to eight weeks. The interaction between course participants was enlightening. It exposed the benefits of looking with fresh eyes at another’s problems and the willingness of farmers to be more adventurous in their exploration of possibilities for the management of land other than their own.\textsuperscript{135} Similar courses, supported by various farm planning manuals and kits are now operating in most states. Even more common are property planning workshops which are often run by Landcare groups or state agencies in farm sheds or local schools over a day or so.\textsuperscript{136}

Two dominant trends are evident when looking back over this evolution, the first focusing on \textit{what} farm planning means and thus
what a plan consists of, the second concerning who should be involved and at what stages of the planning process. The outcome of these two trends has been a continuous evolution in the how of farm planning. We have seen:

- A move away from 'fixing' land degradation problems towards developing better land management systems.
- Greater emphasis (albeit with a long way to go) on integrating the production enterprise and financial management into the property planning process, rather than confining it to the physical layout of the property. What happens between the fences is as important as fence location. A state of the art property plan of the 90s thus consists of: an assessment and mapping of the status and distribution of natural resources (soils, water, vegetation, topography); classification of the farm into various land units according to land capability and recommended practices; definition of options for production systems on each land type and over the whole farm; longer term schedules for managing risk (eg droughts, floods, fires), vertebrate pests and weeds, nature conservation, water conservation and off-site effects; and finally an integration of all this physical planning into farm business management.\textsuperscript{137}
- A continual shift in the degree of participation in, and ownership of, the planning process, away from public servants and consultants towards land users:
  - Accelerating acceptance of catchment and/or district plans which build on individual property plans, which encompass broader ecological issues (eg remnant vegetation, river management, groundwater systems, wildlife habitat), and which are just starting to recognise, if not integrate, social issues.
  - Increasing emphasis on process (recognising the importance of involvement and ownership) and flexibility of output. The presentation of the plan is less important than the changes which occur inside the planners' heads and those which are subsequently implemented on the ground.
  - Institutions, in particular land conservation agencies and agriculture departments, are learning to respond to requests for planning assistance, rather than designing and running their own planning services according to their own priorities and capacities. Consultants are also getting in on the act, latterly with the added stimulus of regulations requiring an approved property plan to be eligible for deductions under section 75D of the Tax Act.
• The artificial lines between researcher, extension agent and land user are being blurred and in some cases dissolved through the planning process. Property planning is now seen much more as an ongoing learning process than as the production of a ‘flash map of the farm’ which is framed and given pride of place on the office wall (or even worse, rolled up and put away) never to work for its keep again.\textsuperscript{138}

One of the most common activities for Landcare groups is property and catchment planning. Most of the land degradation problems which concern groups cross property boundaries and are thus more suited to catchment-based approaches. Groups are also better able to attract resources from government and private sources to run farm planning short courses and to assist in the preparation of catchment plans. As more groups define their own needs and approach the same task in their own way, the evolution of different approaches to farm and catchment planning has accelerated. Some groups are using computer-based Geographic Information Systems (GIS), others have developed very simple processes based around laser-copied enlarged aerial photographs, and others have made very effective use of private consultants as hunters and gatherers of information and as ‘the voice of the catchment’.

We have already looked at the Kalannie-Goodlands Land Conservation District Committee in Western Australia, and briefly mentioned their catchment planning activities. This process is being coordinated by Viv Read, a former adviser with the Department of Agriculture who is now an independent land management and catchment planning consultant.\textsuperscript{139} We asked Viv to put some thoughts on paper which could go into a box on catchment planning. Viv was concerned about encapsulating such an issue so briefly, but he responded in a way which captures the complexity, the potential, and the still-developing status of group-based property and catchment planning.

Viv touches on a number of issues here, such as the importance of information—who generates it, who stores it and who controls it; the interdependence of ecological and agronomic issues at both farm and catchment scales; the relationship between farmers’ land management and management of land by local and state governments (and the ecological importance of the latter); the influence of the structure and cohesion of the Landcare group on the type of planning it can carry out; the significant technical uncertainties and gaps in knowledge which confront efforts to develop more sustainable (‘ecologically robust’) agricultural systems; and the spirit of
Viv Read on property and catchment planning with Kalannie-Goodlands

We have burgeoning barriers at all levels to the development of an intuitively robust landcare ethic and of ecologically robust land use systems. However, those who have a bona fide responsibility or love for the land are not deterred.

The essence of success with the Kalannie-Goodlands group is a complex formulation. It goes beyond representation by visible demonstration of achievement or an account of technical requirements for land amelioration. Replication of the change that is required is dependent upon a very sound planning framework. For Kalannie-Goodlands, this has yet to be developed.

The achievements of the Kalannie-Goodlands LCDC to date represent the early stages of a fully matured catchment management project. We have aroused and aligned curiosity, created an information dissemination system, made participation better than rugged individuality, developed mechanisms for self-energisation and broken the myths of authoritarianism.

Technically, for project administration, the project has developed specialised roles within the LCD structure for Executive Committee, Committee, Catchment Leaders, Group Coordinator and Community Landcare Technician. The latter role is an initiative of the Department of Agriculture but has been embellished and tailored for the requirements of the Kalannie-Goodlands group. With the inclusion of my roles as land management consultant and project manager, each role is now considered indispensable.

Information administration is fundamental to the psyche of success. At an earlier stage, the group recognised the importance of independence of information. They partially addressed this issue by group contributions towards the commercial development of a locally conducted GIS. This initiative has caused some friction with those who need centralised control but has also opened the window of liberty to those who will most use the infor-
mation. Ownership and management of information remains the most threatening barrier to better land management. Centralised information covers for deficiencies where they occur but at the same time disempowers grassroots thought and action.

The planning achievements for the Kalannie-Goodlands LCD are notable for the geographic enormity of the project. We are now about 70 per cent complete with the preparation of property plans for the 95 farming families who manage the 276,000 hectares of agricultural land. There are no plans for the approximately 24,000 hectares of public land within the LCD! The importance of the individual property plans is in providing the land managers with a format for informed decision making. The plans confront status quo agriculture and also provide the rationale for an alternative. Given this along with a robust information base, the land manager will make confident decisions and take prompt action. Without confrontation and a structured alternative, the outcome is inaction.

There is excess emphasis on the importance of economic rationalisation of property plans. The Kalannie-Goodlands project has not adopted this approach because rational economics oversimplifies the required decision processes. My experience elsewhere has been of farmers telling a rational economist to be seated during a land management planning discussion. Farmers intuitively know the complexity of ecological and social systems, and so see through simplification. They are driven more by understanding than by an economic imperative on land issues. Even impoverished landholders expend disproportionately high effort and dollars on their land when they understand it!

To highlight property planning achievements risks over emphasising individual requirements for a technical fix. Owing also to enhanced graphics and enhanced publicity, the technical focus is on ‘tree planting’ and ‘earthworks’. Full implementation of the statistical requirements of these two management tools may be equated with full implementation of a plan. This overlooks the more fundamental benefit of planning, that being to provide a framework for the development of
agricultural systems. Too much effort has gone towards offering useful but specialised management information to farmers without adequate consideration for its integration within the practical farming system or the environmental landscape. The planning approach provides an excellent opportunity to do just this.

Again, to overemphasise the importance of property plans risks diminishing the importance of catchment-scale planning and management. With the Kalannie–Goodlands LCD, we have only just begun the catchment-scale development of planning. Cumulation of natural resource and hazard information from property planning by hand or computer provides a strong structure for the cooperative decision-making processes that are required for the more fundamental environmental management requirements district-wide. The total information base within a catchment allows participant decision makers to see sense in major changes which may seem senseless when considered in part on individual properties.

In the Kalannie–Goodlands LCD, there has been a refreshing response from landholders, research institutions and extension bureaucracies to the possibilities made available by catchment-scale consideration. Soil infiltration rate research is more meaningful if the extent and distribution of hard-setting soil is known. Cooperative water supply schemes are feasible when potential dam sites are identified and waterways are coordinated. Culverts and floodways can be designed with known catchment parameters. Gravel pit management can be considered when their environmental effect is shown. Pressure for reserve management can be developed when it can be demonstrated that adjoining land is to be actively managed. A joint urban group/LCD botanical survey has biogeographical significance when all remnant vegetation within a catchment is mapped. Control of rabbits appears possible when the distribution of soils they frequent is shown. Minimalised firebreaks become obvious on a catchment-scale plan. Cooperative mallee fowl management becomes desirable when their existence and their habitat can be shown.

Perhaps the greatest benefit of the catchment planning
procedure if allowed to develop fully is exposure of the unknown. We suspect that sub-surface geological structures influence the distribution of salinity but we do not know the extent. We suspect that the lakes within the LCD are major areas of groundwater discharge but we do not know how significant this is to the adjacent agricultural land. We suspect that the variability of land characteristics within one particular land unit is more important than the apparent variation between other land units, but we do not know the extent of variability. For each of these issues, and others, we are formulating the appropriate questions and attempting to attract research attention for relevant answers. Landholder involvement in research formulation is imperative. The Kalannie–Goodlands farmers are still to be attributed full credence for the quality of land management questions asked. The project initiatives for ‘farmer-led’ research are beginning to evolve.

The planning project for the Kalannie–Goodlands LCD has deliberately evaded specialisation and isolated management to ensure the holistic development of integrated land management systems.

Gravel pits are usually managed by local government, according to criteria dominated by road making and maintenance, not land degradation or possible ecological impacts at a landscape scale. In many regions, gravel pits (and rubbish tips which are also managed by municipalities) are often in islands of remnant vegetation called nature reserves. As Dennis Saunders, referring at the Tammin Landcare Expo to an aerial slide of a small ‘nature reserve’ remarked dryly: ‘you can tell immediately it’s a nature reserve because of the prominence of the rubbish tip and the gravel pit!’

† The contrast between the management of the monocultural pastures and crops of agricultural land, and the management of these patches of remnant vegetation has been described by Keith Bradby (quoted in Lefroy et al 1992) as ‘ecological apartheid.’

‡ Western Australian fire prevention regulations insist on ploughed firebreaks around certain areas, but in sandy soils, firebreaks can cause significant erosion problems.
inquiry and learning which pervades the process. We discuss these issues further in Chapters 7 and 9.

To date, the emphasis in most Landcare group planning activities, whether at farm or catchment level, has been on the ecological and agronomic aspects of the planning process—because of the sheer imperative of coming to grips with the causes, extent and possible solutions to land degradation problems. But, notwithstanding Viv Read's comments on the limited perspective of 'rational economics', if plans are to be implemented (in the sense that they become a framework not just for farm improvement, but for everyday management), then the planning process must take into account the personal and business aspirations of the farm family. This is an area in which state agencies and other outsiders working with Landcare groups still need to do a lot of work. One group which has looked at this issue in depth is the Farm Management 500 (FM500) project in south-eastern Australia.

**CASE STUDY**

**FARM MANAGEMENT 500**

From 1986, farm management consultants Neil Clark, from Bendigo in central Victoria, and Tim Hutchings, who farms at Yerong Creek near Wagga Wagga in New South Wales, ran a privately-sponsored project called FarmFacts. FarmFacts involved 80 farmers in twelve groups from Young to Hamilton learning how to use computers for farm business management. After initially slow progress, as the families involved became more familiar with computer use, participants were able to develop business plans and farm monitoring and record-keeping systems, and then to compare their data with others to check their relative strengths and weaknesses. Some comments from group members give an idea of the impact of this project:

*It involves all family members in group discussions and learning, rewards spouses and the younger members with recognition and a sense of achievement, builds up their self esteem and confidence, and allows them to make a greater personal contribution to decision making on the farm.*
The major benefits so far have been access to information, resources and people and in the interaction that takes place at annual conferences and regular group meetings. These groups comprise progressive people who want to learn, stay in farming and get personal and financial satisfaction from their involvement. The interchange of ideas is fantastic and we learn from each other's mistakes as well as successes.

One major benefit of group activity such as FarmFacts and FM500 is that it encourages you to set goals and targets. It gives a great sense of achievement each time they are accomplished. At home on the farm, we tend to become insular and narrow, but being a member of a group helps you to retain the right attitude and boosts your confidence.

The success of FarmFacts and the continued commitment of sponsors prompted Neil and Tim to take the project into a much more ambitious phase, involving 480 farmers in 40 groups from Cootamundra in New South Wales to Apsley near the South Australian border, supported by a diverse group of fifteen consultants and a resource network of industry experts. The new project is called Farm Management 500. It got underway in earnest in 1992, with funding from the Rural Industries Research and Development Corporation, the National Australia Bank, Hoechst Agrivet, PIVOT and National & General Insurance. The aim of FM500 is to increase the viability of both farms and farmers by harnessing the power of group learning among peer groups of farmers, facilitated by experienced consultants. Each group meets for one day, four to six times per year in members' homes, and will combine for ten regional conferences in the first two years of the project.

These small groups take advantage of the diversity of skills and experience within each group, which means that members are learning as much from each other as from the consultant or other outsiders. Furthermore, the involvement of all partners in a family business provides opportunities for improved communication about long-term issues in a constructive setting, enabling people to combat feelings of isolation and frustration. The project is based on the premise
that yield and profit underpin all other farming options, including lifestyle and conservation goals. However, FM500 also emphasises the fundamental importance of human resources in farming. In 1993, a particular focus was on estate planning and retirement issues, to help members to ensure a smooth transition between generations within farm businesses, and to manage resources so that both the people retiring from the farm and those remaining to run it are able to meet their needs.

In many ways Farm Management 500 is anticipating the realities of farming in the 1990s and beyond, in the absence of fundamental reform to the Australian agricultural sector. In a country which exports most of its farm produce, which is a price taker in most commodities and which cannot afford farm subsidies, farm costs will continue to rise, prices received for farm outputs will continue to fall in real terms, seasons will continue to vary, farmers will continue to leave the land, and rural communities will continue to wither.

Apart from selling the land, an option which is usually considered much later than it should be, farmers have two main choices if they wish to remain viable as farmers. The first is to become ever more efficient and better at managing all farm resources—reducing costs, improving yields, improving time management, developing alternative enterprises, producing premium products and marketing them more cleverly, making optimum use of all information sources including professional advisers, and managing financial resources astutely. The second is to seek another income to subsidise the farm. Many younger farmers are already heading down both these tracks. Farm Management 500 is committed to helping its members to be among those Australian farmers who manage to survive by simply farming better. The project is operating on the gloomy but pragmatic assumption that today’s conditions must be accepted as normal; therefore members must adjust and farm to these conditions. From this stance, improved prices are treated as a welcome bonus, not budgeted for as a rightful return and then whinged about when they fail to materialise.

The principles and modus operandi of FM500 are sound and the project will generate very useful insights and real farm data of significant value at a much wider level. The model of private and government sponsorship helping farmers to help themselves has great
potential to be used more widely. An extrapolation of the assumptions underpinning this project sees the best farmers surviving by continual fine-tuning of their operations, and efficiencies gained through expansion as they buy the farms of people squeezed out of agriculture. The squeezing process is likely to accelerate with declining prices for agricultural land, particularly away from the coast, during the 90s.

Of course there will be fluctuations, chimeras of hope regarding real increases in world prices, particularly if North America and the European Community manage to reform their agricultural subsidies so as not to distort world markets. Such intervals will bring bursts of increased prosperity for those Australian farmers (like FM500 members) in a position to capitalise on these circumstances. In the long term, most forecasters predict a brighter outlook for Australian agriculture, based on growth in global consumption of agricultural products and an assumed limited capacity of other agricultural exporters to respond to increased demands.

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**A word about 'efficiency'**

Throughout official documents and the rhetoric of politicians, agribureaucrats and captains of agri-industry, the word 'efficiency' is used freely, but rarely defined. Efficient agricultural systems in industrialised countries are thought to be those which produce food at least cost. When viewed through the eyes of an ecologist, a sociologist, or consumers of food, air, water or rural landscapes, this notion of efficiency looks increasingly suspect. It leads to increasing specialisation, monocultures, larger scale, intensification of production, and externalising as many costs (eg environmental and social costs) as possible. If the costs to society of species extinctions, degradation of soil, air, water and vegetation, homogenisation of rural landscapes, withering of rural villages and increased social stress were fully accounted for, the balance sheet of so-called 'efficient modern farming methods' looks sick indeed and, even by the same narrow economic criteria, inefficient.

Tracey Clunies-Ross and Nicholas Hildyard sum up the
myth of economic efficiency as it applies to subsidised EC and US agriculture in their book *The Politics of Industrial Agriculture*:

*In the case of small- and medium-sized farms, versus big farms, the economics of production have become hopelessly skewed by subsidies. In economic theory, farmers produce for a market, and compete with each other to supply that market: the most efficient thrive. In Europe and in the US, taxpayer subsidies are linked to the volume of output: the biggest and most intensive farmers pick up the lion's share of the subsidies, and they thrive. This should not be interpreted as economic efficiency. In fact, in the current situation, where the EC for instance produces grain, the larger the volume of grain a farm produces, the more it costs the EC in storage and export subsidies. Taken to its logical absurdity (which it now has been) it becomes cheaper to pay farmers to produce nothing (set-aside) than to buy their grain. Within this economic framework, small, less intensive farmers should be seen as being more efficient as they produce fewer unwanted surpluses. In effect, it is almost impossible to tell who is producing most efficiently. Past subsidies for fuel, for drainage, for irrigation, for research into high input/high output agriculture, not to mention current subsidies, produce a completely distorted picture. All that can be said with any certainty is that current policies continue to favour large, intensive farmers.*

But in the meantime, the attrition within Australian agriculture seems likely to be grim. The question about what happens to those farmers (the majority in number), who are not able for various reasons to go the FM500 route, remains. This is not merely an economic question of rural 'adjustment'. It has profound environmental and social implications. The desperate fight for farm survival is usually reflected in greater pressure on the land, magnified by the extreme variability of the Australian climate. So-
social depression in a literal sense and the wasting of country towns accompanies the flight of farmers from their land. The social dimensions of the rural crisis were hinted at in the introduction. But it must be recognised that symptoms of social decline such as suicides, health problems, violence, drug abuse and low levels of education are likely to get dramatically worse after the next spurt of farm foreclosures, in a vicious circle of greater and greater stresses on fewer and fewer people. As these are the people managing the land on behalf of the rest of society, we must find better ways of taking these social issues into account than merely offering counselling services and financial assistance ‘to leave the land with dignity’.

We will discuss these wider issues and where Landcare fits in later, as we have drifted away from farm planning. The farm business planning advocated by FM500 complements the more ecological catchment-scale approach of Viv Read, described in the box on pages 150 and 151. Ideally the two should happen concurrently, so that farmers’ thoughts on management options are challenged by their increasing ecological literacy, and by social imperatives in their family and the community.

Central to the FM500 project is the development and implementation of a five-year business plan by each of the families involved. Nigel McGuckian and Mike Stephens (two of the project consultants) have produced an instructional guide and a workbook to help people with farm business planning, which they define as ‘a process of thinking about how you want the farm to develop, and how you will provide the resources to achieve that development’. The FM500 team suggest that a good planning process must challenge farmers to be critical about their performance, recognise the rapidly changing environment in which farming operates, while setting realistic and achievable goals. Climate, commodity prices and input prices may be out of the individual farmer’s control, but it is usually possible through good planning to buffer the effect of drought or fire, reduce vulnerability to price changes, and improve productivity.

The FM500 planning process has ten main subject areas: farm resources, family, finance, productivity, management, marketing, personal development, lifestyle, retirement and estate planning. The planning process in each of these areas
has several components: a situation analysis—where are we now; a strategic audit—the business we are in and its strengths, weaknesses, opportunities and threats; business objectives—where are we heading; relevant strategies—how do we get from here to there; implementation—who does what, when and how; and monitoring—measuring progress and adjusting to changing circumstances.

There are several advantages for farmers who seriously commit themselves to such a planning process:

• It encourages farmers to take time out, to stand back and look critically at what they do, and look ahead a few years or even a generation. This point was made in more colourful language by a farmer at a farm planning workshop: ‘when you are up to your arse in alligators, it is hard to concentrate on draining the swamp!’

• It makes keeping good physical and financial records a must.

• The advantages and disadvantages of moving in various directions (eg expansion, changing enterprise, business as usual, or selling out) can be tested, or at least thought through in a systematic way, before any money is spent or irreversible moves made.

• Business opportunities and threats should emerge, enabling quick responses and thus better timing of decisions.

• Farmers with a good business plan are at a competitive advantage in dealing with financial institutions, agribusiness firms and advisers of all sorts.

Given the pedigree of FM500, it is hardly surprising that more than 60 per cent of members now use computers for managing information, a proportion which is still growing. From an initial focus on farm financial management, the tendency is for farmers to graduate to using paddock management programs and spreadsheets for recording many types of production data.

Various state and private farm planning projects, including those mentioned here, have led to growing recognition of the ecological value and business sense of informing land management with an appreciation of the opportunities and constraints imposed by natu-
nal resources, in a systematic planning process. This recognition culminated in the development of a national property planning initiative, announced by Primary Industries and Energy Minister Simon Crean in August 1992.147

**FENCING**

What do the following land conservation measures have in common?

- protecting an eroding gully, remnant vegetation, or a stream from grazing animals;
- reducing stocking rates on a scalded area, or a patch of range-land in which natural regeneration is desired;
- establishing salt-tolerant fodder shrubs on low-lying, salty, waterlogged areas;
- subdividing farmland according to natural land management units (defined by soil type, slope, aspect, drainage, vegetation) to enable each land unit to be managed according to its potential and its limitations;
- establishing trees, whether for salinity control, shade and shelter, wildlife habitat, wood or aesthetics.

The answer is fencing. In each of these activities, fencing is usually essential, it usually demands a large proportion of the cost of a given project, and its effectiveness is crucial to the effectiveness of the project as a whole.148 A vast quantity of fencing is required both for the rehabilitation of degraded areas and for the implementation of more sustainable systems of land use and management.

We have calculated elsewhere that the establishment of one billion trees, as intended under the federal government’s One Billion Trees Program (OBT), involves at least one million kilometres of fencing. The billion trees (and the million kilometres of fencing) is only a symbolic start. Furthermore, if we consider the fencing involved in protecting the Murray–Darling river system, including major tributaries, from eutrophication and consequent blue-green algae blooms, using the simple vegetative filters described in the Peel–Harvey case study earlier, then the amount of fencing required is much higher again. As fencing costs (including labour) range from less than $750 per kilometre for very efficient electric fences to $3000 or more per kilometre for the more common pre-
fabricated or plain wire conventional fences, a round figure of two billion dollars, for the OBT fencing alone, is reasonable.\textsuperscript{149}

Fencing is an area where farmers seem most reluctant to change, where ‘Grandad’s way’ is still often the rule. With the exception of electric fencing and the development of high tensile wire, fence technology has not changed significantly this century. Government institutions have tended to stay away from fencing research and extension, which has been dominated by suppliers of conventional fencing, in whose interest it is to sell the maximum amount of fencing material. One noteworthy beacon in fencing extension is the innovative maverick fencing consultant, Bob Piesse, who generates more original ideas in a day than most of us do in our lives. Bob has made a tremendous contribution to the development of more efficient fence designs, and consequently to land conservation, over the last 50 years.

When one is aware of, and comfortable with, more efficient fence designs, it is easy to be amazed at the money wasted on inefficient fencing. The most common inefficiencies include having far too many posts, droppers and wires; and inadequate strainer assemblies, costing hundreds of dollars more per kilometre than is necessary. The same farmers would probably drive a hard bargain to save $50 on other products at their local rural merchandiser.

Electric fencing technology has improved out of sight in the last fifteen years. Even in Tasmania and New Zealand, solar-powered, one- and two-wire fences have successfully controlled goats and cross-bred sheep for years. A well-planned, well-earthed, well-insulated and well-constructed electric fence will almost always be the most effective and efficient option. \textit{Planning for Sustainable Farming}\textsuperscript{150} discusses and illustrates a range of electric and conventional fence options for revegetation and other land conservation projects. Electric fencing manufacturers such as Gallagher Australia provide information on specific products, as well as general information on design and construction of electric fences, and have been active in recent years at Landcare group field days and as sponsors of landcare activities.

Even with non-electric fences there are tremendous opportunities to put up effective fences which do not cost an arm and a leg (and heaps of steel and timber). Most people do not realise that, if strainers are up to scratch, and high tensile wire is kept at the right tension, the only reason for posts is to keep the wires off the ground and evenly spaced. A three inch (75 mm) post or a dropper will do that just as well as a six inch
(150 mm) post, and only in really rough country are posts needed more than every 50 metres.

Fencing is a major component of land conservation activity, and fencing costs are one of the biggest hurdles to achieving more practical works on the ground. But it is possible, even in tough times, to do land conservation works which do not cost a fortune, and there are Landcare groups tackling this problem with ingenuity and resourcefulness.

The following example from the Neridup Landcare group illustrates how Landcare groups can share useful practical knowledge, in this case the knowledge of just how much the design of fencing influences its cost and consequently the cost of land conservation projects. The group held a workshop to discuss different fencing options, at which group members presented their preferred fence design, with costings. According to Marg Agnew, this generated an extremely lively discussion on a topic guaranteed to spark interest at most Landcare group meetings.

Some of the systems proposed are outlined in Table 6.1.

Roughly $10 per kilometre should be added to the cost of the electric options to allow for the cost of a mains-powered energiser ($30 per kilometre for a solar energiser). Although farmers rarely cost their labour, it would be reasonable to double these figures to approximate the actual cost of a constructed fence. Furthermore, any gates, bends or corners (extremely common in land conservation work) require additional end assemblies and greater expense, particularly in conventional fencing.

The Harrowgate Landcare group near the Mt Lofty Ranges in South Australia recognised this point, by following the example of the Potter Farmland Plan demonstration farms in constructing curved electric fences around one of their demonstration sites which involves revegetating a saline discharge area.

The West Hume Landcare Group in the Riverina district of New South Wales has been able to protect shelterbelts with two or three electric wires, using Insultimber posts and droppers, at a cost of about $630 per kilometre plus end assemblies. Sue Rose, coordinator of the West Hume group, notes that stock which are not used to electric fences may require a four- or five-wire fence, and that it is particularly important to use earth-return wires in dry conditions. Considerable savings can be made when stock are accustomed to electric fences, which can be achieved with the use of impregnable electrified training yards for off-shears sheep, weaned lambs and calves, and newly purchased stock. Information and advice on electric
Table 6.1 Materials cost for one kilometre of straight fence with two end assemblies

<table>
<thead>
<tr>
<th>System 1</th>
<th>System 2</th>
<th>System 3</th>
<th>System 4</th>
<th>System 5</th>
<th>System 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>Conventional</td>
<td>Conventional</td>
<td>Electric</td>
<td>Electric</td>
<td>Electric</td>
</tr>
<tr>
<td>6:70:30 ringlock</td>
<td>6:70:45 ringlock</td>
<td>5:70:30 ringlock</td>
<td>4 plain wires,</td>
<td>4 plain wires,</td>
<td>4 plain wires,</td>
</tr>
<tr>
<td>+ 1 barb</td>
<td></td>
<td>+ 1 barb</td>
<td>clips &amp; insulators</td>
<td>clips &amp; insulators</td>
<td>clips &amp; insulators</td>
</tr>
<tr>
<td>treated pine posts</td>
<td>1.5 m steel posts</td>
<td>1.65 m gal posts</td>
<td>mallet posts @</td>
<td>1.65 m steel posts</td>
<td></td>
</tr>
<tr>
<td>@ 15 m</td>
<td>@ 14 m</td>
<td>@ 11 m</td>
<td>40 m, 3 droppers</td>
<td>@ 50 m, 3 black</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>between</td>
<td>poly droppers</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>between</td>
<td></td>
</tr>
<tr>
<td>box assembly</td>
<td>125 mm mallet</td>
<td>200 mm strainers,</td>
<td>box assembly</td>
<td>200 mm strainers</td>
<td></td>
</tr>
<tr>
<td>strainers</td>
<td>strainers</td>
<td>pipe stays,</td>
<td>strainers</td>
<td>cemented in</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>cemented</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$1200</td>
<td>$822</td>
<td>$1285</td>
<td>$624</td>
<td>$490</td>
<td>$489</td>
</tr>
</tbody>
</table>

Source: Neridup Landcare Group
fence design and components can be obtained from manufacturers such as Gallagher Australia, who have been very active in sponsoring Landcare group field days and demonstration sites.

The limitations of conventional fence designs have proscribed farmers' options in terms of the use of different land units and layout of farms. In the words of Ron Watkins, a leading conservation farmer from Western Australia, Australian agriculture has been 'square farming in a round world', operating on rectilinear grids in a landscape and topography which is anything but linear. The reasons for the chequerboard layout of farms and farming landscapes are largely historical: ease of surveying on a grid and calculating allotment sizes when land was initially subdivided; the cost of fencing; and also the design of conventional (non-electric) fencing, which relies on very tight wires, most easily achieved on straight sections of fence. But as the Harrowgate Landcare Group demonstration site shows, fences need no longer be rigorously straight, and fencing to the lie of the land is now much more realistic with modern electric fencing, careful design and installation, and some education of stock.

The following sections highlight some landcare options and some farm families which show in a practical way how landcare and improved productivity can be complementary, rather than competitive, goals. This is only a tiny sample. There are thousands of farm families involved in similar efforts (but using very different methods) on their land in an incredible diversity of circumstances. We were reluctant to single out any individuals, but it is useful to look at what can be achieved, through some real examples. Readers of this section should be careful not to fall into the easy tendency to think that landcare means planting trees, or planning the physical layout of farms and catchments, or building cheap fences, or particular cropping practices, though any or all of these could be part of landcare projects. Landcare should not be identified with any particular farming methods, but rather with attempts to develop and implement farming systems which are compatible with the long-term health of the land, whether in the wet/dry tropics of the Top End, the ancient dunes of the Eyre Peninsula or the cold, dry Tasmanian Midlands. Of course the farming methods in these regions are completely different, but in each case there remain practices which are much more sustainable than others. Landcare is about integrating the best available knowledge to improve the sustainability of farming systems and applying it in a cooperative way at a catchment or district level.
CASE STUDY

‘JANGARRI’

Jan and Garry English have transformed a ‘run-down block’ into a more ecologically sustainable enterprise since the late 1970s. They have increased animal performance as well as increasing stock numbers, improved paddock management, introduced agroforestry, and turned problem areas into assets. One of the basic tenets of their property management strategy is not to use every square metre for production. All decisions are based on being able to survive the harshest of conditions. Their feats were recognised in 1990 by their win in the primary producers category at the Australian Landcare Awards.

‘Jangarri’ covers 1534 hectares and lies 30 kilometres due north of Esperance, on the south coast of Western Australia. The property was released as virgin land (covered by coastal mallee scrub, Banksia and an extraordinary diversity of understorey species) in 1960. The soil is basically sand underlain by clay. It receives about 450 mm (eighteen inches) of rainfall per year, of which one-third falls outside the winter growing season.

Jan and Garry English purchased their first thousand hectares of the present block in 1976. The land had been overcleared and remaining native vegetation was in a poor state. The cleared area of 440 hectares carried only 1600 sheep with difficulty because of poor pastures and insufficient dam water. Wool cuts averaged 4.6 kilograms per head and lambing percentages were low—only 58 per cent marked and 44 per cent weaned, largely owing to worms and ill thrift throughout the flock. Wheat yields were 1.17 tonnes per hectare and barley yielded less than half a tonne per hectare. Wind erosion was a problem. There was little bird life and earthworms were rare in the garden and paddocks. ‘The remnants of paperbark swamps were becoming bare salt scalds with skeletons of trees ring-barked by sheep. Fencing was on the grid with large paddocks and few watering points.’

In 1981, the English family purchased the adjoining block of 484 hectares, making the present total of 1534 hectares, of which 1034 hectares are used for conventional farming, leav-
ing 500 hectares of saline watercourses, swamps and remnant vegetation.

Jan and Garry laughingly reflect:

*The beginning of the farm plan was a small aerial photo and paddock layout drawn on the back of a 'Weeties' packet in 1977. Climatic events had a big bearing on the planning in the early years and it became obvious that re-fencing to soil type and degradation hazard was necessary to improve the yields in crops and allow more efficient grazing of pasture.*

Heavy rains in 1979 caused waterlogging and ponding problems. As a consequence, 'V' and 'W' drains were installed at a low cost using a plough. The watertable has been rising in recent years, with salinity readings greater than 3000 micro-siemens per metre as shallow as one metre below the surface. To tackle this problem, which threatens the long-term viability of the property, Jan and Garry have sown strategic strips of country to lucerne to draw down the watertable and provide useful fodder. Belts of mixed tree species have been planted for water control and as windbreaks. An eight hectare recharge area has been sown to Tagasaste and *Acacia saligna*. According to Garry: ‘Many of the local native trees are too efficient with water use and hence not very good for water control on their own. Because crops do not use much water, their future on the property is under close review. Although we have developed the property using ecological principles, there seems to be little draw-down of the watertable. More trees appears the only long-term solution.’

A major goal throughout the property planning process has been to reduce the effects of wind erosion, which wrought havoc in 1981, with major losses in stock and newborn lambs, as well as topsoil from paddocks under crop and pasture. Jan and Garry introduced minimal tillage, stubble retention and extensive tree planting. Non-wetting soils have affected the establishment of annual pastures. A mixture of veldt grass, perennial rye, lucerne, fescue, consol and phalaris has been used with some success. It also required a change to rotational grazing to maintain stable pastures. Jan and Garry have decided over the fifteen years of developing their property that pasture production is the most sustainable enterprise and only
limited cropping will be continued. A mixture of clovers with annual Ryegrass has been selected and superphosphate is applied at 20 kilograms for each Dry Sheep Equivalent carrying capacity (ie 200 kilograms per hectare with ten sheep per hectare). After experiments in 1988, 1989 and 1990, the English’s found that by using small paddocks, stocking rates could be increased a further 50 per cent on the better soil types.

Several strategies are used to maintain stocking rates through the autumn feed gap. For example, making silage from the spring flush in pasture growth; rotationally grazing perennial pastures; lot feeding weaners and so on. Salt scalds have been drained and sown to Puccinellia and Tall Wheat Grass to regain some productivity, reduce erosion and use water. Some scalds have been oversown with saltbush and wattles to take up more groundwater.

An agroforestry project was commenced in 1984 on 160 hectares to produce timber and crops and reduce erosion and waterlogging. *Pinus radiata* was chosen and triple rows were planted at a cost of $60 per thousand seedlings and ten days work in preparation, planting, fertilising and insect control. Crop yields (lupins, wheat, oats) have increased; tree survival has been 98 per cent; wind erosion has been controlled; and there has been a marked draw-down in the watertable under the tree belts.\(^{132}\) Since 1976, trees have been planted for landscape improvement, for bird life, as windbreaks and for watertable control. Jan and Garry believe in multiple use plantings wherever possible. Most of the early plantings were done using seedlings, but with costs rising they have tried direct seeding methods using seed collected on the property.

Careful management of 500 hectares of naturally saline watercourses and lakes allows some production for short periods of the year. The biggest benefit according to Jan and Garry is the ecological value of conserving habitat for flora and fauna. The English family have created an eight hectare arboretum on a formerly cleared island, establishing trees by seedlings and by direct seeding, with some hope of future timber production. Old paperbark swamps have been fenced and planted with salt-tolerant trees. ‘Each year the number of birds found on the farm is increasing due, in part, to creating the conservation refuge. On country unsuitable for agriculture, permanent native vegetation has been left. Protection of the diverse flora, which is unique to this part of Australia, is our high priority.’
Banksia speciosa, a spectacular member of the Proteaceae family, occurs on the deep white sands on the property. After a feasibility study, cuttings have been harvested to supply the cut-flower market, which is now a valuable and sustainable contribution to farm income.

In summary, the main features contributing to the development of this relatively sustainable enterprise have been:

- The farm plan is continually modified and updated—it is a working document.
- The farm is fenced according to soil type and topography with all lands seen as having a use.
- The farmed area has been reduced from 1050 to 850 hectares, yet overall stock numbers, productivity and profitability have increased.
- Problem areas have been turned into assets, such as the wildflower producing areas, natural drainage features and conservation areas.
- Tree planting has formed a significant part of the management for crop and pasture protection, reducing water-tables, improving aesthetics, attracting bird life and possibly providing future timber production.
- The works carried out in implementing the plan are integrated into farm business management, not regarded as an add-on.

According to Jan and Garry: ‘We have achieved this so far by just doing a bit of planning and one project each year.’

This work has been successfully done by Jan and Garry with the help of their three children, and despite the fact that they have hosted literally thousands of hours of farm visits. They do not want to charge people to inspect this work because they consider that talking to anyone about landcare is actually gaining allies in the long run.

CASE STUDY

‘BONNEYS PLAINS’

The Fingal Valley is a beautiful stretch of country, east of the Tasmanian Midlands. Biz and Lindsay Nicholson’s 2310 hectare property ‘Bonneys Plains’ is in the heart of the valley. Biz
Making Landcare pay

and Lindsay took over management of the property in 1988. They base their farm management on a whole farm approach and a philosophy of ‘working with nature, not against it’. This has paid dividends through increased productivity and capital value of the property, and farm management changes which the Nicholsons believe are more sustainable over the long term, ensuring that the condition of the farm will improve as a result of their stewardship.

Soon after assuming control of the property, Biz and Lindsay participated in a Whole Farm Planning course run by the Burnie TAFE college, which led them to devise a physical property plan and a financial plan in line with their overall farm management and lifestyle goals. The property plan led to a reorganisation of paddock layout, reduced paddock sizes to improve stock and pasture management and to farm on the contour as much as possible, and planned rotations for each paddock. The physical plan has extended emphasis on using electric fences and stock laneways, larger plantations and more efficient livestock handling facilities. They have since attended a four day Grazing Cell course which gave them a better understanding of pasture ecology and efficient grazing management—knowledge which will hopefully be translated into better productivity from both native and improved pastures.

The Nicholsons have also fenced off streams and remnant vegetation, increased water storage, established shelterbelts and wildlife corridors, maintained tussocks and sedges for shelter, changed to direct drilling of pasture to maintain soil structure and prevent erosion, and installed shallow surface drains to remove excess surface water and prevent waterlogging. All revegetation work has relied on a mixture of about twenty local species of trees and shrubs propagated and grown in the ‘Bonneys Plains’ nursery.

Biz and Lindsay run a mixed enterprise, producing wool (from about 4500 Spanish Merinos), 130 beef cattle, goats for fibre production and weed control, barley, oats, triticale and dryland lucerne. Their overall stocking rate is low because of the proportion of uncleared bush, which has a carrying capacity of less than ten per cent of improved pastures. Monitoring all aspects of this business has been crucial to its success. Thorough paddock records of the condition of soil, water and pastures, and all inputs and outputs are compiled to
complement farm financial management. According to Biz and Lindsay: 'The key to the success of our whole farm plan is flexibility within the implementation timetable, with the ability to incorporate planting, natural regeneration and land capability projects in each year, in line with the farm budget.' Some ecological indicators are already promising. Fish and platypus are returning to Buffalo Brook as a result of fencing it on both sides, creating a 23 hectare reserve for five kilometres along the stream. Natural regeneration of native species is healing the once severe erosion of the streambank. Another 22 hectares of remnant bush has been fenced from stock to provide wildlife habitat and a seedbank for a great diversity of local species. This patch may provide occasional emergency shelter for newly shorn sheep or lambing ewes. Hollow trees, fallen branches and litter are all left undisturbed to provide habitat for birds, marsupials, echidnas, amphibians, lizards and insects. Trees and shrubs seem healthier as a result of not being grazed or subject to soil compaction by livestock. According to Lindsay: 'The species in this patch range from orchids to eucalypts, and are maintained for our enjoyment and for future generations.' Overall, the changes in farm management are directed to reducing erosion, maintaining and increasing populations of native plants and animals, increasing agricultural efficiency and productivity, and improving the quality of life for the whole family.

CASE STUDY

'PARADISE'

Dean and Sherren Melvin and Dean's brother Craig jointly farm 'Paradise Farm' and 'Clover Downs', near Dowerin about three hours east-north-east of Perth, in 350 mm rainfall wheat country, similar to the Kalannie–Goodlands landscape described earlier. But 'Paradise' is anything but a typical wheat–sheep operation.153 'Paradise' is a 508 hectare mosaic of sandplain soils, and Clover Downs is 1255 hectares consisting of ten per cent York Gum/Salmon Gum country, 30 per cent Tamma country and
The natural vegetation prior to European settlement on the sandplain soils was mallee (multi-stemmed eucalyptus spp), heath dominated by three families—Myrtaceae (melaleuca, leptospermum, calothamnus, eucalyptus), Leguminosae (acacia) and Proteaceae (banksia, xylomelum, hakea), and small patches of York Gum (Eucalyptus loxophleba) woodland. The land type referred to as Tamma consists of gravelly sands over laterite with a neutral to acid pH, formerly covered with Tamma (Allocasuarina spp). The land known as York Gum/Salmon Gum country consists of brown sandy loams and red brown loams, neutral to alkaline, formerly covered with a woodland of E. loxophleba and E. salmonophloia.

So, of the total 1760 hectares, there are 125 hectares of red-brown earth, 375 hectares of lateritic podsolic and 1260 hectares of earthy sands. The main income sources are two-thirds from cropping (920 hectares wheat, lupins and cereal rye) and one-third from sheep (840 hectares pasture). The conventional farming system for the wheatbelt is based on a rotation of wheat- and legume-based annual pastures on heavier soils, and wheat and lupins on lighter sandy soils. Sheep graze annual pastures, which are supplemented by stubbles after crops are harvested, providing an extra source of income. Lupins and annual pasture legumes provide a disease break and a nitrogen boost for subsequent crops.

The conventional farming system really struggles on the poorer sandplain soils. Wheat and lupin yields average 0.8 tonnes per hectare, compared with 2.3 tonnes per hectare and 1.2 tonnes per hectare respectively over the rest of the farm. The carrying capacity of these soils for grazing is about 2.5 sheep per hectare. Given rising input costs and low prices for wheat and wool, the profitability of the conventional system on sandplain soils is marginal at best (in Dean’s words ‘a fast way to lose money’). Environmentally, conventional cropping of sandplain soils is extremely dubious.

The conventional system, after crops are harvested, leaves the topsoil exposed in the period from February to June. This is when it is most vulnerable to soil loss through wind and water erosion from high intensity summer storms, and storms which accompany the first of the winter rains, often removing 20 to 30 tonnes per hectare of fines from the topsoil. The fines, or dust fraction, of topsoils in the wheatbelt typically
contain most of the nutrients and trace elements. In one wind erosion event in March 1988, researchers estimated that some soils lost as much as 80 kilograms per hectare of nitrogen in two days. The conventional system, based on annuals, is also inefficient in its use of water as it is unable to take advantage of the 20 per cent of annual rainfall that falls in summer/autumn, which either runs off, causing erosion, or infiltrates to groundwater, contributing to the risk of salinity. Neither can the annual crops or pastures make use of excess winter rainfall that infiltrates beyond their shallow root zone. Rising watertables on a regional scale bring dissolved salts into the capillary zone where waterlogging and the increasing concentration of salt limit plant growth and ultimately preclude conventional agricultural production on much of the valley floors.

The Melvin family was forced to look at the sustainability of their enterprise before the term itself became trendy. In 1983, their farm adviser suggested that either Dean, his brother, or his father would have to leave the farm, given the proportion of unproductive sandplain soils on their land. This was not an attractive option, so Dean worked off-farm shearing sheep, saved some money and then went on a trip through the Middle East, looking at farming systems in Mediterranean climates which had been farmed for thousands of years.

On his return, Dean began to experiment to develop alley farming systems, in response to low crop yields due to infertility and poor moisture-holding capacity, and very poor persistence of annual legume pasture species due to soil acidity, wind erosion (removal of organic matter) and low soil moisture-holding capacity. These systems have been in continuous development on ‘Paradise’ over the last six years, with the help of scientists, especially Ted Lefroy from the Department of Agriculture. Alley farming, the production of crops and pastures between hedgerows of trees and shrubs, will continue to evolve on ‘Paradise’. The essential ingredients are the incorporation of permanent vegetation belts consisting of the fodder shrub Tagasaste (Chamaecytisus palmensis), native eucalypts and the natives Acacia saligna and Atriplex amnicola. On the poorer soils, this has been accompanied by a reduction in the amount of cropping, and a consequent increase in grazing and the introduction of cattle. Along the way Dean has pioneered the development of a large-scale system for raising inexpensive, open-rooted seedlings suitable for
machine planting, thus substantially reducing the establishment cost and increasing the reliability of planting large numbers of trees into cropping systems.

It must be stressed that the alley farming options discussed below are but a sample of a number currently in place or under consideration, all of which are likely to be improved with Dean’s increasing knowledge and confidence in alley farming, and as external influences change.

Essentially the alley farming system involves the establishment of tree and shrub species (including legumes) in strips at regular intervals against the prevailing wind or on the contour, during a year in which the paddock is in crop. On 'Paradise', the original alley farming layout consists of three rows of trees (Tagasaste, eucalypts and Acacia saligna), with rows two metres apart and trees two metres apart within rows, then 30 metres of inter-row (crop or pasture), then another triple row of trees and so on. Thus the trees take up seventeen per cent of the paddock area, at an overall density of from 277 stems per hectare (with 3 metres between trees) to 831 stems per hectare (with 1 metre between trees), as illustrated in Figure 6.1.

![Figure 6.1 Layout of the alley farming system](image)

The layout in Figure 6.1 was the original alley farming option, developed for the poorer sandplain soils. The pasture is composed of a summer-active perennial grass, Rhodes Grass (Chloris gayana var. Katamboora), a winter-active annual grass, Ryegrass (Lolium rigidum var. Wimmera), a winter-active annual legume, clover (Trifolium subterraneum var. Daliak) and several other species including brome grass, capeweed and hares-foot clover. This was over-sown with grain lupins in the fourth year to produce a cash crop and replenish soil nitrogen. It is assumed that lupin yield will increase in the alleys by twenty per cent owing to the benefits
of shelter from the trees, but that this will be offset to some extent by competition from the perennial grass in spring. As seventeen per cent of crop area is taken up by trees, it is assumed that the overall yield of lupins will be somewhat lower than in an open paddock.

However, with subsequent experience and constant innovation on ‘Paradise’, Dean and Ted now consider this layout to be at the green feedlot end of the spectrum of alley farming options. Seventeen per cent of a paddock taken up with trees is a lot, appropriate where cropping is marginal, that is, where you can grow lupins but not wheat. Where cropping is a viable option, the alleys widen out to 60, 100 or even 200 metres, with hedgerow species chosen appropriately, and the land occupied by trees changes to nine, six and three per cent, respectively. The impact of these lower tree densities on recharge to groundwater is debatable but as yet unknown. Where reasonable pasture can be grown, the feed value of the alley system is the leverage effect of a 20 per cent increase in pasture production in the alleys due to shelter, not so much the feed value of the trees themselves. Even in the green feedlot option illustrated above, where a good (preferably perennial) pasture can be grown, the value of the trees is in their shelter effect primarily and direct feed value second. Where few or no existing pasture or crop options exist, then fodder tree species become very important and their density goes up, and the major economic benefit for farmers arises from opportunistic trading in livestock to make best use of extra summer feed.

Ted Lefroy asserts that the biggest potential impact of alley farming is in broadacre cropping on duplex soils and heavier soils, where it represents the only way to increase water use sufficiently (compared with annual cropping) to prevent further salinity and waterlogging, and the only way to prevent wind erosion. So the option illustrated above represents only a small slice of the potential application of alley farming. Table 6.2 illustrates the spectrum of alley farming options on different soil types with their different potential for cropping.

Dean’s preferred planting pattern now that he has shown he can have a perennial and annual pasture in the alleys on the poorest soil type, is 60-metre alleys separating two or three row hedgerows. The low cost option is two rows of *Chamaecytisus palmensis* (Tag in Table 6.2) or *Acacia saligna*,
with trees three metres apart in each row, giving 100 stems per hectare (nine per cent of the paddock area) at a cost of about $10 per hectare, and good shelter coverage with a potential hedgerow height of four metres. The higher cost option is for three rows of trees in the hedgerow, the centre row being Tag or saligna, with *Atriplex amnicola* (river saltbush), in the outer two rows, giving 170 stems per hectare (twelve per cent of the paddock) at a cost of $20 per hectare. Even on sandplain the latter option provides saltbush shrubs of three metre diameter, all within browsing range, if planted with a legume such as saligna or Tagasaste.

**Table 6.2 Alley farming options from feed supply to crop shelter**

<table>
<thead>
<tr>
<th>Options</th>
<th>Green feedlot</th>
<th>Feed/crop</th>
<th>Crop/seed</th>
<th>Grain bowl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alley width</td>
<td>10–30</td>
<td>30–60</td>
<td>30–60</td>
<td>60–200</td>
</tr>
<tr>
<td>Alley width (m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stems/ha</td>
<td>3000–1000</td>
<td>300–100</td>
<td>300–100</td>
<td>100–40</td>
</tr>
<tr>
<td>Hedgerow shelter</td>
<td>Tag/saligna</td>
<td>Tag/saligna</td>
<td>Mallee eucalypts</td>
<td>Taller eucalypts (eg <em>E. camaldulensis</em>)</td>
</tr>
<tr>
<td>Hedgerow fodder</td>
<td>Tag/saligna</td>
<td>Saltbush</td>
<td>Acacias</td>
<td>Acacias</td>
</tr>
<tr>
<td>Hedgerow height</td>
<td>4–5 m</td>
<td>4–5 m</td>
<td>4–5 m</td>
<td>10–15 m</td>
</tr>
<tr>
<td>Alley perennial</td>
<td>lupin/wheat</td>
<td>wheat/pasture</td>
<td>wheat/pasture</td>
<td>wheat/pasture</td>
</tr>
<tr>
<td>species</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>pasture</td>
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</table>

The trees are planted by machine in late winter as one-year-old open-rooted seedlings rather than by direct seeding or by seedlings in containers. This has proven to be a reliable method of getting trees sufficiently well-established to survive the first summer. The other huge advantage of this system is that no fencing is required, usually the most expensive component of farm revegetation, as the seedlings can be grazed in the autumn following planting, providing this is done with a
high stocking rate for a short period. The young trees will recover from a quick, one-off defoliation but not persistent grazing pressure over several months.

The main constraint to production of wool or beef in the region is the lack of feed in late summer and autumn. This shortfall is met by supplementing dry pasture and crop residues with lupins or oats. The alley farming system is designed to fill this feed gap using perennial shrubs, enabling more livestock options to be considered. Trees are mechanically cut and fed to sheep, or grazed directly by cattle and sheep from February to June. Taking advantage of the extra feed in the alley farming system has meant big changes to the Melvins’ livestock strategies. From having 4000 sheep all year round previously, Dean now has only 500 sheep throughout the year, and he buys 3500–4000 sheep and 80 cattle in March, which are rotationally grazed (at an average stocking of ten DSEs\textsuperscript{157} per hectare) through the alley paddocks, then sold in July. The cattle are good for pruning the shrubs and bringing them down to within the browsing range of sheep, thus avoiding the expense (about $35 per hectare) of mechanical topping.

In 1991, Dean averaged $100 gross profit per head of cattle and $17 per head of sheep (including three kilograms of wool at $4 per kilo). However, it must be noted that the profitability of this short-term livestock trading is enhanced by the fact that few farmers in the region have summer/autumn feed, which means that Dean enjoys the benefit of buying stock cheaply when others have run out of feed, and selling on a rising market after the break in season, when everyone else has feed again and wants to buy stock. If everyone adopted the alley farming system as a grazing option, the profitability of such trading would be reduced, although income from wool would be unaffected. This is a classic example of differential profits between the first few people to adopt an agricultural innovation and those who follow much later, usually when forced to by declining terms of trade.

Few farming systems are as monocultural as the Western Australian wheatbelt. One can drive for over 1000 kilometres from Esperance to Geraldton, through farms which average over 2000 hectares (but may be more than 10 000 hectares), and which consist almost entirely of wheat and lupins and an occasional mob of sheep. The monotony of the landscape is
broken every 60 to 80 kilometres by huge silos on the horizon, signalling the probable presence of a town, with one or two shops, one or two pubs, one or two petrol stations, a school, a council chambers, a hall, a footy/cricket ground, tennis courts and a few hundred people.

Through summer and autumn, the alley farming system on 'Paradise' is a startling island of green in this vast beaten-gold and dun coloured landscape. It represents a radical departure from the conventional system—ecologically, aesthetically and agronomically. As three of the four main tree species planted are natives, the alley farming system can potentially improve the chances for survival of some of the wheatbelt bird species currently in severe decline, especially if the hedgerows of trees form corridors that connect larger habitat areas of remnant native vegetation.\textsuperscript{158} While the influences of native birds, small mammals, insects and other invertebrates on crop and pasture pests are not well understood, anecdotal evidence suggests that they can play a useful role in some instances. Some of these interactions are illustrated in Figure 6.2.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{image}
\caption{Ecological interactions within the alley farming system}
\end{figure}
From an ecological perspective, alley farming has a number of advantages over conventional cropping in the wheatbelt. Moisture is often a limiting factor for crop growth in this landscape, which receives a very high input of solar radiation and in which evapotranspiration losses can be extremely high. The triple rows of trees absorb the energy of drying winds, reducing wind speeds across crops and pastures, increasing humidity within the crop/pasture, and reducing the amount of moisture lost to the atmosphere. Shelter is also likely to increase the temperature within the crop canopy early in the growing season when low temperatures are limiting. In three separate studies in different parts of southern Australia, shelterbelts within crops have been found to increase cereal crop production by an average of twenty per cent, representing a handsome investment.\textsuperscript{159}

Data from research at Rutherglen Research Institute in south-eastern Australia,\textsuperscript{160} illustrated in Figure 6.3, suggests that the benefits of shelter on crop yields are maximised between four and ten tree heights from the trees, a zone which researchers call the ‘quiet zone’. This research suggests that the main influence of shelter is the reduction in wind speeds (and hence evaporation from the soil surface), conserving water which is critical when moisture is a limiting factor during the period of grain filling in late spring/early summer. With legumes especially, shelter is likely to reduce flower abortion caused by drying winds in spring.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure6.3.png}
\caption{Effect of shelter on yields of wheat and oats}
\end{figure}
The sandplain soils in the wheatbelt are highly permeable, which means that nutrients (including fertilisers) can be leached beyond the root zone very easily during summer and autumn rains. The root systems of the trees in these soils often extend ten to twenty metres below the soil surface, extracting nutrients from a much greater soil volume than can crops, and ensuring that nutrient cycling is inherently more efficient. Furthermore, the alley farming system has livestock grazing pasture for three years out of each four, which means that nutrients and organic matter in the form of manure are also kept within the system, whereas in a conventional wheat rotation a greater proportion of nutrients are removed.

An important off-site effect of the alley farming system is that it will use more of the available water throughout the year, particularly that which falls in summer/autumn storms, thus reducing the off-site impact of rising saline water-tables. As the tap roots of the eucalypts in particular can reach the groundwater, and as shelter reduces evaporation losses, the alley farming system is also better able to cope with extended dry periods. More importantly, this system ensures complete soil cover throughout the year, almost eliminating the possibility of wind and water erosion which is always a risk under conventional cropping.

A desk-top analysis of the energy efficiency of alley farming, in which alleys in a wheat/lupins rotation on heavier soils or alleys with perennial pastures on sandplain soils are compared with open crops or pastures without alleys, suggests that the alleys considerably increase (by a factor of between two and four), the energy efficiency of the farming system in this environment. This is basically because fossil fuel energy inputs (diesel and fertiliser) are reduced, but energy yields are comparable, and with alleys there is a greater livestock turn off without the same requirement for supplementary feed. If occasional topsoil losses through erosion are prevented by alleys (which seems likely), then the energy efficiency gains of alley farming systems relative to conventional cropping become much higher.

Gordon Conway proposed in a 1985 paper that the behaviour of agroecosystems can be described by four system properties—productivity, stability, sustainability and equitability. He defines productivity as the yield or net income per unit of resource (interpreting resources in a very wide sense
including energy, biodiversity and human inputs); stability is the degree to which productivity is constant in the face of small disturbances caused by normal fluctuations in environmental variables such as climate; sustainability refers to the ability of the system to maintain productivity in spite of a major disturbance such as a large stress (e.g., salinity, indebtedness) or a large perturbation (drought, flood, disease, a new pest); and finally, equitability expresses how evenly the products of an agroecosystem are distributed among its human beneficiaries.

Our analysis comparing alley farming with conventional cropping on ‘Paradise’ lacks complete information to exploit fully Conway’s analytical framework. In order to get a more complete comparison of these systems it is essential to examine their impact on nutrient cycling, biodiversity and water use at the farm level, their response to stress and perturbations, the impact of these systems on profitability, cash flow, equity and debt, and finally to assess their social viability at the community and landscape level in order to give the picture real depth and meaning. Many assumptions and areas of incomplete information will be encountered along the way, but such an analysis can enhance understanding of the complexities and imperatives implicit in the challenge of developing more sustainable farming systems. We should be doing more such analyses, highlighting assumptions, information gaps and emerging questions, and exposing the inter-relationships between economic, social and ecological factors.

For the purposes of debate, let us look at each of these criteria, applying existing knowledge and intuition to a comparison of the two systems with the information currently available. Table 6.3 compares and contrasts the two systems in each of the key agroecosystem properties proposed by Conway.

This analysis is as yet incomplete. However, the data currently available, some basic ecology and farmer’s common sense suggest that the alley farming system is a very promising option in the Western Australian wheatbelt. While the optimum combinations and configurations of trees, pastures and crops are still being tested, there is great scope for wider application of this system. Sandplain soils cover significant areas of the Western Australian wheatbelt and they already exhibit stark evidence of the unsustainability of conventional
### Table 6.3: Summary comparison of alley farming and conventional cropping on sandplain soils

<table>
<thead>
<tr>
<th>Agroecosystem</th>
<th>Alley farming</th>
<th>Conventional cropping</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Productivity</strong></td>
<td>22,500 MJ/ha/year, with a ratio of output/input of about six. Products include wool, beef, tree seed, fodder and lupins, with potential for honey and wood products in the long term. The use of perennial plants ensures better use of rainfall throughout the year.</td>
<td>18,000 MJ/ha/year, with an energy output/input ratio of about 1.5. Products are wheat and lupins, and yields are extremely dependent on rainfall between May and October. In good years this system may make more money, in poor years it loses money.</td>
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<tr>
<td><strong>Stability</strong></td>
<td>Productivity is very stable owing to the combination of perennial plants with deep root systems.</td>
<td>Productivity varies according to growing season rainfall, which is not reliable. Yields average 2.3 tonnes/ha, but range from one to four tonnes.</td>
</tr>
<tr>
<td><strong>Sustainability</strong></td>
<td>Continual soil cover, increased diversity of flora and fauna, greater biomass above and below ground, lower reliance on external inputs and more efficient nutrient cycling suggest a more sustainable system at both farm and watershed scales, owing to the off-site benefits of increased plant water use and protection from erosion.</td>
<td>Wheat and lupin monocultures are vulnerable to pests and disease. Bare, exposed soils from January to April are vulnerable to summer storms and subsequent wind and water erosion which is irreversible in these soils. These systems mine nutrients and thus rely on external inputs. They are unsustainable at the landscape scale.</td>
</tr>
<tr>
<td><strong>Equitability</strong></td>
<td>This is not easy to assess. Costs are lower and returns more even and less dependent on international markets. More intensive management and higher yields suggest that smaller farms are more viable under this system, creating the potential for more even distribution of benefits and more viable rural communities.</td>
<td>Fluctuating yields and prices determined by overseas markets distorted by EC and US subsidies; reliance on external fossil fuel inputs which are increasing in price; a continuing trend to larger farms, fewer people and dying towns; all these serve to question the equitability of this system.</td>
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**Note:** *Campbell, Lefroy and Melvin (unpublished)*
cropping on these soils—wind and water erosion, soil structure decline, waterlogging, soil acidification, species extinctions and so on. Alley farming systems also have potential in other soil types given a different choice of species for the hedgerows and appropriate alley widths.

As this landscape was covered with trees and shrubs for millennia until about twenty years ago, intuition suggests that any permanent farming system in this landscape will also have to incorporate perennials as a key component. This analysis backs up such an hypothesis, suggesting that alley farming is significantly more efficient in terms of water, energy and nutrient cycling, and it is more productive, more stable and more sustainable on this soil type. Given its lower reliance on external inputs and international market prices, it also appears that alley farming will provide a more secure livelihood for the Melvin family—probably the most crucial determinant of all in the future development of alley farming in the wheatbelt.

In Dean Melvin's words: 'I'm sick and tired of trying to keep alive animals and plants which just want to die in this country, while shooting and clearing animals and plants which are well adapted and just want to live in this country. I want to develop Australian farming.'

Alley farming is just one option, and its relative merits as a farming system are not as important as the fact that some families and some scientists are having a real go at developing farming systems which may be more appropriate to the landscape. They deserve all the support the wider community can muster.

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**CASE STUDY**

**'ATARTINGA'**

Bob Purvis has been running 'Atartinga', 200 kilometres north of Alice Springs, since the late 1950s. When he took over the 229 000 hectare property (smaller than the average cattle station in the Northern Territory), it was severely run down after years of overgrazing. 'Atartinga' came out of the 1959–65 drought with only 280 cattle, a debt of £19 000, extensive land degradation and no immediate prospect of buying more land.
But over more than 30 years, Bob has thoughtfully, patiently and skilfully turned ‘Atartinga’ around, so that today it is one of the most consistently profitable stations in Central Australia and in considerably better ecological condition than most.

Bob Purvis is a tall, dry, far-sighted man, independent of mind, with a clearly articulated personal philosophy on managing rangelands. Bob’s outlook is essentially based on continuous learning about the land and its natural characteristics, and how to live within the limits these characteristics impose.

The question of limits and capacities is still problematic within the Australian rangelands. Many regard the rangelands as being among the most degraded land in Australia: because of overgrazing of very old, weathered, shallow soils by cloven-hoofed animals; the introduction of animals and plants which have become pests over vast areas and which have displaced native species; the establishment of permanent fresh water in troughs and bores leading to significant increases in populations of native herbivores including kangaroos; and alterations to the burning practices formerly used by Aborigines. Mining, tourism and human settlements have also had significant impacts within small areas in this vast expanse of pastoralism.

For Bob Purvis, living within natural limits means having a significantly lower stocking rate than the average for the region, being prepared to reduce stock numbers at an early stage in drier seasons, maintaining and increasing groundcover as much as possible, careful use of patch burning for scrub control, and skilful management of water. Water management means planning and everyday management of stock watering points but, just as important, it also involves planning and being ready for unpredictable rains. Overland flow during infrequent heavy rainfalls can cause huge long-term damage, or be of lasting benefit for plant growth, depending on how it is handled.

CSIRO scientist Gary Bastin points out that water management in arid regions is not a new idea, but was a feature of early civilisations who developed elaborate methods for diverting flood waters over cropping areas, for example on the Tigris and Euphrates more than 2000 years ago. On ‘Atartinga’, as on most stations, there is a considerable diversity of
land types occurring in irregular shapes which are not practical to fence. Bastin describes a process which illustrates the need for careful water management in Australian rangelands:

Non-degraded rangelands function through the maintenance of resource-rich ‘fertile patches’ (Tongway et al 1989; Tongway and Ludwig 1990). These areas are relatively stable in space and time and, in seemingly flat landscapes, accumulate water, nutrients and seed through their microtopographical relief. On land in good condition, there are many small patches and water flow is intercepted before it can gain velocity and erosive force. The landscape is buffered against erosion by the proximity of well vegetated run-on areas to comparatively small source areas (Pickup 1988). However, fertile patches are the focus of intense grazing pressure by inadequately controlled stock, particularly in adverse seasons. The country as a whole then degrades as palatable species decline and vegetation cover is reduced. Run-off is increased and erosional processes become intensified. Buffering is reduced as patches lose their capacity to respond to ... small rainfall events.165

When Bob Purvis took over ‘Atartinga’, this process had occurred on extensive areas, causing large ‘scalds’—completely bare, compacted, eroded patches of land which had previously been among the most fertile lands. With the help of soil conservation officers from the then Northern Territory Administration, Bob used a cable blade bulldozer to build 25 earthen banks on bare, degraded granite plains in 1969, to trap water and encourage regeneration of herbage species. Over the years since, with the help of Bob Keetch and others from the Conservation Commission (NT), he has refined the design, construction methods and placement of banks, and tested a huge range of introduced forage species sown behind the banks—the best of which have proven to be US Buffel grass and Blue Panic. There are now more than 500 banks on the eastern side of ‘Atartinga’, and native perennials are
recolonising formerly scalded areas. The extra nutritious forage on the areas adjacent to the banks provides a handsome return (in beef production alone) on the investment in the banks, according to CSIRO calculations.166

Another key aspect to improved range management on ‘Atartinga’ is the use of fire—a technique used by Aborigines in the rangelands over millennia. There is a considerable problem on ‘Atartinga’ (and over vast areas of Australian rangelands) with woody shrub encroachment, primarily caused by historic overgrazing which created more favourable conditions for regeneration of shrubs than for grasses and herbs, converting formerly open country to vast woody thickets. As grasses are replaced by shrubs, and under continued grazing pressure, it becomes very difficult to get a decent burn going—the traditional method of killing shrubs and stimulating grass regeneration, creating and maintaining open grasslands. But Bob’s low stocking rates, some strategic sowing of Buffel grass, and judicious opportunistic use of the firestick when weather conditions and fuel loads are favourable, is enabling him to nibble away at the patches of scrub, recreating more productive and stable open grasslands.

Bob Purvis is forthright in his criticism of the general standard of rangeland management, in particular of the high stocking rates maintained on many stations, which he believes are leading to the loss of perennial species and long-term damage to exposed soil. While many in the pastoral industry respect what Bob has achieved on ‘Atartinga’, his well known views on stocking rates are not universally acclaimed.

Research over many years by scientists at the CSIRO Division of Wildlife and Ecology at Alice Springs definitely supports Bob Purvis in suggesting that lower stocking rates are not only more ecologically sustainable, but more profitable. When actual figures are compared over twenty years or so (still a fairly short-term comparison, given the climatic variability of the arid zone), a low stocking rate regime, with conservative drought de-stocking policies, is more profitable in cash terms. Bob is able to turn off heavier beasts earlier, attracting premium prices, his input costs are lower and he does not suffer the same fluctuations in net return that characterise most of the industry.
The advantages of lower stocking rates are gradually becoming accepted in the northern cattle industry, as people start to focus on kilograms of beef of a certain quality per square kilometre, rather than just numbers of cattle. This change in focus has been accelerated by the Brucellosis and Tuberculosis Eradication Campaign (BTEC), the national campaign which has eradicated brucellosis and tuberculosis from cattle and buffalo throughout Australia. BTEC has forced (and subsidised) the cattle industry to become more professional in the rangelands—less like hunting and more amenable to herd management. There are clear trends towards more control of stock, more watering points, more paddocks, higher weaning and calving percentages, greater ability to spell paddocks and recognition of the profitability of more conservative stocking rates.

However, there are still many pastoralists who believe that the major influence on range condition is the season, not grazing pressure, which means they tend to run what they regard as the most profitable number of stock (usually the maximum), expressing the popular view that ‘the country will come back’. So the development of more conservative stocking regimes, and management which is responsive to range condition, is much more likely to be driven by profitability than a concern for the environment. Indeed, one has only to drive through Australian rangelands after good rains to see extravagant displays of wildflowers and furious growth of annuals from horizon to horizon. Such spectacles support the view that rain, not cattle, determines the condition of the land. But the sheer variability of climate in the rangelands masks long-term trends. It is very difficult to tell just by eye and memory whether the country does completely ‘come back’ after a good rain, or whether there is a gradual disappearance of some species and a decline in the ability of the country to recover after extended dry spells. The most urgent extension priority in the rangelands, then, is to demonstrate in dollar terms the advantages of lower stocking rates and better control of stock.

Properties like ‘Atartinga’ provide a tremendous resource of practical information to support such a research and extension effort.
A STIRLING EFFORT

Lyn and Barry Stirling have literally been pushing landcare uphill for the past eighteen years. They farm near Tumby Bay on the south-eastern edge of the Eyre Peninsula in South Australia, which we introduced in Chapter 4.

Rural decline is rampant on Eyre Peninsula. Barry Stirling describes in bald terms a scenario which sees this region in deep social and economic crisis:

Farmers are suffering from advanced AIDS (Acquired Income Deficiency Syndrome). We have had below average seasons in 1985, 1986, 1987, 1988, 1989, and since then a drop in prices. When 400 farmers out of 2200 walked off their farms, they were bought up by other farmers. With high interest rates, most are now in trouble. Now with wool prices falling and land not selling at all, 70 per cent of the farmers are technically bankrupt. Average farm equity ranges from seventeen per cent in the far west to 63.5 per cent around Tumby Bay. Average farm debt in this area is about $207 000 and the 1993 harvest was pretty bad.

Another unfortunate reality for agriculture on Eyre Peninsula is the nature of the soil and the history of its (ab)use since European settlement. The first clearing started early last century in the Sheoak (Allocasuarina spp) woodlands, to provide wood for the boilers of coastal steamers. Rabbits relished the sandy soil and dry climate of the Peninsula and became a massive problem early this century. By 1940 rabbits had ruined the property of which the Stirling’s farm was formerly part, as sheep numbers crashed from 28 000 to 3000. After the Second World War, this property was split up into about 25 soldier settlement blocks, one of which was taken up by Barry’s father for dairying. In 1972, the Stirling family bought out their neighbours, who could not handle the stony soils on their 650 hectares, which they sold for $40 000, with 1000 sheep and machinery thrown in. The Stirlings ran this land as a dry stock block until 1977, when they split the fam-
ily partnership and Lyn and Barry started to farm the new block on their own.

Their new farm was totally devoid of trees, with only 70 arable hectares when they took over. This did not deter Lyn and Barry, whose achievements are especially noteworthy in the ecological and economic reality of the Eyre Peninsula. They set about replanning the property so that they could raise productivity without degrading it. Barry describes the first steps:

We ran into water erosion problems in the early 1980s and started contouring [constructing earthen banks along the contour, and doing all cultivation along the contour to trap run off and prevent erosion] in 1985. We have since done 70 kilometres this way and have gone from thirteen paddocks to 30 in this time. We have stabilised creek banks using Kikuyu grass and Red Gums (E. camaldulensis). I had to learn how to modify plant to suit our property, as we could afford only older, cheaper machinery. Our header has a special self-levelling shelf system we designed, and comb plates with lower points and shear pins for protection against rocks. We have shifted the tractor draw-bar to a central point under the middle of the motor and widened the wheels of all plant to allow safer working along the contour on side slopes.

Many kilometres of contour banks have been constructed on the steep (up to 25 per cent) slopes. On these slopes the Stirlings also ripped and cleared off the stones and rocks. The life of a tractor tyre can be as short as 700 hours in this country, so the benefits of farming in this way are starting to attract other farmers in the district, who are beginning to follow the Stirlings' lead and contour their lands.

Barry Stirling describes the essence of their program: 'Since 1976 we have brought into production 330 hectares of difficult country through conservation farming methods such as minimum tillage practices for all cropping programs, working on the contour, sinking dams and soaks in all paddocks, planting 20 000 trees and seeding about 100 kilometres of tree lines with our home-made direct seeder. We are now self-sufficient in regards to water supply.'
The revegetation efforts of the Stirlings are a great example of what a combination of farmers' practical nous and ingenuity, coupled with determination and hard work, can achieve without excessive out-of-pocket expenditure. Lyn and Barry are establishing trees for shelterbelts and wildlife corridors which will connect small patches of remnant native vegetation, and the steep country is being planted back to native trees for fodder, fuel, wildlife habitat and beautification. Barry is experimenting to find the most reliable and cost-effective establishment technique. After persevering with tubed seedlings, he feels that this method of establishing trees does not achieve their aims quickly enough, so they are trying direct seeding. Using direct seeding, Barry believes they can establish 100,000 to 150,000 trees and shrubs quickly and economically:

We have developed one large direct seeding contour plough and a small seeder attached to the bulldozer ripper. We call it the 'Ripper Seeder'. We have also done some direct seeding by hand into roughly prepared ground and we tried using a combine pulling a sheet of chain mesh. A good direct seeder costs up to $16,000, but ours is now recognised as one of the best and costs $1200 to build. We also discovered a new method of scarifying tree seed by freezing it for two days before putting it in hot water.

Waterfowl have benefited considerably from the tree plantings, giving them more protection and nesting sites. Rabbits and feral cats have been eradicated and a host of weeds, which infested the slopes, are now under control. Adding to the uphill battle was a fearful storm which dumped 175 mm (seven inches) of rain in three hours in April 1989. Barry recalls: 'This one rain destroyed half the contour work and 21 out of 23 dams. All in all we spent $30,000 repairing fences, dams and contour banks. Without our conservation work it would have been much more devastating. It proved we were on the right track.'

As a result of their activities the Stirlings have boosted their farm production by 40 per cent and have alleviated water shortages formerly faced every season. Stocking rates have in-
creased from 1000 sheep in 1977 to 3500 on the same area.

Initially the Stirlings were looked upon as ‘greenies’ and with a lot of suspicion by some people in the district. Says Barry: ‘It would have been far easier to just farm the hilly country and not worry about causing any erosion or managing it for long-term viability. But the benefits have outweighed the costs and we know we are on the right track.’ Other people obviously agree, as the Stirlings’ achievements have been recognised in the South Australian Ibis Awards and Primary Industries Landcare Awards, the BP Conservation Farmer of the Month for June 1992 and the Victorian Banksia Foundation’s Conservation Award for Primary Production in 1992.

This recognition is gratifying, but it brings with it many additional demands, as Lyn and Barry caution: ‘We have had approximately 40 visitors per week for the whole year, and numerous public engagements all over Australia. At night, the phone runs hot. We would recommend people in landcare groups be very careful in promoting a local person, because that person has to put up with a lot of pressure and needs to be aware of what can happen.’

Lyn and Barry summarise the advantages of the improvements to their property since taking over in 1977:

- Contour banks and working on the contour has evened out the distribution of water from the tops to the bottoms of hills, giving more even crop yields. Improved water penetration has increased yields.
- Shelterbelts are good for stock and also for lowering evaporation rates by lifting winds. Eyre Peninsula is a very windy environment with the sea on both sides.
- The value of the property has increased by ten to fifteen times the original purchase price and our increased production has enabled us to reduce our mid-1980s debt to a manageable $23 000 dollars.
- Our working environment and self-satisfaction has really changed and gives us some pluses to think about during these hard economic times.

Lyn, Barry and Trevor Trenberth were instrumental in the initiation and development of the Tumby Bay Landcare Group, one of the most diverse and active groups in South Australia, which we introduced in Chapter 4.
Wooragee Primary School in north-east Victoria has its own Landcare group, involved in composting (shown here), revegetation, rabbit and weed control, and farm planning activities.

Landcare for Teachers course participants learn how to measure soil pH.
Dunecare members erecting a hessian fence to halt sand drift and allow revegetation.

Greg Bugden and Barry and Peter Gillies inspecting electric fencing constructed at the Uranquinty Landcare group's demonstration site west of Wagga Wagga.
Shearing time on 'jangarri': Garry English counting out shorn sheep.

Jan English and kids skirting a fleece.

ANDREW CAMPBELL
'Bonneys Plains':
Biz and Lindsay Nicholson in their farm nursery.

'Paradise':
Dean Melvin.
While this chapter attempts to show that landcare and profitability are not mutually-exclusive and that there are numerous examples where more sustainable land use practices are also more profitable, we should not fall into the trap of using profitability as the only arbiter of the worth of any particular land management option.

This is not a book about economics, but it is worth reviewing briefly the major problems generated by the doctrine of neoclassical economics (or 'free market economics' or 'market-oriented economics' or that hackneyed oxymoron 'economic rationalism'), as it is at present the dominant paradigm in Australian politics and thus has significant implications for the management of natural resources.

There is a compelling argument that continued reliance on economic models and investment criteria as the main input to political decision making is impeding our ability to deal effectively with environmental and social issues. 167

In neoclassical economics, the market determines value; it is 'the hidden hand' which serves as a neutral judge. At the heart of this theory is the assumption of rational individuals pursuing their own self-interest, which is also assumed to be consistent with the interests of society as a whole. In its modern guise, neoclassical economics holds that individuals seek to maximise their utility (constrained personal satisfaction) and they make trade-offs at the margin to equate different positions of equal utility, thus reflecting their preferences through 'rational' choices. Thus the value of anything (goods and services, wilderness experiences, clean air and water for future generations or whatever) is determined by the market, which reflects the sum total of individual preferences, each of which is based on the amount of personal utility yielded. Doug Cocks summarises the attractions of the neoclassical model:

*Market capitalism is a very good core system for organising the production of goods and services. Through mutually beneficial and voluntary exchanges validated by the price mechanism, it rations the use of scarce resources into producing goods which people are willing and able to pay for. With the promise of profit it fosters innovation to meet unsatisfied needs and, conversely, moves resources from where they are no longer required. It avoids the crushing burden experienced in centralised economies of trying to calculate relative prices for everything such that shortages and surpluses are minimal. 168*
The most powerful arguments against the possibility of sustainable use of natural resources ever occurring or even being approached, in a globally integrated economic system operating within a political climate dominated by belief in market forces, are those which come under 'market imperfections', a euphemistic term often used by economists to refer to the acknowledged faults when markets are not quite 'perfect'. When viewed through the prism of sustainability, these 'imperfections' could be more accurately described as glaring fundamental deficiencies and contradictions, rather than blemishes which can be corrected by routine servicing of the economic apparatus with a political tweak here and some fiscal lubricant there.

The World Bank economist Herman Daly and the theologian J.B. Cobb Jr identify six socially essential functions which unrestricted markets cannot perform, but which are nevertheless essential for efficient functioning of the market:

- **Fair competition.** The competitiveness of a market is always under threat from oligopolies, monopolies and collusion, which routinely distort prices. There is a natural tendency for successful businesses to grow and gradually work towards market dominance. Daly and Cobb point out that the current tendency is towards mergers, takeovers, and aggregation in the search for international competitiveness, vertical and horizontal integration, and economies of scale.

- **Moral capital.** Markets are driven by individualistic self-interest, yet their efficiency depends on values such as honesty, initiative and thrift. This is a fundamental contradiction—the notion that self-interest works to the common good is unsound. The crises following the deregulation and speculation frenzy of the 1980s point to the consequences of the depletion of moral capital.

- **Public goods.** Markets do not supply goods which, once available, are freely available to all—for example, infrastructure such as highways and national defence. This point is readily conceded by market-oriented economists, so it is expected that governments do have a role to provide such functions, using public funds. Real markets rarely produce pure public goods (eg attractive landscapes), at least deliberately, nor can they produce positional goods such as the Mona Lisa or rainforest in increased quantities, yet markets attempt to ration such goods by price. \(^{170}\)

- **Externalities.** Those who engage in market transactions rarely
pay the full costs of those transactions. Costs imposed by issues such as pollution, loss of biodiversity or ozone depletion are routinely passed to the community, rather than reflected in product prices. These side effects which are not accounted for by the market are called externalities. Externalities and imperfect information commonly lead to 'incorrect' prices for goods and services, which then distort the prices of all other goods and services and, in the case of the environment, commonly lead to rates of resource depletion or degradation which would not be economically rational if full costs were reflected in the price of goods and services.

- **Just distribution (equity)** ‘Real markets are not good at producing goods for poor people or unborn people or incompetent people or minority groups.’ There is nothing in the market mechanism which works to provide employment at a living wage for all who need it, nor to provide for those unable to work. It does not follow that if the cake is bigger, everyone will get a bigger slice; in fact economic growth has tended to widen the gap between rich and poor in countries of the north and the south.

- **Ecological sustainability** Market forces are notoriously myopic. The market has no way of determining its optimum scale relative to the ecosystem on which it depends—it does not have a ‘Plimsoll Line’ criterion, nor an ‘existence theorem’. It responds to resource depletion by transferring an ever greater share of available resources to the economically powerful.

At the social level, neoclassical economics assumes that a competitive market equilibrium, which in turn assumes, among other things, perfect information available to all, well-defined property rights and an absence of externalities (unpriced side-effects on third parties), will maximise collective welfare.

However, most environmental issues are characterised by large scales in space and time, ubiquitous externalities, ill-defined or non-existent property rights, imperfect information, and intangible values which are difficult to express in monetary terms. Thus there are many aspects of mainstream political/economic theory and practice which stimulate, reinforce and justify patently unsustainable uses of natural resources.

So what are the alternatives to the currently dominant paradigm?

Alternative strands of economic theory which are more consistent with wiser use of natural resources and thus avoiding or at least
postponing the extinction of *Homo sapiens*, are presented and discussed by Daly and Cobb in *For the Common Good*, by Robyn Eckersley in her excellent review of Green politics, *Environmentalism and Political Theory: towards an ecocentric approach*, and by various authors in *Ecological Economics*, edited by Robert Costanza.  

The central values of Green economics are participatory democracy, ecological responsibility, social justice, decentralisation and the dispersal of economic and political power. Green economists accept the Western liberal traditions of representative democracy, tolerance of political diversity, the rule of law and due process, and protection of human rights including freedoms of speech, assembly and organisation, but they are suspicious of the concentration of economic power in either the state or corporate capitalism. Essentially Green economics envisions a market economy (within circumscribed ecological limits) with a large private sector. As put by Daly and Cobb:

> If one favours independence, participation, decentralised decision making, and small- or human-scale enterprises, then one has to accept the category of profit as a legitimate and necessary source of income. There is plenty of room to complain about monopoly profits, but that is a complaint against monopoly, not against profits per se ... If one dislikes centralised bureaucratic decision making then one must accept the market and the profit motive, if not as a positive good then as the lesser of two evils ... We have no hesitation in opting for the market as the basic institution of resource allocation.

However, Green economists, while accepting the market, have been at the forefront of the critique of prevailing modes of free market economics and private and state capitalism—accepting the price mechanism does not imply endorsement of existing patterns of ownership and control, nor of the existing distribution of wealth.

Some practical initiatives and institutional implications flow from Green economic thought, such as:

- a range of new fiscal measures (eg resource depletion quotas, marketable permits, resource taxes, pollution charges) to control resource depletion and reduce throughput. Technological progress should seek to increase efficiency, not increase through-
put. High natural resource prices and high taxes on energy would be a good start. Renewable resources, both as sources and sinks should be exploited on a profit-maximising sustained yield basis, that is, harvesting rates should not exceed regeneration rates and waste emissions should not exceed the renewable assimilative capacity of the environment. Depletable resources should be exploited at a rate equal to the creation of renewable substitutes, and the revenue from this exploitation should be divided into an income component and a capital component, the latter being reinvested to create new renewable assets, so that by the time the resource is depleted a replacement will have been created:

- improved long range impact assessment and technology assessment;
- replacing misleading GDP/GNP statistics with more meaningful indicators of economic well-being;
- shifts in the burden of taxation away from labour toward increasingly scarce factors of production such as land, natural resources and fossil fuels;
- the development of local credit and banking facilities and ethical investment funds;
- greater worker and community ownership of capital assets and participation in corporate investment decisions;
- cultivation of the well-informed ‘Green consumer’, through independent consumer organisations, stricter controls on labelling, advertising and certification systems;
- fostering of non-market exchanges at a community level.

The Green economic agenda is not without problems however. There are formidable political difficulties (and naiveties) associated with implementing the propositions of alternative economics, some of which are so alien to the dominant way of life in modern industrial societies. For example, the notion that decentralised decision making by local communities or bioregions will result in more ecologically sound management of natural resources assumes ecological literacy throughout all human populations and ignores the rights of other people in other regions. Many progressive social and environmental reforms (eg affirmative action, abolition of slavery, homosexual law reform, preservation of wilderness) have emanated from cosmopolitan central governments, rather than provincially or locally, often against the wishes of the local community. Achieving redistributive justice at the same time as encouraging reduced material throughput in a predominantly market
economy will be extremely difficult. Robyn Eckersley predicts increasing tension between democracy and efficiency, as the need to retain and discipline the market and the price mechanism will confer greater powers in the state. She also suggests that Green economists underestimate the cunning of market rationality in finding ways around macro-economic controls. Finally, Eckersley asserts that the urgency of many environmental issues demands multilateral action by nation states and she echoes the concerns of others in stressing the critical importance of effective international treaties, agreements and controls:

... there are few material (as distinct from moral) incentives for exemplary ecological action—whether on the part of transnational corporations or nation states—in the competitive environment of global capitalism. Without concerted ecodiplomacy resulting in a comprehensive range of treaties providing for macro-ecological controls and standards at the international level, Green economists will be hard-pressed to convince an effective majority of voters in their own nation that they must become ecological saints while individuals and corporations in other countries continue to engage in ecologically irresponsible practices. 181

Thus, when we begin to consider the implications of shifting human management of natural resources to a more sustainable basis, we are immediately confronted with a tension between ‘bottom-up’ and ‘top-down’, especially as we move between scales in space and time (discussed in more depth in Chapter 9). As mentioned earlier, reform is necessary in both directions and they can be mutually reinforcing, rather than mutually exclusive. Grassroots movements, like Landcare, allow desirable reforms at a macro level to become more politically feasible, and prominent commitment and leadership at a high level can provide the clout to make more space and resources for community-based initiatives. We are not suggesting that Landcare groups are the answer to all environmental problems, but neither do we think that these problems can be tackled effectively without the commitment, knowledge and direct involvement of those whose daily activities and decisions directly affect natural resources.

Returning to the farm level, there are many motivations for people to manage a given piece of land in a given way, and none is more rational than any other. Jan Doewe van der Ploeg posits that
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agriculture is an extremely heterogeneous activity, in which farmers, by means of their farming strategies, participate actively in shaping agricultural development. Farmers are seen as knowledgeable actors who manage their human and biophysical resources according to specific objectives and rationalities, which of course vary within a given society and between societies. However, farmers are not completely free to do whatever they want; their room for manoeuvre is limited by the structural context in which they operate, established by such influences as the state, markets, technology and social norms. The variation between farmer strategies within a given structural context can be attributed to their differing farming styles.\(^{182}\)

Van der Ploeg discusses farming styles in the context of two extremes in the forms of agricultural production: (a) relatively autonomous, historically guaranteed reproduction; and (b) market-dependent reproduction. In the former case, the labor force and all the means of production in any farming cycle are the material result of the preceding cycle, production in the present cycle creates the inputs for the next cycle and so on. Emergencies and inputs which cannot be produced on the farm (such as iron) are paid for out of savings generated by selling surplus production. In market-dependent reproduction, the necessary production factors and inputs are commodities mobilised through the relevant markets and thus depend on the market, not on the previous production cycle on the farm.\(^{183}\)

Clearly modern industrial agriculture is the end-point of a transition to market-dependent reproduction, which is the result of what van der Ploeg calls ‘the process of externalisation in agriculture’, in which inputs and management tasks and processes become progressively removed from the farm and more subject to external (particularly market) forces. Yet even within this process, at any given stage in any region, there is a diversity of farming styles.

The usefulness of van der Ploeg’s concepts is that they provide a sociological basis for a critique of contemporary agricultural policies, which are widely seen to be contributing to environmental degradation.\(^{184}\) For example, in western Europe, official policies discuss ‘marginal’ and ‘underdeveloped’ regions, yet these terms only make sense within a strictly unilinear model in which ‘development’ is assumed to mean progression towards greater market dependency and high-input/high-output farming. However, van de Ploeg’s discussion of farming styles makes it clear that no particular rationality is any more valid than another, and that there is a
sound case, on equity grounds alone, for differentiating within agricultural policy interventions (especially subsidies) to account for different farming styles, rather than simply labelling any deviations from the high input-high output model as 'backward' or 'inefficient'.

If Australian farmers were 'economically rational', as assumed by neoclassical economics, most would have sold their farms and invested the money years ago—even bank interest has been higher than the return to capital of most farms over the last twenty years.

Of the many motivations for owning and/or managing land, one which is important for an increasing number of land users in Australia is nature conservation. For these people, the arbiter of success is not the amount of money they make (above their basic needs), but the impact of their management on the ecosystem in which they live. There are thousands of such people and we cannot possibly do them justice, but it is useful to look at one case more closely.

CASE STUDY

ANDREW HALL, MT WARNING CRATER

The Northern Rivers Rainforest in northern New South Wales is one of the most botanically rich and most beautiful plant communities in Australia. In 1980, Andrew Hall purchased a 54 hectare property on the rim of the Mt Warning Crater, near Murwillimbah. The small farm, lying between the Nightcap National Park and the Nullum State Forest, had been a soldier settlement block released in 1919 for soldiers returning from the First World War and had been used for banana production and dairy farming until 1980. The land is on very steep slopes in a very high rainfall area, and its use for agriculture had led to serious water erosion. When Andrew first bought the block it was covered with kikuyu grass, crofton weed and lantana, surrounded on three sides by rainforest and eucalypt forest in which there was very little natural regeneration.

Andrew started planting trees to control weeds, to protect the soil from erosion and to establish a woodlot. He committed himself to focus on species native to the area, and has planted more
than 30,000 trees over the last 13 years—a mixture of rainforest species, hoop pine, eucalypts and understorey shrubs. The first koala was seen in 1989 and in the last five years there has been a noticeable increase of all sorts of small marsupials, including brown antechinus, paddy melon and wallabies, as well as platypus, goannas, snakes and a myriad of birds. These plantings have started to create their own micro-climate, which is encouraging natural regeneration from seed distributed by wind, water, animals, birds and insects.

Recreating a rainforest is not easy. Andrew had a lot of trouble getting rainforest seedlings to survive at first, because voracious weed growth overwhelmed the slower growing rainforest species and exposure to the sun burned off the remainder. A wildlife corridor between the State Forest and the National Park was replanted three times because of the difficult terrain. But slowly, techniques were developed to give a 90 per cent success rate.

Throughout the Landcare movement, new ideas are being tested and new techniques being developed. This is not just trial and error, but purposeful experimentation to solve particular problems in particular circumstances. Of course there is great potential for scientists, if there were enough of them with sufficient resources, to help people with such experimentation, and such interaction may lead to more learning for all involved. But the key point of this and thousands of other instances is that innovation is not necessarily science-led, but an outcome of people working in a more or less systematic way to improve their own situation.

Andrew employs local people to help him with his annual planting, which lasts between one and four weeks early in the year. These people gain terrific practical knowledge of rainforest planting techniques and are further encouraged by the success of previous years' plantings. Neighbours have used this experience to help in replanting their own properties, and some have planted small areas to cabinet timbers as a form of superannuation.

Andrew's project is an earnest attempt to restore the unique environment of the Northern Rivers rainforest. He is aware that he will not see his forest fully mature, but he is rewarded by the delight he gets from watching it grow and caring for it, knowing that he is making a difference in his part of the world.