Natural Resource Policy for Rural Australia

Alan Curtis and Michael Lockwood

This chapter focuses on natural resource management in rural Australia and provides the context for policy development and the associated institutional arrangements. The social and economic foundations for current arrangements are explored, including economic rationalism, community participation and planning approaches.

Landcare and catchment management are presented as important elements of natural resource management in Australia. These programs help to identify the limitations of existing policies and provide lessons for improving the institutional and policy framework.

Issues examined include: an insufficient knowledge base to invest limited public resources across issues and between catchments; inadequate decision support tools; poor program evaluation; and ineffective support for volunteer groups.

Recommendations are made for the achievement of ecologically sustainable development in rural Australia, based on a state-sponsored citizen participation model. Elements of this model include: articulation and separation of roles for representative regional bodies and local community groups; commitment to the use of decision tools to determine efficient and equitable distributions of resources; development of a flexible suite of policy options; provision of incentives to landholders for maintaining supply of public benefits; and developing cost sharing principles that can be used to allocate public moneys for work on private land where there are demonstrated community benefits.

The institutional arrangements required to deliver the most effective returns from the Natural Heritage Trust must be consistent with these elements and provide responsibility and resources to regional communities.

1 INTRODUCTION

Rural Australia is beset by a range of difficult, long-term environmental problems, including dryland and irrigation salinity, soil erosion, declining water quality, feral pests and exotic weeds, all of which are affecting agricultural productivity, biodiversity and public health (ABS 1996). Successive Prime Ministers have acknowledged that land degradation is the number one environmental issue in Australia (Farley 1993). A 1995 estimate of the cost of land and water degradation was $1.41 billion, which included the $450 million spent dealing with the problems (Alexander 1995). These sustainability problems pose particular challenges for the development of public policy. Difficulties include the range of spatial and temporal scales across which the problems need to be addressed, the urgency with which solutions must be found, the irreversibility of many decisions, the ignorance and uncertainty about actual outcomes, the often ill-defined property and management rights and responsibilities, and the need to consider both interpersonal and interspecies ethical issues (Dovers 1997).

Early attempts to address these problems focused on their technical aspects, with key contributions from biologists, hydrologists, soil scientists and engineers. As natural resource management (NRM) has matured, the contributions of social scientists have assumed increasing importance. As noted by Maltby (1997), NRM is now about 'coupling sustainable economic, social and political systems with a sustainable environment maintaining the biodiversity and natural resources on which we all depend'.

Most natural resource degradation results from the activities of people and improvement will only happen when people alter their behaviour. Effecting behavioural change is often a complex, time consuming task. Of course the move towards ecologically sustainable development (ESD) will also require better understanding of natural systems, as well as technological innovation. However, technical solutions may not exist, and if they do, may be too expensive, have unforseen consequences, or be viewed as inappropriate to people's needs. There are numerous examples where desired changes have not occurred even though apparently feasible management options have been developed and promoted. Closer examination frequently reveals that the target group believed the proposed options were inappropriate for their circumstances. Changing behaviour usually requires understanding of the organisation, beliefs and aspirations of people.

Social and economic inequalities are fundamental causes of resource degradation at local, national and global scales. Large agribusiness firms exercise their market power to maximise profits, in part by squeezing the margins of farmers. There is no 'level playing field'. Australian exporters compete against products from countries with lax environmental controls and limited protection for labour. Over-harvesting of renewable resources in third world countries is driven by a complex and powerful mix of population growth, local people attempting to meet basic needs, multinational companies seeking to optimise profits and regional elites attempting to sustain their power and privileges. It must also be remembered that rural communities are not homogeneous: class, gender, age and geographic location are important determinants of people's capacity to

access resources and adjust to change. Sectional interests also promote issues of concern to them. For example, some regional groups in Australia have used salinity to gain a disproportionate share of natural resource management funds.

Most of the world's ecosystems have been shaped by people and are as much cultural as natural landscapes. Resource degradation is also a social issue because it affects living standards and the quality of life for current and future generations. Intergenerational equity also means that today's generation cannot be held responsible for all the costs of repairing past degradation. Social science has a central role to play in the successful development and implementation of NRM programs. Identification of management objectives, options for achieving these objectives, and selection of preferred options are a matter of social choice, and are based on values as much as technical facts. Establishing institutions and processes for representing and giving expression to these values requires input from social scientists with expertise in political science, management science, economics and sociology.

Previous chapters in this volume have explained key aspects of many of these issues and suggested ways of managing them better. The focus in this chapter is on the institutional and policy setting for natural resource management in Australia. The underpinnings of current settings are explored, key issues highlighted, important lessons illustrated, and recommendations made for achievement of ESD in rural Australia based on a state-sponsored citizen participation model.

2 THE CURRENT INSTITUTIONAL AND POLICY SETTING

Over the past two decades, natural resource policy in rural Australia has been influenced by two widely accepted sets of principles: ESD and total catchment management (TCM). Economic rationalism, though not favoured with the same widespread acceptance, has been an important influence on the policies and institutions which provide the framework for NRM. The first part of this section describes these principles, and processes they have engendered, which have helped shape NRM policies and institutions. The second part outlines some of the major policies and institutions which have been developed to deal with the NRM issues identified earlier. Emphasis is given to the National Landcare Program (NLP), since this enables exposition of many of the features of the current policy setting.

Key principles and processes

ESD and TCM

The ideal of sustainable development has been adopted internationally by the United Nations in the Rio declaration and Agenda 21, by the International Union for the Conservation of Nature (IUCN), and by Australia through the National Strategy for Sustainable Development (NSSD) (Commonwealth of Australia 1992). ESD is based on three broad goals: environmental integrity; economic

efficiency; and equity across present and future generations. Other elements in ESD include:

- enhancing international competitiveness in an environmentally sound manner (NSSD);
- adopting cost effective and flexible policy instruments (NSSD);
- providing for broad community involvement (NSSD);
- taking a global perspective (NSSD);
- respect and care for the community of life (IUCN);
- keeping within the earth's carrying capacity (IUCN); and
- improving the quality of human life (IUCN).

NSW was the first jurisdiction in Australia to have ESD embodied in legislation, in the *Protection of Environment Administration Act* 1991. The purpose of this Act is to 'protect, restore and enhance the quality of the environment in NSW, having regard for the need to maintain ecologically sustainable development'. The Act specifically refers to:

- the precautionary principle: 'if there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation';
- intergenerational equity;
- biodiversity and ecosystem conservation; and
- improved valuation and pricing of environmental resources.

Recognition of the environment as an integrated system of inputs, components, processes and outputs has led to adoption of TCM as a planning framework for achieving ESD. The characteristics of TCM are:

- integration of economic, social and environmental values;
- recognition that stakeholder representation and participation is an essential component of legitimate and successful NRM;
- adoption of a strategic planning approach, that is planning is driven by key issues;
- use of an adaptive approach to planning and management;
- recognition of the need to address long-term and incremental change; and
- establishment of catchment-based regional planning units for planning and community participation.

Community participation

Demands for greater community participation reflect concerns about the legitimacy and efficacy of modern systems of representative government. Perceptions of community participation vary, largely in terms of the extent to which the community exercises decision making power, with notions of participation ranging from the provision of information through to local control of decision making (Arnstein 1969).

There are ethical and pragmatic reasons for involving the public in decision making. Public participation is believed to legitimise planning outcomes, reduce citizen alienation, avoid conflict, give meaning to legislation, build support for agency programs, tap local knowledge, provide feedback on program outcomes, contribute to community education and enhance democratic processes by

increasing government accountability (Creighton 1981; Daneke 1983; Lyden *et al.* 1990).

However, participation processes must also recognise that representative democracy already provides for representation of stakeholders' views and protection of individual rights (Wengert 1976). Some authors have argued that participation processes should not attempt to articulate a representative cross-section of views, and be confined to informing rather than determining policy (Cuthbertson 1983; Daneke 1983; Priscoli 1983). The effectiveness of participation may also be compromised by:

- participants feeling that their contributions were only token, since the relevant decisions had already been made (Lyden *et al.* 1990);
- the difficulty of resolving conflict in the context of a participatory process (Landre and Knuth 1993);
- different perceptions between an agency and stakeholders regarding the purpose of participation (Kweit and Kweit 1981);
- co-option of participation processes by agencies (Grima 1983); and
- tendency of some processes to favour advantaged groups (Sandercock 1986).

Although such concerns need to be taken into account in the development of participatory processes, stakeholder involvement remains an essential component of achieving ESD in rural Australia. Opportunities for rural people to manage their own affairs, shape public decisions, and participate in activities that affect their economic productivity and quality of life are crucial for accomplishing broad-based rural development (Esman and Uphoff 1984). Successful rural development projects have been those that provided for the active participation of beneficiaries and were sensitive to local conditions and cultures (Kottak 1991; Uphoff 1991). If stakeholders are adequately represented in decision making, and if decision making processes are adopted that allow stakeholders to co-operate in an honest and open exchange of views, stakeholders can develop empathy for the positions of others and it is possible for agreed positions to be reached that are accepted as fair to all parties (Kaplan and Kaplan 1989; Landre and Knuth 1993). Ostrom (1990) believed this 'social capital' would allow stakeholders to develop cooperative mechanisms to resolve common pool resource dilemmas as alternatives to reliance on market forces or a central authority. In particular, participation through local organisational structures can motivate people to obtain the knowledge and resources required to adopt new land management practices.

Planning approaches

Most NRM in Australia has been undertaken using some mix of participative, rational/comprehensive and incremental approaches. Incrementalism is an *ad hoc* approach to management, in which there are no medium- or long-term objectives, and no strategic vision. Problems are addressed as they arise, and solutions are only considered if they are easily implemented. Policy is constructed according to determinants such as political acceptability, administrative tractability, and cost. Rational/comprehensive planning is a science-driven process which attempts an

objective and exhaustive analysis of environmental conditions. This analysis is then used to develop models and processes designed to arrive at a solution which best meets a set of objective criteria. Uncertainty and risk are very difficult to accommodate, and social and political dimensions tend to be neglected (Briassoulis 1989). The mix of approaches has generally not been arrived at through any consciously deliberative process. It simply reflects the imperatives of dealing with the issues at hand and the nature of the organisations responsible for planning and policy development. The move towards adaptive management is in part a recognition of the failure of the incremental and comprehensive/rational approaches.

Incrementalism has been particularly evident in the development of environmental policy, which has had a history of 'lurching, myopic '*ad hocery*" (Dovers and Mobbs 1997). Local scale planning has tended more towards a combination of the rational/comprehensive and participative approaches. This is particularly true of public land planning (as, for example, in the production of management plans for protected areas), but also applies to attempts to deal with rural issues (as, for example, in the Shepparton salinity management plan; SPPAC 1989). Although these have had some effect, the plans have suffered from an inability to deal with changing circumstances, a poor record of implementation (many actions specified in such plans have never been carried out), and a lack of evaluation.

Adaptive management treats NRM as an iterative process of review and revision, not as a series of fixed prescriptions to be implemented (as in the rational/comprehensive approach). Management interventions are seen as a series of successive and continuous adaptations to variable conditions. The approach emphasises flexibility, requires willingness to learn through experience, and may require sacrificing present or short-term gains for longer term objectives (Briassoulis 1989). The emphasis is on learning how the system works through management interventions which are both issue orientated and experimental (Ackoff 1970; Dovers and Mobbs 1997).

Integrating effective stakeholder participation with the adaptive approach is not straightforward. In the past, NRM often maintained a separation between the planning phase and implementation of the plan. Evaluation and monitoring, though specified in many plans and policies, have often not been implemented (ANAO 1997). Stakeholder participation, particularly in the management of public lands, has generally been confined to the initial planning phase. In contrast, effective stakeholder participation in the adaptive approach demands an ongoing and long-term involvement (Dovers and Mobbs 1997). Such extensive and open-ended commitment places considerable demands on all stakeholders; demands that are often impossible to meet. It is probable that the only stakeholders to maintain engagement with an adaptive process would be those with the most to gain (or lose). Stakeholders such as urban residents in regional centres and city-based environmental groups often find it difficult to make a meaningful contribution to such processes. Any approach which disadvantages certain stakeholders will pose problems of legitimacy and credibility for the outcomes.

Economic rationalism and its limitations

Concurrent with the increasing influence of ESD and TCM, has been the rise of economic rationalism as an approach to the development of public policy. In essence, economic rationalism advocates maximising the role of the market as a mechanism for determining the production and allocation of resources. The primacy of the market is based on the following logic. Welfare and micro-economic theory show that maximising net economic welfare can be achieved though economic efficiency. Economic efficiency is achieved when the marginal benefits associated with consuming a particular good are equal to the marginal costs of producing that good. Perfect markets will automatically achieve efficiency as an equilibrium position. Therefore, we should strive to create perfect markets for as many goods and services as possible. These ideal markets require perfect competition between actors in the market; availability of full information in relation to goods being traded and the mechanisms of trade; and allocation of property rights so that all goods in the market can be exclusively owned by individuals, and 'non-paying customers' excluded. The extreme economic rationalist view is that the state should only intervene to ensure that perfect competition and full information are maintained and to ensure price stability. Beyond these activities, state intervention is regarded as a source of inefficiency. However, state intervention may be required when one or more of the ideal market conditions does not apply. The role of government is to bridge the gap between private actions and social objectives (Young *et al.* 1996).

Of most significance for NRM are two (related) classes of problem: the oversupply of goods which have external (outside the market) costs such as pollution; and the undersupply of public goods such as biodiversity conservation over which individual property rights cannot meaningfully be allocated. The costs of resource degradation have rarely been included as a cost of production. These external costs may include reduced water quality, loss of non-use values, and loss of recreational opportunities. The external costs of clearing remnant native vegetation on farmland are borne by downstream landholders and other stakeholders, and include loss of biodiversity, effects of rising watertables and lowered water quality. There is no incentive for landholders clearing vegetation to consider these costs as they do not affect their profitability. Landholders who do take external costs into account are likely to lose out to competitors who do not (Thomson 1986).

Pure public goods and services contribute to the general welfare of society, but cannot be 'owned' by individuals. The private sector is not able to efficiently provide these goods and services because benefits arising from them do not directly accrue to specific individuals. When benefits are available to all, consumers are assumed to be unwilling to offer voluntary payment, and the link between production and consumption is broken (Barkley and Seckler 1972).

To some extent resource degradation results from a pricing mechanism that fails to measure the full range of values of natural resources. A truly efficient allocation requires that the environment is fully valued to reflect the relative scarcity of all goods and services:

> *for markets to promote sustainable investment and resource use, the information embodied in prices must include environmental values so that producers and consumers pay for the costs of maintaining environmental integrity, landscape amenity values, and conditionally-renewable resource stocks* (Young 1992).

The allocation of individual property rights is one way to address this problem. For example, property rights can be issued over water allocations to create a market for tradeable permits. This would encourage more efficient use of water. For other goods this is not feasible or possible. Perhaps the best example of this concerns what economists have termed 'non-use' values. Non-use values concern the value people place on the existence of a natural area, regardless of the importance of other values related to consumption, either of products (as in grazing fodder), or experiences (as in recreation). Non-use values are pure public goods, and vesting natural areas in private ownership would not guarantee their continued supply. Indeed, such values would be undersupplied by private nature reserves, since management would be orientated towards providing consumptive activities from which revenue could be generated. Many of these activities would have an adverse effect on non-use values. With respect to natural areas on private property, it is inequitable that the farming community should bear the cost of maintaining the supply of non-use values (Donaldson 1996). Methods for determining the non-use values of resources have only been widely canvassed in recent years and are not always included in benefit-cost analyses. The accounting practice of discounting future values of a resource compared with the value of current use also tends to understate the environmental values of natural resources.

A market system alone cannot perform all economic functions. The public sector is required to provide those social goods and services required by the community where the market is an inefficient producer and to manage situations where externalities arise that affect social welfare. A crucial task for natural resource policy is to determine the appropriate allocation of property rights and responsibilities, together with the associated distribution of costs and benefits. Both efficiency and equity are important guiding principles for directing this task. Efficiency in particular should not be thought of in narrow economic terms, but more broadly in terms of 'different property rights regimes, institutional arrangements, co-operative approaches, covenants, agreements and so on' (Dovers and Mobbs 1997).

Of course it must also be recognised that government policies have contributed to resource degradation. Perhaps the best examples of this are in the settlement schemes that established inappropriate property sizes, the subdivision of marginal land, government support for irrigation schemes, and vegetation clearing promoted by taxation incentives. However, the numerous instances of 'government failure' do not mean that market-based approaches would fare any better. Indeed, when ensuring continued supply of non-use values, for example, they are bound to fail. Ways must be found to improve government performance, not substitute markets for government.

Current NRM programs and the NLP example

The major NRM programs developed by Commonwealth, State and Territory governments up until 1997 are indicated in Fig. 1. Perhaps the most significant of these for rural Australia has been the NLP. Landcare and TCM are very important elements of an emerging Australian success story which involves:

- community participation in natural resource management;
- agency/community partnerships;
- regional catchment planning; and
- the application of cost sharing principles to deliver public resources for improved management on private property.

These are some of the key elements of a practical model of state-sponsored citizen participation for resource management in developed nations. There are also lessons here for other countries. This review of Landcare and TCM also highlights important issues and challenges. These include:

- inherent limitations and contradictions in the principles underpinning our current settings;
- limitations of our current policy mix or institutional arrangements;
- critical gaps in our knowledge base and planning tools; and
- inadequate management practices.

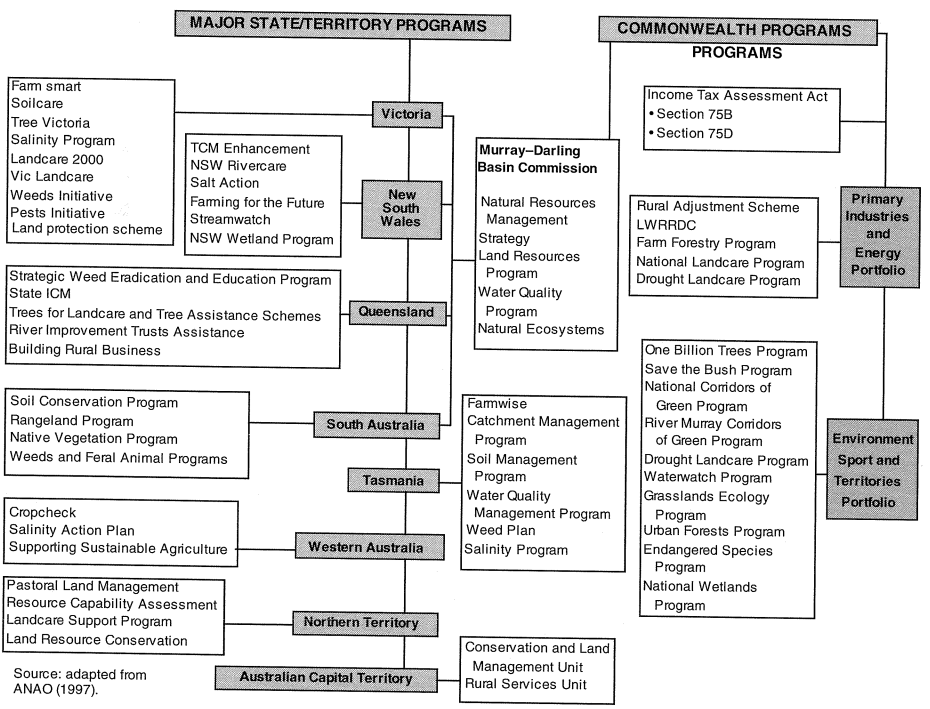

Fig. 1. Natural resource management programs, 1996–1997.

The NLP first emerged as a distinctive entity in Victoria during 1986, and after lobbying from major farmer and conservation groups, the Commonwealth Government committed spending of $360m in the *Decade of Landcare* program (Hawke 1989). Landcare was intended to achieve more sustainable use of Australia's farming lands (DCE 1992) and enhance biodiversity (Farley and Toyne 1989). The NLP embraced all facets of sustainable resource use (ASCC 1991) but it was the emergence, activity and impact of voluntary, local community groups working in partnerships with agency staff which captured public attention and distinguished Landcare from previous strategies. There is now a huge investment in Landcare and in many ways, Landcare offers the current generation a one-off opportunity to make a difference.

Landcare means different things to different people. Some see it as an ethic, some as a 'greenie' plot, others as an extension program or a delivery mechanism for government funding of NRM. Most landholders see Landcare as a way of coming together and working with governments to fix problems in their local area (Campbell 1994). From a government perspective (ASCC 1991; DCE 1992), Community Landcare was a catalytic program attempting to engage a large proportion of the rural population and produce more aware, informed, skilled and adaptive resource managers with a stronger stewardship ethic (Curtis and De Lacy 1996*a*). It was expected that this process would result in the adoption of more sustainable resource management practices. Landcare involved limited government funding of education and demonstration activities as opposed to direct funding of large-scale, on-ground work.

Landcare attempts to work with a broad section of the rural community and has moved extension beyond the 'expert farmer' group. There are now over 4000 Landcare type groups with around 120 000 volunteer members (Curtis and De Lacy 1996*b*), involving about 30% of the farming community (Mues *et al.* 1994), or an average of 50% of households where there is a Landcare group (Curtis and De Lacy 1996*b*). Participation in group activity has enhanced social cohesion and the capacity of rural communities to pull down resources from government and adjust to change (Alexander 1995). Landcare participants are now making important contributions to natural resource management decision making (Curtis *et al.* 1995). Group processes provide opportunities to learn by doing and by interacting with peers and enable Landcare participants to discuss conflicting views and explore emerging issues in a reasonable fashion (Curtis 1998; Millar and Curtis 1998). Landcare participation has increased awareness of issues and enhanced landholder skills and knowledge (Curtis and De Lacy 1995). Landcare has also contributed to increased adoption of best management practices (Curtis and De Lacy 1996*a*). There are now many examples where group activity has accomplished on-ground work likely to reduce land and water degradation at the local or subcatchment scale (Campbell 1994; Commonwealth of Australia 1997; Curtis 1998).

The community–agency partnership is a fundamental element of Landcare and nurturing an effective, enabling relationship is critical to program success. Surveys across a number of Australian states (Curtis and De Lacy 1995; Curtis 1998) suggest that overall, groups and agency staff have established effective

working relationships based on trust and a shared sense of purpose and that the lead agencies have a firm commitment to developing effective partnerships with groups. For example, large majorities of respondents to these surveys believed that agency contact staff showed respect for the skills and knowledge of most members. Respondents also indicated high levels of satisfaction with the communication and technical skills of agency contact staff; and with the support provided by agencies in terms of information and advice relating to land management, assistance with group administration and coordination of on-ground activities.

By 1992, state agency projects funded by federal Landcare money and the project submissions of local Landcare groups were being scrutinised by Regional Assessment Panels (RAPs) with a majority of community representatives. These panels operated under the authority of regional Catchment and Land Protection Boards (CALP Boards in Victoria) or Integrated/Total Catchment Management Committees (TCM Committees in New South Wales). These catchment management committees comprised Ministerial appointees from regional communities, including Landcare representatives, and were funded and coordinated by the lead agency responsible for Landcare. Catchment management committees are now responsible for developing regional catchment strategies and managing regional assessment panels which assess community and agency project applications as part of the National Heritage Trust (NHT) 'one-stop-shop' process (Commonwealth of Australia 1998).

Regional catchment committees may provide the missing institutional mechanism that links and supports the activities of the local, community-based Landcare groups. These regional bodies have the potential to provide the important regional perspective necessary to manage what are increasingly regional issues; provide accountability for expenditure of public money; coordinate, but not control the activities of the various independent community groups; and enable community groups to influence broader policy development and 'pull down' additional resources (Curtis *et al.* 1995).

Landcare advocates in the early 1990s pressed for an expanded and revised NLP. Through their representation on regional catchment management committees and fora such as the Murray–Darling Basin Ministerial Community Advisory Committee (CAC) and the National Landcare Advisory Committee (NLAC), they argued for a change in policy. They contended that whilst Landcare had been successful, limited funding of a rural development process would not make a significant impact at the landscape scale. These advocates argued for increased funding of on-ground work on private property using cost-sharing principles where community and private benefits from specific works are identified. They argued that increased funding for Landcare work on private property was not an unwarranted industry subsidy and was justified on the grounds that:

- the community benefits of important remedial works such as revegetation on steep hills, fencing water courses to control stock access and establishing perennial grasses on steep, infertile hills usually outweigh benefits accruing to private landholders;

- most land degradation problems have been inherited from previous generations;
- government policies have contributed to many land degradation issues; and
- there is an important linkage between the conservation of native flora and fauna and the condition of privately owned agricultural land.

Prior to the 1995 federal election, both major political parties in Australia committed to increased funding for Landcare, including large scale works on private land where there were identifiable conservation outcomes. With proceeds from the partial sale of Telstra (the national telecommunications carrier), the federal Liberal Government has provided increased funding for Landcare for five years through the establishment of a $1.25 billion NHT. 'The NHT is based on the premise that conservation and production objectives converge in the long run' (Commonwealth of Australia 1998). The NHT consolidated a number of the programs listed in Fig. 1. Major programs encompassed by the NHT (and the approximate dollars allocated by the Commonwealth to each program for the next five years) include Bushcare ($328 million); NLP ($264 million); Murray Darling 2001 ($163 million); Coasts and Clean Seas Program ($106 million); National Rivercare Program ($97 million); National Reserves System Program ($80 million); National Land and Water Resources Audit ($37 million); National Weeds Program ($24 million); Farm Forestry Program ($22 million); Endangered Species Program ($16 million); National Feral Animal Control Program ($16 million); and National Wetlands Program ($11 million) (Lyle, pers. comm.).

The NHT has a much greater emphasis on on-ground works than the old NLP: 'The highest priority of the Natural Heritage Trust is to fund activities which will result in long-term on-ground environmental or natural resource improvement' (Commonwealth of Australia 1998). The NHT assumes that 'regional or catchment-level actions are an important approach to sustainable management' (Commonwealth of Australia 1998). Priority is being given to funding projects which address priorities already identified in existing regional or catchment plans. NHT applicants are required to demonstrate the relative proportion of public and private benefits flowing from projects. The majority of funds and programs will be delivered through the existing regional and state assessment panel processes. The revised objectives of the NLP are to:

- enhance long term productivity of natural resources;
- promote community, industry and governmental partnerships in the management of natural resources;
- assist in establishing institutional arrangements to develop and implement policies, programs and practices that will encourage sustainable use of natural resources;
- assist in developing approaches to help resolve conflict over access to natural resources; and
- assist in raising the natural resource and business management skills of landholders (Commonwealth of Australia 1998).

The NHT represents a large increase in federal funding of NRM, however, it is still only a small proportion of the estimated cost of land and water degradation associated with lost agricultural production.

Allocation of resources and responsibility under NLP and NHT

Although there is widespread community support for Landcare there has been concern about both program logic and program implementation. Agencies can co-opt participation processes and subvert rural development efforts. Midgley (1986) defined co-option as '... a process by which the state seeks to gain control over grass-roots movements and to manipulate them for its own ends'. Landcare has been criticised as an exercise in shifting responsibility for action from government to local communities (Martin *et al.* 1992). It was undoubtedly cheaper to invest in Landcare as a process of awareness raising and education than in funding large scale on-ground work.

Landcare participants openly express frustration that their successes are held up as evidence of government commitment at the very moment state governments are imposing severe cuts to extension support and massive reductions in education, health and transport services to rural communities. One of the reasons for these cuts has been reduced funding for the states by successive federal governments. It is ironic then that in recent NHT funding rounds the Federal Government has loudly castigated the states for attempting to shift the costs of NRM to the Federal Government by dipping into NHT.

Agency staff play an important role in the decision making of many Landcare groups and group work is significantly related to government funding (Curtis 1998). Despite the lack of prescription of the role and operation of Landcare groups, governments exert control over groups through the allocation of Landcare funds to groups and projects which address government priorities (Lockie 1992). In the absence of an independent Landcare organisation, groups are reliant upon agency staff for much of their information. Intergroup communication is improving, but remains limited. There is also evidence that state agencies have captured a large part of the Landcare resources provided by the Federal Government. Direct funding to Landcare groups represented 20% of Community Landcare Program expenditure in 1991–92 and 15% in 1994–95 (Campbell 1992; Alexander 1995). Concerns about Landcare resources not 'hitting the ground' often resulted from misunderstandings about the scope of the NLP. Although most funding went to Community Landcare projects, the NLP also funded Commonwealth–State partnership agreements and a limited number of Commonwealth projects.

An important trend encouraged by the lead agencies is for Landcare groups to be linked through so called networks (Youl 1996; DLWC 1997).Youl (1996) reported that there were 25 networks in Victoria which usually comprised between 5 and 25 local groups. Linking together in a network may appeal to groups as a way of increasing their capacity to compete for scarce resources and enhance group impact on agencies, catchment committees and government. For example, a network might be more competitive in securing funds through regional assessment processes. Networks can provide opportunities for incorporating local knowledge into knowledge and information systems and they should facilitate information dissemination. Given sufficient resources, networks could facilitate more sophisticated approaches to landholder training that move beyond the typical one-off field day or workshop held by many Landcare groups (Race and

Curtis 1996). In part, the trend towards networks of groups is driven by government and agency demands for efficiency, accountability and effective regional planning (Youl 1996). With a large and increasing number of groups it is easy to understand the reasons why government and agencies would want to deal with a smaller number of coordinating groups. Government and agency partners may use networks as a way to control group processes. It is also possible that the effort required to establish and run a network may divert the energy of key Landcare members to the extent that group activity and impact declines. Networks may also form around individuals more concerned about promoting personal or sectional interests than the work of Landcare. Without adequate resourcing and appropriate training of network personnel it is likely that networks will be weighed down by poor management and substantially increase Landcare member frustration and burnout amongst leaders.

Landcare can also be seen as a strategy for farmer organisations and government to deflect criticisms of structural impediments to sustainable resource management and defer taking hard decisions about farm and regional viability, land tenure systems, allocations of river water for irrigation or vegetation clearing. Farmers may have embraced Landcare as a way of propping up existing ownership structures such as the family farm or leasehold rights; or protect access to leasehold grazing land in opposition to conservation or aboriginal interests; or act as a bulwark against the claims of 'greenies' and 'animal libbers' that they make costly changes to current practices. Dr Bob Brown, Tasmanian Greens Party Senator, speaking at the 1994 National Landcare Conference in Hobart (Grose 1994), suggested as much when he said Landcare had failed to address the need to remove grazing from the 1.8 million hectares of Australia's arid zone and that Landcare was overly preoccupied with increasing agricultural productivity. On the other hand, Alexander (1995) documented examples where groups were beginning to address structural impediments to sustainability. These concerns about Landcare also reflect the limitations of public participation as an approach to policy and strategy development.

'Management of a volunteer program constitutes a legitimate job in itself, which requires a significant investment of time and can benefit from specialised education and/or training.' (Brudney 1990). The reality is that the community Landcare component at both federal and state levels has been 'run on a shoe string' with small budgets and limited numbers of personnel, has very few senior staff directly involved in program management, and a limited number of managers with specific knowledge of volunteer management. A number of authors have highlighted important Landcare group management issues including: inadequate leadership and management skills training; low turnover and gender stereotyping of leadership positions; limited intergroup communications; minimal intergroup interaction; poor communications between groups and agency decision makers; and inequity in funding allocation between groups (Campbell 1991,1992; Edgar and Patterson 1992; Alexander 1995; Curtis 1998). The potential of these problems to reduce the effectiveness of Landcare was highlighted by the finding that about one-quarter of all Victorian groups were operating at very low levels of activity (Curtis 1998).

In the absence of rigorous and consistent cost sharing guidelines, the NLP/NHT generally allowed community groups to attract funds on a two dollar for one community dollar basis. It was recently announced that from 1999, community projects will be expected to contribute one dollar for each federal dollar (Commonwealth of Australia 1998). Whilst this change may spread federal funds further, it is not based on sound cost sharing principles, was developed without community consultation and has not been explained. This change has undermined community confidence in the government's commitment to NHT, as has the long wait for approval of 1998/99 NHT grants. The ANAO (1997) review found that the process of separate regional, state and federal assessments was time consuming and excessive.

A large number of groups are requesting support with group coordination. Some groups have members with the skills, commitment and time to undertake group coordination, but many groups want ongoing funding of a coordinator (usually part-time and often in partnership with other groups). Until now, the assumption has been that groups could be 'kick-started' by government funding, but over time they would become largely independent of funding for coordination. This approach fails to acknowledge the growing weight of Australian (Campbell 1992; Rush 1992) and overseas (Brudney 1990; Pearce 1993) evidence highlighting the critical role of group coordination in volunteer programs.

Newspaper articles (Lunn 1998) have claimed 'pork-barrelling' in the allocation of NHT funds across federal electorates. Information obtained by *The Australian* under a Freedom of Information request indicated that electorates held by the government parties secured nine out of every ten dollars allocated for the NHT in 1997–98 (Kerin 1998). The mean allocation per Coalition seat was $727 476. However, most rural electorates are held by the governing Liberal and National parties and you would expect the majority of funds from programs ostensibly supporting conservation in Australia's rural environment to go to those electorates. Political influence is unlikely to have much impact on the development and approval of NHT community projects. Projects are developed at the local/regional level and ranked by regional assessment panels. These rankings are examined and usually accepted by state panels before being passed to the federal bureaucracy for scrutiny and final approval as part of state–federal partnership agreements. Interim figures released by the Commonwealth to *The Australian* appear to confirm this view: '... of 2020 projects — worth more than $100 million — submitted by the state panels, 10 times as many came from Coalition rural seats as Labor seats. Of these, 1475 projects (83.8 per cent) received approval. Only 182 applications, or 9 per cent, came from Labor seats, with 151, or 83 per cent, approved.' (Kerin 1998).

Some catchment committees have complained that projects rated highly by regional and state assessment panels were not funded under NHT. It seems that the Commonwealth judged some of these projects to be examples of cost shifting by the states or work that was largely a landholder responsibility. There are also examples where regional priorities have not been followed by state panels. Regional panels have been given little information about the reasons for changes to their priorities and community groups receive little feedback from state and

federal assessment processes on unsuccessful applications. Changes to regional priorities need to be explained and processes established, including developing and communicating clear guidelines, to prevent this happening.

Landcare and biodiversity conservation

Conservationists are alarmed by continued loss of critical habitats and believe Landcare and the NHT have not adequately addressed biodiversity conservation. Dr Bob Brown, Tasmanian Greens Party Senator, suggested that Landcare was overly preoccupied with increasing agricultural productivity (Grose 1994). Tim Fisher, Australian Conservation Foundation (ACF), has criticised NHT programs like Murray Darling 2001. He claimed that they are little more than industry subsidies, with negligible spending on nature conservation (Lunn 1998). There is an element of truth in these claims. In part they also reflect the ACF's frustration with being excluded from most catchment committees and with the capacity of the NLP/NHT to deliver improvements at the landscape scale. For example, the rate of land-clearance in Australia has fallen slightly in the last decade, but 500 000 ha are still being cleared each year (Bita 1997).

The authors' experience in Victoria is that over the past five years few projects with a biodiversity focus (other than revegetation projects that mostly addressed salinity) have been submitted or supported as high priority projects. The ACF believes that this issue reflects a fundamental limitation of regional catchment committees and NHT delivery. A large part of the problem is that catchment committees do not have the decision support tools which would allow them to make a scientifically sound allocation of resources across competing issues (see Section 3). Groups and agencies must be encouraged to submit projects addressing biodiversity issues. Governments, conservation organisations and natural resource managers need to ensure that environmental interests are represented on catchment management committees and NHT RAPs. In some of the more remote regions of Australia there are few individuals with sufficient expertise or credibility to represent environmental interests on RAPs. To a large extent the economic interests of landholders have dominated catchment management committees which develop regional catchment plans and manage the NHT RAP process. In Victoria, the Liberal Government continues the narrow representation on these regional boards, with a majority of farmers on each of the recently established Catchment Management Authorities (CMAs) (established 1 July, 1997). For the 1998 NHT round, the Commonwealth requested the states to ensure that RAPs had members with conservation expertise. With poor returns from agriculture and limited resources for Landcare, groups and NHT RAPs have understandably focused on group coordination and issues such as salinity, soil acidity, erosion, rabbits and pasture decline which directly affect production. The priority given to production issues in Victoria is partly due to the greater power of the Agriculture Program compared with the Parks and Flora and Fauna Programs in the amalgamated Department of Natural Resources and Environment.

ACF and Greening Australia have played critical roles in bringing biodiversity conservation issues to the attention of regional catchment management

committees and boards. Greening Australia's regional network of Bushcare Support staff has been important in providing expertise for the development of large, integrated regional revegetation projects (Curtis and Race 1998). The authors' experience of the 1997 NHT RAP process suggested that increased numbers of projects addressing biodiversity issues had been submitted and had received higher priority than in the past.

Concerns that Landcare groups have ignored important biodiversity issues such as riparian areas, wetlands, native grasslands and vegetation clearing are largely unjustified. Wetlands and native grass management are emerging national issues which natural resource agencies and conservation groups are only just coming to grips with. For example, the Federal Government only recently released its draft wetlands policy (ANCA 1996). It would be unrealistic to expect Landcare groups to be in the vanguard on these issues, although some groups have taken them up (Curtis 1996). Landcare participants across Australia are undertaking work such as feral animal and weed control, fencing of water courses, and planting trees and protecting remnant vegetation, all of which make a considerable contribution to biodiversity conservation.

A recent survey of Victorian Landcare groups (Curtis 1996) found that even in a year affected by drought, Victoria's 700 Landcare groups established about five million trees and shrubs in 1995. Fencing water courses to manage stock access to riparian areas is one example where Landcare work results in community benefits outweighing the benefits accruing to private landholders. Fencing water courses assists with establishing habitat corridors by planting trees/shrubs or encouraging regeneration of remnants. This then helps stabilise eroded creek banks, limiting the deposition of sediments in rivers and storages which damages sensitive plants and reduces native fish habitat. Revegetating water courses traps nutrients in runoff, or stabilises eroded gullies to prevent the loss of nutrients attached to clay particles, which in turn helps prevent algal blooms. Curtis (1996) calculated that in 1995, Victorian Landcare participants erected about 3500 kilometres of fencing as part of their efforts to manage land degradation. Government funding for tree planting and fencing is consistently positively correlated with the level of group activity (Curtis 1996). However, community or private contributions usually exceed government funding for a project.

In part, concern that Landcare is not adequately addressing biodiversity conservation reflects confusion about what can reasonably be expected of these voluntary groups. As Campbell (1997) explained, 'the extent to which land degradation problems are fixed and land management changes implemented depends on the everyday decisions of individual land users, decisions which are only influenced at the margins by Landcare groups'. Landcare participants are concerned about biodiversity and make the linkage between sustainable agriculture and biodiversity conservation. They are understandably more concerned about the profitability of their enterprises than with their responsibility for enhancing off-farm conservation values. These findings highlight the importance of clearly articulating linkages between conservation of biodiversity and profitable agriculture and using a mix of policy options to support on-farm conservation. Landcare continues to provide an excellent forum for landholders

to learn about linkages between conservation of biodiversity and profitable agriculture and develop locally appropriate management strategies.

3 TOWARDS EFFECTIVE STATE-SPONSORED, COMMUNITY-DRIVEN NRM

Despite the gains made over the past two decades, especially through the NLP, rural Australia continues to suffer large-scale environmental degradation. The way forward requires the following challenges to be met:

- improving governments' ability to identify and apply an effective mix of policy instruments;
- increasing adoption of best management practices at the local level;
- adoption of formal methods to determine efficient and equitable allocation of resources; and
- development of institutions capable of applying these methods, delivering allocations effectively to community-based organisations, and where necessary making the 'tough decisions' despite the opposition of strong sectional interests.

Effective policy development and implementation

Underlying causes of biodiversity loss arise in part from:

> *the failure of markets to value all biodiversity considerations, incomplete specification of property rights, poor institutional arrangements, failure to distribute information, inadequate resources allocated for biodiversity conservation, and a general lack of awareness of the value of biodiversity* (Young *et al.* 1996).

It is impossible for one instrument to address all these causal factors. An effective policy mix requires the use of instruments which have complementary strengths and which provide buffers against each others' weaknesses. The challenge is to develop integrated packages which may include:

- legislation or regulations which can be used to create an institutional framework for management, set aside areas of land, and enforce standards and prohibitions;
- self regulation;
- research to clarify problems, develop solutions, and monitor environmental conditions;
- education to convince people of the need to change behaviour, gain support for policy instruments, and ensure the ability to apply instruments; and
- economic measures such as charges, subsidies, penalties, and tradeable permits to assist efficient allocation of resources and equitable distribution of costs and benefits (Dovers 1995).

As noted in Section 2, market approaches to achieving ESD are insufficient when used in isolation. However, they can be effective when used with other mechanisms and incentives (Young *et al.* 1996). Governments have played a critical role in establishing and maintaining the policy framework within which competitive markets promote sustainable forms of resource use and investment (Hodge 1991; Young 1992).

Regulatory methods, on the other hand, attempt to impose rigid, uniform solutions which lack the necessary flexibility to address rapidly changing conditions (Nichols 1984). The outcome may be inefficient allocation of control efforts: too tight in some cases, too lenient in others. Regulatory failure through insufficient implementation and enforcement of regulations is widespread, especially with respect to biodiversity protection, where valued attributes are widely dispersed, enforcement resources are thin on the ground, and regulation is not supported by the local community (Young 1996). Regulatory instruments are not sufficient in themselves and more adaptive and educative tools need to be used in conjunction with these measures (Nadolny *et al.* 1991; James 1997). However, they do provide an essential safety net to ensure continued supply of essential public goods and services in the event that other policy approaches such as voluntary instruments fail (Bowers 1994; Young *et al.* 1996).

Economic instruments tend to be more flexible and provide greater individual choice (Buckley 1992), and may offer more cost effective ways for achieving environmental objectives (James 1997). The national ESD strategy (Commonwealth of Australia 1992) indicated the need for improved use of economic instruments for implementing the principles of sustainable development and achieving environmental protection at least cost to the community (James 1993). An example of where economic instruments may be more effective than regulation is in the management of externalities. Governments can 'internalise' external costs through the use of charges, or prices to be paid for environmental damage. One of the ways to implement charges is under the polluter pays principle, where landholders bear additional costs for damaging nature conservation values. This principle can be most effectively applied to catchment problems which have some point-source component, so that the 'polluter' can be directly identified (MDBC 1996). The limitation of the polluter pays principle is that it is restricted to external costs, and does not address the need to maintain supply of unpriced benefits associated with, for example, non-use values. This need is addressed by the beneficiary pays principle: anyone who receives benefits from conservation measures should contribute to the cost of on-ground works (Young 1992).

To date there have been relatively few financial incentives for conserving biodiversity (Young *et al.* 1996; Binning 1997; James 1997). However, there are signs that this is changing. The recently drafted Murray–Darling Basin Commission's cost sharing for on-ground works program sought to internalise external costs where possible, applying both the polluter pays and the beneficiary pays principles, while specifying the role of public funding where broader community benefits are involved (MDBC 1996; James 1997). The Murray–Darling Basin Commission (MDBC) cost sharing proposal applied the following principles:

- the full cost of providing services to specific identifiable beneficiaries or polluters should be recovered by way of charges to them;

- costs of public benefits or impact management which are unable to be attributed and charged to specific beneficiaries or polluters should be treated as community service obligations; and
- where costs are subsidised by government, they should be defined explicitly so that unsustainable precedents are not established (MDBC 1996).

The Victorian Government also attempted to develop cost sharing arrangements with its recently released cost sharing guidelines for nutrient management. Unfortunately, these initiatives towards national cost sharing arrangements are now bogged down in the maze of federal NRM agencies. At a local level, however, there are a few successful initiatives, such as the 'Fencing Incentive Program' run by the Murray Catchment Management Committee in New South Wales. Financial assistance of $1200 per kilometre of fencing is provided to farmers within the Murray catchment to fence out areas of remnant native vegetation. This program began in November 1996 and in the first six months of its operation resulted in 1039 ha of remnant native vegetation being fenced (142 km) (Wheaton pers. comm.).

Economic incentives must be developed concurrently with education and regulation (Roberts 1995). When combined with other mechanisms, financial incentives can make a significant contribution to strategies for nature conservation on private land (Crosthwaite 1995). These need to take the form of forward-looking payments for management rather than backward-looking compensation (Farrier 1995). Tax arrangements need to complement other policies and programs which influence land management decisions (Peterson 1995). The level of incentive offered by tax arrangements cannot be adjusted to reflect the magnitude of the potential off-farm costs and benefits, nor the diversity of regional conditions found in Australia. It is possible that, for example, a tax based instrument may have a positive effect in one bioregion and a negative effect in another. This inherent inflexibility can be overcome using non-tax instruments, although these may be administratively more expensive (Peterson 1995; Mues *et al.* 1994).

Management agreements are another approach that is gaining favour, in part because they can provide a framework for the integration of a number of other instruments. Essentially, a management agreement is a contract between a landholder and a third party regarding the use and management of their land (Binning and Young 1997). This third party can be government agencies, local government, non-government organisations or trusts (TPLUC 1996; Binning and Young 1997). Voluntary involvement in nature conservation on private land is also a more flexible and adaptive approach than the severity of regulations or binding agreements. It has the added benefits of low administrative costs, high community and political acceptability, and minimal equity implications (Platt and Ahern 1995*a*; Young *et al.* 1996). Where landholders have a genuine interest in protecting biodiversity, voluntary mechanisms are an effective strategy, particularly for encouraging and advising landholders (Platt and Ahern 1995*b*). Although voluntary programs are an essential step to achieving ESD, they are unlikely in themselves to change behaviour, and usually require a safety net of other approaches such as regulation.

Adoption of best practice

Increasing the adoption rates of best management practices by rural landholders is a difficult and complex task. Community development programs work best when they address local needs, extension agents respect local people and their knowledge, local people are meaningfully involved in decision making, and sufficient resources are provided to support change (Chambers 1983; Cernea 1991; Uphoff 1991). Raising landholder awareness of issues and enhancing their skills and knowledge are critical in effecting behavioural change (Vanclay 1992; Curtis and De Lacy 1995). It is also important to address structural impediments to community development (Midgley 1986; Wright 1990), which may require institutional change.

The assumption that behavioural change can be effected by developing a stewardship ethic has permeated important natural resource management programs in Australia.

> *Stewardship refers to the notion that farmers are stewards of the land and that farming is a way of life that places implicit responsibility on farmers to look after the land for future generations. The stewardship concept recognises that farmers may have to make uneconomical decisions in order to protect the land* (Vanclay 1992).

For example, the Murray–Darling Basin Commission's Natural Resources Management Strategy (MDBC 1990) stated that one of the objectives of this strategy is to 'Increase the Community's knowledge of natural and cultural resources and develop a stewardship ethic ...'. In a 'Statement on the Environment', the Federal Government of the day claimed 'The development of a landcare ethic among landholders and land managers is one of the most important developments in the environment debate in the last 10 years' (Keating 1992). Australian research suggests that most farmers have a strong stewardship ethic and a majority of landholders is concerned about the environmental impacts of land degradation (Curtis and De Lacy 1998). These findings suggest that moral considerations are an important influence upon landholder decision making and that much of the appeal of Landcare is that it reflects values already widely held in the rural community (Lockie 1992). However, landholders who hold a strong stewardship ethic do not necessarily adopt best management practices at a significantly higher rate (Vanclay 1992; Curtis and De Lacy 1998). Attempts to manage land degradation by developing landholder stewardship therefore appear misguided. Australian policy makers would be better advised to focus upon identifying what it takes to change landholder behaviour.

Attitudinal change is a relatively slow process, and research suggests that the link between attitudes and behaviour related to the adoption of conservation or farming practices is weak and unclear (Vanclay 1992; Curtis and De Lacy 1995). Although attitudes can be important, other factors may be more significant in influencing landholders' decisions. Expensive, unproved, complicated or non-traditional proposals will be adopted at a lower than expected rate despite positive attitudes (Australian examples include adoption of conservation tillage

for cropping, planting of perennial pastures, and farm forestry). Other factors relevant to the adoption of new behaviours include financial and time commitments required; uncertainty with respect to benefits and costs, especially financial costs; and family dynamics such as number of dependents, stage in the life cycle, and intergenerational transfer of property. Efforts to effect behavioural change need to address the underlying reasons for non-adoption (Vanclay 1992; Vanclay 1997). This may require education and training, financial support and provision of infrastructure. Vanclay (1997) emphasised that:

> *farming is a social process and farm management practices are a manifestation of that social activity ... farmers do not make conscious decisions about most issues — they do what is consistent with their social situation. Farming is a way of life more so than it is a business. An ethnographic understanding of how different groups of farmers construct their way of life is a more informative explanation of farmer behaviour than any economic concern.*

Although the social aspects are undoubtedly important, Vanclay has underplayed the significance of economics in farming decisions. Given the diversity of circumstances and motivations, landholders need to be offered a flexible suite of policy options.

Efficient and equitable allocation of resources

A fundamental concern with NHT is the absence of a scientific method supporting the allocation of resources to regions and projects. Campbell (1997), Assistant Secretary in Environment Australia, supported this concern: 'we need better ways of identifying and evaluating the public good to justify investment of public funds on individual properties, and to work out equitable cost-sharing arrangements'. Government has also invested increased sums of public money in NRM through NHT on the basis that regional catchment plans are of sufficient quality to ensure investment returns which would satisfy the Department of Treasury. This is a very risky strategy. Regional communities have sufficient knowledge to identify the issues and to manage some of them. Although there are numerous plans, there are few that are based on formal assessment of how limited resources should be allocated across issues and between regions. Decision support tools are being developed to address this problem, but massive investment in large scale on-ground works has already been made. No formal assessment has been made of the benefits associated with this investment.

Programs such as NHT could be better targeted if options for allocating resources were more formally assessed. Consider, for example, the role that economics can play in development of policies designed to conserve remnant native vegetation on private property. The standard tool to assess the economic implications of environmental policy options is benefit cost analysis (BCA). The values which can be assessed in a BCA include market and non-market economic benefits and costs. The market values relate to the on-farm benefits and costs associated with conserving remnant native vegetation. Benefits may include increased stock and crop production due to shelter and shade, increased

agricultural production due to land degradation control, and the provision of timber for firewood and fencing. The costs may include the opportunity cost of not clearing the land, loss of bush grazing and timber products, the materials and labour associated with fencing, and the ongoing management of the remnant. There are also off-farm market benefits associated with prevention of land degradation. Non-market benefits which may have an economic component include conservation of native plant and animal communities (both on and off-farm) and provision of scenic amenity.

These non-market values can be estimated using stated preference techniques such as contingent valuation (Mitchell and Carson 1989). Since landholders have no economic incentive to supply the off-farm and non-market on-farm benefits associated with native vegetation conservation on their properties, one way of ensuring the continued supply of these benefits is to implement a publicly funded incentive scheme. To be economically rational, such a scheme must be based on an extended BCA which includes consideration of community willingness to pay to secure the benefits.

Consider three possible outcomes of the BCA. If, for particular properties, on-farm costs of conserving remnant vegetation are less than the on-farm benefits, then conserving remnant vegetation makes economic sense for landholders. If they do not do so, it may be because they are unaware of the economic benefits the remnants contribute to their properties; and in this case, information programs are appropriate. If, for other properties, the on-farm costs of conserving remnant vegetation are greater than the on-farm benefits, then there is no economic reason for the landholder to conserve the remnants. If the on farm benefits plus the off-farm benefits plus the community's willingness to pay is greater than the on-farm costs, then a subsidy, paid by the community to the landholder for conserving the remnants, can be economically justified. In this case, the combined demand for private and public values is essentially much greater than the private demand for conserving remnant native vegetation. This provides a rationale for government intervention in the form of incentives to conserve native vegetation on private land, and other environmental functions and services that fall outside traditional markets. Government provision of economic incentives is a crucial mechanism to help promote conservation. Landholders pay costs associated with private benefits and communities contribute to landholders' resource management activities which yield public benefits (MDBC 1996). For a third class of properties, on-farm cost of conserving remnant vegetation may be greater than the on-farm benefits plus the off-farm benefits plus the community's willingness to pay. In this case, conserving remnant vegetation does not make economic sense, though there may be, of course, non-economic reasons for conservation.

This type of analysis is controversial, since it involves non-market economic valuation techniques which have yet to be accepted in Australia as reliable tools for economic measurement. Efforts are underway to overcome these concerns (Lockwood 1998). In any case, even conventional BCA, which is limited to readily measured market values, is rarely used to assist allocation of resources across NRM issues.

Attempts are being made by the Victorian Department of Natural Resources and Environment and the MDBC to introduce more formal assessment through the use of multicriteria analysis (MCA). MCA presents the effects of various proposals according to some preselected assessment criteria. Simple MCA applications present impacts in an appropriate form (number of jobs lost/gained, cost in dollars, description of animal and plant species affected and so on) and rely on decision makers to use this information, presumably on the basis of some intuitive aggregation of the various impacts. There is no attempt in this approach to MCA to aggregate formally across the different criteria to determine the best option. If one option performs better against all criteria, then clearly it is superior. However, different options are often superior in relation to different criteria. In such cases, MCA serves as a means of organising and presenting the value implications involved. In more sophisticated approaches to MCA, some attempt is made to rank criteria by their importance, or to reduce all values to a common scale. Such values should be derived through input from stakeholders, otherwise the rankings or values will merely reflect the views of the decision maker. The Resource Assessment Commission's view of MCA was as follows:

> *In the Commission's view, MCA can be an instructive tool in considering natural resource-use issues because it permits the combining of criteria based on different units or measurement. It is able to take into account the complex mixture of economic, social and ecological losses and benefits which resource-use issues inevitably involve, and different assumptions about weightings that analysts and decision makers may wish to give to different objectives. To be useful, MCA requires a level of data about resource-uses and their impacts as well as weightings associated with objectives, that may not often be available* (RAC 1992).

Efforts are also underway to develop NRM decision support tools which incorporate a commitment to efficient resource allocation. The economics branch of the Performance Evaluation Division in the Victorian Department of Natural Resources & Environment is developing and refining dynamic programming methods to apply to irrigation and dryland salinity policies, fisheries management options, and forestry management policy. The broad aim of this evaluation of programs is to improve resource allocation by the department across issues and between catchments. The development of decision tools designed to be used at the level of an individual farm enterprise is also encouraging. For example, a team from the University of Melbourne is working on a decision support package which will enable landholders to analyse the financial consequences of management options related to native grasslands (Price and Tracy 1996).

The ANAO (1997) review identified problems with the capacity of federal agencies to satisfactorily account for public money spent on NRM programs. ANAO findings of inadequate project reporting and limited evidence of project and program outcomes have been reported by other evaluations (Curtis and Race 1995; Robertson and Curtis 1995). ANAO (1997) also criticised the relatively high level of program management efforts committed to the administrative tasks associated with project selection as opposed to project evaluation.

Equitable distribution of resources is one of the goals of ESD, and was part of the pre-NHT NLP. In practice, serious concerns remain about allocation of funding across different groups within rural Australia. Landholders who run large and/or profitable enterprises are more likely to be involved with Landcare (Black and Reeve 1993; Mues *et al.* 1994), and a small number of groups has gained a disproportionate amount of Landcare funding (Curtis and De Lacy 1996*b*). There is also evidence that some regional communities have gained large proportions of NLP/NHT funds in some states. For example, in Victoria in 1997/98 the Goulburn/Broken region received $6.4m of the $10.5m (60.7%) funds allocated for Murray–Darling 2001. This region received 34.5% of the total NHT funds allocated to Victoria's nine regions (DNRE 1997). This level of funding was largely based on historical precedent, and in part reflects the spurious justification that work in the Goulburn Valley would be used as a model for other areas; spurious because there are simply not the resources to fund replicate work in a large number of other regions. In many ways this outcome reflects the political and organisational skills of key players in the Goulburn Valley and their capacity to establish salinity as a priority issue for funding. This example reinforces the point made above about the need for better decision support tools.

Of course one can be sceptical about the ability of rational decision tools to mediate the influence of political deals, powerful rural elites and grantsmanship. However, there is a growing acceptance of the need for strategic investment of public funds. In addition to the tools themselves, more efficient and equitable investment in NRM requires an institutional commitment to their use, and a political willingness to be guided by their advice.

4 CONCLUSION

The key elements of a more efficient process, one that balances the competing demands of greater regional autonomy and accountability to national priorities, and successfully implements adaptive management through state-sponsored public participation, are beginning to emerge. The Australian NLP experience provides a useful model for:

- establishing the roles and linkages between local community groups and regional planning bodies;
- developing cost sharing principles that can be used to allocate public money for work on private land where there are community benefits;
- creating effective community–agency partnerships; and
- effectively supporting volunteer groups.

Federal and state funds for natural resource management, including those outside NHT, should be allocated on a triennial basis to regions using improved decision support tools negotiated between federal and state governments. Regional strategies should be supported by decision support tools and ratified at the state level, say every three years. Elected regional catchment management committees representing all stakeholders would then allocate funds to regional

projects on the basis of NHT priorities and the regional catchment strategy. Catchment management committees would have real power but they would also be accountable to their regional communities and to federal and state governments. Details such as the method of election and eligibility of candidates; legal responsibilities of office-bearers; links to other elected bodies, such as local government; and relationship with state agencies; will need to be determined.

The Victorian CMAs provide a model by which this structure might be approached. The CMAs have legislative backing and are responsible for developing and implementing catchment plans. CMAs are now moving to become the purchaser of most regional natural resource management services (apart from those provided by local government), including those of the lead agency, the Department of Natural Resources and Environment. Unfortunately, the Victorian CMAs are unrepresentative. Major stakeholder groups with the capacity to challenge government and agency positions, such as the ACF, have largely been excluded on the basis that CMA membership should be skills based and not stakeholder based. Very few women or people from urban communities have been appointed to the CMAs and many appointees appear to have strong conservative political connections. In north-eastern Victoria, despite the presence of major rural cities in Wodonga (30 000) and Wangaratta (15 000), there is not one urban representative on the CMA in a region with a population of about 60 000 people.

Experience with the CMA and NLP models suggests that the most important institutional and policy elements required for ESD in rural Australia through a state-sponsored citizen participation model are:

- articulation and separation of roles for representative regional bodies (aggregating and articulating regional needs, setting regional priorities for allocating government funds, providing accountability for expenditure of public money, linking and supporting independent local groups) and local community groups (mobilising participation, initiating learning, undertaking on-ground work);
- provision of funding for on-ground work on private property to the extent that activities match regional priorities and have identifiable public benefits;
- commitment to the use of decision tools to determine efficient and equitable distributions of resources across issues and between catchments, as well as the costs and benefits of projects;
- provision of a flexible suite of policy options to accommodate the diversity of landholders' circumstances and motivations;
- provision of incentives to landholders for maintaining the supply of public benefits, particularly those associated with biodiversity and nature conservation values;
- accountability of regional bodies to state and national jurisdictions;
- support for the emergence of an independent communication network between local groups, for example, through Landcare networks;
- acknowledgment that the most important roles for most landholders are participation in group activities, establishing community priorities and undertaking work on their properties, rather than administering projects;

- development of an agency culture that supports community participation; and
- recognition that agency staff need to facilitate the development of group management skills, and, will in turn, require training in group and volunteer management.

ACKNOWLEDGEMENTS

We thank Marike Van Nouhuys for assisting with the editing and proofing of this paper, and Carla Miles for compiling material on remnant native vegetation.

REFERENCES

Ackoff, R.L. (1970). *A concept of corporate planning*. Wiley, New York.

Alexander, H. (1995). *A framework for change: the state of the community Landcare movement in Australia*. The National Landcare Facilitator Project Annual Report. National Landcare Program, Canberra.

Arnstein, S. (1969). A ladder of citizen participation. *Journal of the American Institute of Planners* **4**: 216–224.

Australian Bureau of Statistics (1996). *Australians and the environment*. Australian Government Publishing Service, Canberra.

Australian National Audit Office (1997). *Commonwealth Natural Resource Management and Environment Programs: Australia's land, water and vegetation resources*. The Auditor-General performance audit Report No. 36: 1996–97. Australian Government Publishing Service, Canberra.

Australian Nature Conservation Agency (1996). *Draft wetlands policy of the Commonwealth Government of Australia*. Australian Nature Conservation Agency, Canberra.

Australian Soil Conservation Council (1991). *Decade of Landcare Plan*. Australian Soil Conservation Council, Canberra.

Barkley, P.W., and Seckler, D.W. (1972). *Economic growth and environmental decay*. Harcourt Brace Jovanovich, New York.

Binning, C. (1997). Changing policy to change values and protect remnant vegetation. *Australian Farm Journal: Bush*.

Binning, C., and Young, M. (1997). *Motivating people: using management agreements to conserve remnant vegetation*. Final report to LWRRDC and Environment Australia national R & D program on rehabilitation, management and conservation of remnant vegetation. CSIRO, Canberra.

Bita, N. (1997). Ungreening Australia: 500 000 ha a year but slowing. *The Weekend Australian*, 27–28 December: 3.

Black, A.W., and Reeve, I. (1993). Participation in Landcare groups: The relative importance of attitudinal and situational factors. *Journal of Environmental Management* **39**: 51–57.

Bowers, J. (1994). Incentives and mechanisms for biodiversity: observations and issues. Working Document 94/4. CSIRO Canberra.

Briassoulis, H. (1989). Theoretical orientations in environmental planning: an inquiry into alternative approaches. *Environmental Management* **13**: 381–392.

Brudney, J.L. (1990). *Fostering volunteer programs in the public sector: planning, initiating and managing voluntary activities*. Jossey-Bass, San Francisco.

Buckley, R. (1992). Taxation and the environment, part 1: green taxes and related instruments in Australia. *Australian Environmental Law News* March, pp. 52–54.

Campbell, A. (1991). *Landcare: testing times*. National Landcare Facilitator 2nd Annual Report to Department of Primary Industries and Energy. National Soil Conservation Program, Canberra.

Campbell, A. (1992). *Taking the long view in tough times*. National Landcare Facilitator 3rd Annual Report to Department of Primary Industries and Energy. National Soil Conservation Program, Canberra.

Campbell, A. (1994). *Landcare: communities shaping the land and the future*. Allen & Unwin, Sydney.

Campbell, A. (1997). Facilitating Landcare: conceptual and practical dilemmas, In: Lockie, S., and Vanclay, F. (eds), *Critical Landcare*, pp. 143–152. Key Papers Series, No 5. Centre for Rural Social Research, Charles Sturt University, Wagga Wagga.

Cernea, M. (1991). Knowledge from social science for development policies and projects, In: Cernea, M. (ed.), *Putting people first*, pp. 1–43. Oxford University Press, New York.

Chambers, R. (1983). *Rural development: putting the last first*. Longman, New York.

Commonwealth of Australia (1992). *National strategy for ecologically sustainable development*. Australian Government Publishing Service, Canberra.

Commonwealth of Australia (1997). *Evaluation report on the Decade of Landcare Plan — National Overview*. Australian Government Publishing Service, Canberra.

Commonwealth of Australia (1998). National Heritage Trust guide to new applications 1998–99. Commonwealth of Australia, Canberra.

Creighton, J.L. (1983). The use of values: public participation in the planning process, In: Daneke G.A., Garcia, M.W., and Priscoli, J.D. (eds), *Public involvement and social impact assessment*, pp. 143–160. Westview, Boulder.

Crosthwaite, J. (1995). A review of potential financial incentives to achieve nature conservation goals on private and leasehold land, In: Bennett, A., Backhouse, G., and Clark, T. (eds) *People and nature conservation: perspectives on private land use and endangered species recovery*. The Royal Zoological Society of New South Wales, Sydney.

Curtis, A. (1996). *Landcare in Victoria: a decade of partnerships*. Johnstone Centre, Albury.

Curtis, A. (1998). The agency/community partnership in Landcare: lessons for state-sponsored citizen resource management. *Environmental Management* **22**: 563–574.

Curtis, A., and De Lacy, T. (1995). Landcare Evaluation in Australia: towards an effective partnership between agencies, community groups and researchers. *Journal of Soil and Water Conservation* **50**: 15–20.

Curtis, A., and De Lacy, T. (1996a). Landcare in Australia: does it make a difference. *Journal of Environmental Management* **46**: 119–37.

Curtis, A., and De Lacy, T. (1996b). Landcare in Australia: beyond the expert farmer. *Agriculture and Human Values* **13**: 20–31.

Curtis, A., and De Lacy, T. (1998). Landcare, stewardship and sustainable agriculture in Australia. *Environmental Values* **7**: 59–78.

Curtis, A., and Race, D. (1998). Evaluation of the 'One Billion Trees' Program: 1995–1997. Report prepared for Greening Australia. Johnstone Centre, Charles Sturt University, Albury (unpublished).

Curtis, A., Birckhead, J., and De Lacy, T. (1995). Community participation in landcare policy in Australia: the Victorian experience with regional landcare plans. *Society and Natural Resources* **8**: 415–430.

Cuthbertson, I.D. (1983). Evaluating public participation: an approach for government practitioners, In: Daneke G.A., Garcia, M.W., and Priscoli, J.D. (eds) *Public involvement and social impact assessment*, pp. 101–109. Westview, Boulder.

Daneke, A. (1983). Public involvement: what, why and how, In: Daneke G.A., Garcia, M.W., and Priscoli, J.D. (eds) *Public involvement and social impact assessment*, pp. 11–34. Westview, Boulder.

Department of Conservation and Environment (1992). *Victoria's decade of Landcare plan.* Department of Conservation and Environment, Melbourne.

Department of Land and Water Conservation (1997). New South Wales Landcare Facilitators Project — Progress Report. Department of Land and Water Conservation, Sydney.

Department of Natural Resources and Environment (1997). Notes to the North East Victorian National Heritage Trust regional assessment panel, NHT 1997/98 approved funding. DNRE, Melbourne.

Donaldson, S. (1996). A community perspective, In: Price, R. (ed.) *Sustainable management of natural resources: who benefits and who should pay?* Land and Water Resources Research and Development Corporation, Canberra.

Dovers, S.R. (1995). Information, sustainability and policy. *Australian Journal of Environmental Management* **2**: 142–156.

Dovers, S.R. (1997). Sustainability: demands on policy. *Journal of Public Policy* **16**: 303–318.

Dovers, S.R., and Mobbs, C.D. (1997). An alluring prospect? Ecology, and the requirements of adaptive management, In: Klomp, N., and Lunt, I. (eds) *Frontiers in ecology: building the links*, pp. 39–52. Elsevier, Oxford.

Edgar, R.V., Patterson, D. (1992). The evolution continues — Victorian Landcare groups, In: *Proceedings of the 7th International Soil Conservation Organisation Conference — people protecting their land*, pp. 198–203. ISCOC, Sydney.

Esman, M.J., Uphoff, N.T. (1984). *Local organisations: Intermediaries in rural development.* Cornell University Press, New York.

Farley, R. (1993). Environmental dispute resolution. *Significant Speeches* Summer: 30–4.

Farley, R., Toyne, P. (1989). A National land management programme. *Australian Journal of Soil and Water Conservation* **11**: 6–9.

Farrier, D. (1995). Policy instruments for conserving biodiversity on private land, In: Bradstock, R.A., Auld, T.D., Keith, D.A., Kingsford, R.T., Lunney, D., and Siversten, D.P. (eds) *Conserving biodiversity: threats and solutions*, pp. 337–359. Surrey Beatty & Sons, Sydney.

Grima, A.P. (1983). Analyzing public inputs to environmental planning: a summary and discussion of public involvement in Great Lakes management, In: Daneke G.A., Garcia, M.W., and Priscoli, J.D. (eds), *Public involvement and social impact assessment*, pp. 111–121. Westview, Boulder.

Grose, S. (1994). Calling to rid farming from arid regions. *The Canberra Times* 8 September, p. 2.

Hawke, R.J.L. (1989). *our country: Our future.* Statement — on the environment by the Prime Minister of Australia. Australian Government Publishing Service, Canberra.

Hodge, I. (1991). Incentive policies and the rural environment. *Journal of Rural Studies* **7**: 373–84.

James, D. (1993). *Using economic instruments for meeting environmental objectives: Australia's experience.* Department of Sport and Territories, Canberra.

James, D. (1997). *Environmental incentives: Australia's experience with economic instruments for environmental management.* Environment Australia, Canberra.

Kaplan, S., and Kaplan, R. (1989). The visual environment: public participation in design and planning. *Journal of Social Issues* **45**: 59–86.

Keating, P. (1992). *Australia's environment: a natural asset.* Statement on the Environment by the Prime Minister of Australia. Australian Government Publishing Service, Canberra.

Kerin, J. (1998). Howard sees red over green-barrelling claims. *The Australian* 24 February, p. 4.

Kottak, C.P. (1991). When people don't come first: some sociological lessons from completed projects, In: Cernea, M. (ed.) *Putting people first* (2nd ed), pp. 431–465. Oxford University Press, New York.

Kweit, M.G., and Kweit, R.W. (1981). *Implementing citizen participation in a bureaucratic society.* Praeger, New York.

Landre, B.K., and Knuth, B.A. (1993). Success of citizen advisory committees in consensus-based water resources planning in the Great Lakes Basin. *Society and Natural Resources* **6**: 229–57.

Lockie, S. (1992). Landcare — before the flood. *Rural Society* **2**: 7–9.

Lockwood, M. (1998). Contribution of contingent valuation and other stated preference methods to evaluation of environmental policy. *Australian Economic Papers* **37**: 292–311.

Lunn, S. (1998). $1.25bn environment fund: coalition rolls out the green barrel. *The Australian* 16 February, pp. 1, 4, 8.

Lyden, J.F., Twight, B.W., Tuchman, E. (1990). Citizen participation in long-range planning: the RPA experience. *Natural Resources Journal* **30**: 23–138.

Maltby, E. (1997). Ecosystem management: the concept and the strategy. *World Conservation* **3**: 3–4.

Martin, P., Tarr, S., and Lockie, S. (1992). Participatory environmental management in New South Wales: policy and practice, In: Lawrence, G., Vanclay, F., and Furze, B. (eds) *Agriculture, environment and society*, pp. 184–208. Macmillan, Melbourne.

Midgley, J. (1986). Introduction: social development, the state and participation, In: Midgley, J. (ed) *Community participation, social development and the state.* Methuen, London.

Millar, J., and Curtis, A. (1998). Moving farmer knowledge beyond the farm gate: an Australian study of farmer knowledge in group learning. *European Journal of Agricultural Education and Extension* **4**: 133–142.

Mitchell, R.C., and Carson, R.T. (1989). *Using surveys to value public goods: the contingent valuation method.* Resources for the Future, Washington.

Mues, C., Roper, H., and Ockerby, J. (1994). *Survey of Landcare and land management practices*. 1992–93. Report No. 94/6. Australian Bureau of Agricultural and Resource Economics, Canberra.

Murray–Darling Basin Commission (1990). *Natural Resources Management Strategy*. Murray–Darling Basin Commission, Canberra.

Murray–Darling Basin Commission (1996). *Cost-sharing for on-ground works*. Murray–Darling Basin Commission, Canberra.

Nadolny, C., Burrows, W.H., Pickard, J., and Hannam, I. (1991). Tree clearing in Australia. *Search* **22**: 43–52.

Nichols, A.L. (1984). *Targeting economic incentives for environmental protection*. MIT Press, Cambridge.

Ostrom, E. (1990). *Governing the commons: the evolution of institutions for collective action*. Cambridge University Press, Cambridge.

Pearce, J.L. (1993). *Volunteers: the organizational behavior of unpaid workers*. Routledge, New York.

Peterson, D. (1995). The land care taxation provisions — some issues, In: Australian Bureau of Agricultural Resource Economics (eds) *Outlook 95*. ABARE, Canberra.

Platt, S.J., and Ahern, L.D. (1995*a*). Nature conservation on private land in Victoria, Australia — the role of Land for wildlife, In: Saunders, D.A., Craig, J.L, and Mattiske, E.M (eds) *Nature conservation 4: the role of networks*, pp. 300–311. Surrey Beatty & Sons, Sydney.

Platt, S., and Ahern, L. (1995*b*). Voluntary nature conservation on private land in Victoria — evaluating the land for wildlife program, In: Bennett, A, Backhouse, G., and Clark, T. (eds) *People and nature conservation: perspectives on private land use and endangered species recovery*, pp. 211–216. Royal Zoological Society of New South Wales, Sydney.

Price, P., and Tracy, K. (eds) (1996). *National R&D program on rehabilitation, management and conservation of remnant vegetation*. LWRRDC, Canberra.

Priscoli, J.D. (1983). The citizen advisory group as an integrative tool in regional water resources planning, In: Daneke G.A., Garcia, M.W., and Priscoli, J.D. (eds) *Public involvement and social impact assessment*, pp. 79–87. Westview, Boulder.

Race, D., and Curtis, A. (1996). Farm forestry: how things stand. *Australian Journal of Soil and Water Conservation* **9**: 29–35.

Resource Assessment Commission (1992). *Multi-criteria analysis as a resource assessment tool*. RAC Research Paper No. 6. RAC, Canberra.

Roberts, B. (1995). Are current incentives sufficient to encourage sustainable agriculture? In: Australian Bureau of Agricultural and Resource Economics (eds), *Outlook 95*. ABARE, Canberra.

Robertson, A., and Curtis, A. (1995). *Review of completed Murray–Darling Basin Commission Riverine Environment Investigations and Education projects* (1&2). Johnstone Centre, Albury.

Rush, J. and Associates (1992). A review of the efficiency of landcare facilitator projects. Report prepared for the Land and Resources Division, Department of Primary Industries and Energy. Canberra.

Salinity Pilot Program Advisory Council (1989). *Shepparton Irrigation Region land and water salinity management plan*. SPPAC, Shepparton.

Sandercock, L. (1986). Citizen participation: the new conservatism, In: Sarkissian, W., Perlgut, D., and Ballard, E. (eds). *The community participation handbook: resources for public involvement in the planning process*, pp. 7–9. Impact Press, Roseville.

Tasmanian Public Land Use Commission (1996). *Inquiry into areas to be reserved under the Tasmanian–Commonwealth Regional Forest Agreement: Background Report Part F Mechanisms for achieving conservation management on private forested land: a discussion paper.* Tasmanian Public Land Use Commission, Hobart.

Thomson, N.J. (1986). Fiscal incentives for Australian bushland. *Environmental Management* **10**: 591–597.

Uphoff, N. (1991). Fitting projects to people, In: Cernea, M. (ed.), *Putting people first* (2nd ed). Oxford University Press, New York.

Vanclay, F. (1992). The social context of farmers' adoption of environmentally-sound farming practices, In: Lawrence, G., Vanclay, F., and Furze, B. (eds) *Agriculture, environment and society*, pp. 94–121. Macmillan, Melbourne.

Vanclay, F. (1997). The social basis of environmental management in agriculture: a background for understanding Landcare, In: Lockie, S., and Vanclay F. (eds) *Critical Landcare*, pp. 9–28. Key Papers Series, No 5. Centre for Rural Social Research, Charles Sturt University, Wagga Wagga.

Wengert, N. (1976). Citizen participation: practice in search of a theory. *Natural Resources Journal* **16**: 23–40.

Wright, S. (1990). Development theory and community development practice, In: Buller, H., Wright, S. (eds) *Rural development: problems and practices*, pp. 41–64. Gower, Vermont.

Youl, R. (1996). Case study — Landcare in the states — Victoria, In: Blackadder, J. (ed.), *Landcare in Australia yearbook 1996–97*, pp. 43–54. Executive Media, Melbourne.

Young, M.D. (1992). *Sustainable investment and resource use: equity, environmental integrity and economic efficiency.* UNESCO, Paris.

Young, M.D. (1996). Mixing instruments and institutional arrangements for optimal biodiversity conservation, In: Organisation for Economic Co-operation and Development (eds) *OECD International conference on incentive measures for biodiversity conservation and sustainable use.* OECD, Paris

Young, M.D., Gunningham, N., Elix, J., Lambert, J., Howard, B., Grabosky, P., and McCrone, E. (1996). *Reimbursing the future: an evaluation of motivational, voluntary, price-based, property right, and regulatory incentives for the conservation of biodiversity.* Department of the Environment, Sport and Territories, Canberra.