Social, Economic, Legal, Policy and Institutional R&D for Natural Resource Management: Issues and Directions for LWRRDC

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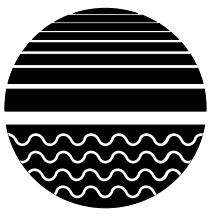

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Study team

This study was carried out by:

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- Ms Catherine Mobbs, Doctoral Candidate, Centre for Resource and Environmental Studies, Australian National University (Project Officer); and
- Dr Helen Ross, Research Fellow, Centre for Resource and Environmental Studies, Australian National University (Commissioned Researcher).

Summary

This document reports on a consultancy task undertaken for the Land and Water Resources Research and Development Corporation (LWRRDC), exploring its future involvement in R&D into the social, legal, economic, policy and institutional dimensions of natural resource management. The report spans a large, complex and diffuse field at some length, and is structured in three main parts:

- Part I introduces the consultancy task, explains the approach taken, documents LWRRDC's mode of operation and efforts in social and institutional R&D to date, reviews relevant literature, and reports on consultation with individuals and agencies undertaken during the consultancy.
- Part II comprises four separate papers, dealing with the nature of legal, economic, social and policy–institutional research, and how these fields can or might connect with LWRRDC's interests in natural resource management. Four separate studies were required to do justice to the topic, as no single author or essay could competently span the many disciplines and methods involved. These four papers stand alone as introductions to their fields, and as original analyses of R&D potential and directions.
- Part III synthesises some of the key points of the first two parts, and makes recommendations regarding future LWRRDC investment in social and institutional R&D—guiding principles, organisation and delivery options, possible research themes, and suggested ways of extending LWRRDC's catchment of R&D providers and partners.

Appendices include some background material pertinent to the report. The Recommendations (Section 8) give a flavour of the fields dealt with here, and some core arguments, and could be read as a summary by those short of time, attention or interest. However, an appreciation of the basis of the recommendations, and a glimpse of the complex nature of the social sciences as they do and can contribute to sustainable natural resource management, can be gained only through reading the entire report.

In summary, the report finds ample justification for increased investment in R&D into the social, legal, economic, policy and institutional dimensions ('social and institutional (S&I) R&D') of natural resource management, by LWRRDC and others. The potential field is at least as large as the total existing portfolio encompassed by LWRRDC's existing programs, so what can be achieved by the Corporation needs to be carefully scoped and of a strategic nature, and moreover there needs to be clear recognition that this under-attended area requires investments and efforts by other agencies as well.

It is recommended that the Corporation establish a Social & Institutional Program of R&D, with the dual roles of, first, investing in social science and interdisciplinary research of a more substantial nature and, second, of seeking to incorporate S&I expertise and perspectives into R&D undertaken through existing or future program configurations. That is, a program but also a process or network. The basic organisational features of such a program are outlined in Section 8.7. This program should be guided by the overarching goal of informing the evolution of adaptive, informed and participatory policy processes, institutional arrangements and management regimes in the longer term, and of enriching and informing the menu of options available to decision and policy-makers and stakeholders in natural resource management (NRM). The program should be established for the normal five-year period, but with an evaluation at two years to assess priorities and the need for larger investments. Expanded use of postgraduate scholarships as an R&D and training vehicle is also recommended.

The report also recommends a number of processes and initiatives to further these overarching aims, regarding the training of the next generation of R&D providers and managers, communicating the outcomes of S&I research to both research and lay communities, creating linkages with a wider catchment of R&D providers and relevant groups in the S&I area, and the need for development of 'meta-arrangements' to provide greater coherence across the presently disjointed ESD/NRM field.

The Recommendations present a set of guiding principles and an extension to LWRRDC's 'Template of Questions', to inform program design and project appraisal. A number of research directions, themes and projects are suggested in the Recommendations, and more and broader possibilities are canvassed in

the commissioned papers in Part II. It is suggested that initial investment should favour a larger number of smaller studies of a scoping, pilot or review nature, leading to well-chosen larger investments being considered after the two-year evaluation.

While this report suggests that a positive near-term decision can be made by the Corporation on the basis of this report, it encourages a wider discourse on directions for the new program amongst stakeholders and cognate agencies.

Part I The Background

This part of the report, which covers three sections, introduces the study, its scope and methods, and provides a summary from literature and interviews of current and emerging issues in natural resource management that are perceived to have implications for research in the social sciences and humanities.

1 Introduction

This report addresses the need, opportunities and scope for LWRRDC to expand its research portfolio to encompass R&D in the humanities and social science fields. More specifically, this report is on policy, institutional, economic, social and legal areas of research as these are relevant to the conservation and management of natural resources in the rural environment.

As the only research and development corporation (RDC) with a broad and national mandate to protect and enhance the natural resource base that underpins rural Australia, LWRRDC plays an increasingly critical and pivotal role in planning and funding natural resource management research and development.

LWRRDC's intention to consolidate and embed a transdisciplinary research portfolio reflects an increasing realisation within the Corporation, and more broadly, that the predominant focus of natural resource management research has been on biophysical issues and technical in orientation, and that such a singular perspective is insufficient to bring about the necessary changes. This concern has been noted in several LWRRDC reviews of R&D, in national reviews (eg. PMSEC 1995) and in the international literature (eg. Berkes and Folke 1998; Gunderson *et al*. 1995), and most recently by Stuart Harris in a review of the contribution of the social sciences to environmental issues for the Academy of the Social Sciences in Australia (Harris 1998).

There are many reasons why research in the humanities and social sciences fields has played a relatively minor role in addressing the issues of concern to LWRRDC. Some of these reasons can be better addressed within the disciplines themselves (eg. perception that problem-orientated natural resource management work is not academically or professionally valued), others are amenable to a strategic effort on the part of an organisation such as LWRRDC, particularly in concert with other key organisations.

While noting the range of reasons that may limit the role of such research, this report is primarily concerned with identifying the ways in which LWRRDC can most effectively act to address the imbalance in its R&D portfolio. We note that LWRRDC has already made significant efforts to develop an integrated perspective on major natural resource issues, has incorporated some socio-economic projects within individual programs, and particularly over the last two years, has actively sought to fund research in areas outside the traditional biophysical domain. We also note LWRRDC's perception that the response to its calls for such research has been disappointing both in terms of quality and quantity[1], and that the issues of concern have relevance across its program areas.

Given this context and other issues discussed in Section 2, our major contribution to LWRRDC's existing efforts is a better understanding and critical evaluation of the role of research in the humanities and social sciences in sustainable natural resource management. We stress understanding, rather than a set of recommendations (although these are included), because of our perception informed by interviews with LWRRDC staff, Board members, and others, that before LWRRDC embarks on these new areas of R&D the corporation needs a common language and understanding of what is involved. This will facilitate more effective targeting of research interventions and the relevant members of the research community. To a large extent then, the key audience for this report is the members of LWRRDC's Board of Directors, whose role it is to guide the Corporation's decision-making on research directions. Throughout this report, we use the term

1. LWRRDC staff note that their most recent call was much more encouraging in these terms, which may indicate the time lags involved in gaining the attention of the research community to a new focus of activity.

social and institutional R&D as a necessary shorthand when we wish to refer to the diverse areas of relevant research in aggregate.

2 Scope and methods

Our response to the issues raised in the Terms of Reference (Appendix A) has three components:

- a summary of current and emerging issues in natural resource management that are perceived to have implications for research in the social sciences and humanities (Section 3);
- four commissioned papers written from the perspectives of individual scholars in the fields of legal, social, economic and policy/institutional studies (Sections 4–7); and
- a synthesis of findings and recommendations drawn from the summary background information, the four commissioned papers and the outcomes of a workshop (Section 8).

In line with the Terms of Reference, the project largely comprised a desktop study of existing material. However, we attempted to add value to such a study with our deliberate approach of bringing multiple and fresh perspectives to bear on the issues. It is important to bear in mind that this is not an evaluation or a scoping review study in the style usually commissioned by LWRRDC in the early stages of designing a new R&D program. Such studies are focused on a particular resource management problem while the current study has to consider a range of issues that are relevant in some way across all the resource management problems that concern LWRRDC. Each of the components of the project is described below. First, we define what we mean by social and institutional research.

2.1 Defining social and institutional research in natural resource management

The purpose of this section is to provide discussion and explanation of key terms. At a broad level, research[2] in the field of natural resource management (NRM) is usually characterised as falling within the domain of 'physical and biological sciences' (hereafter biophysical) or the 'humanities and social sciences'. In simple terms, biophysical research explores events, processes and relationships within and between elements of the biological and physical world. Research in the humanities and social sciences explores human individual and social behaviour and culture (see Section 4). Within the broad field of the humanities and social sciences, our Terms of Reference specified a focus on social, economic, legal, policy and institutional areas. Some relevant disciplinary fields in these areas, for example history, are represented in both the humanities and the social sciences, but it is fair to say that the concerns of this report fall mainly within the social sciences and, for convenience, hereafter we refer to the social sciences.

There is no general agreement in the academic community on how the social science areas identified above should be defined or the scope of their concerns; they take many and varied forms depending on the purpose and context of inquiry. Table 2.1 offers a simple characterisation of the different foci of research areas. We offer the following preliminary definitions of the areas addressed in this report and fuller discussion in the commissioned papers (Sections 4 to 7).

Within the social sciences, 'social research' is usually used to refer to relations of the individual to others, or aggregates of individuals forming more-or-less organised groups, or tendencies and impulses towards others. Social research also explores forms of knowledge and bases of understanding and perception.

Economic research concerns the allocation of scarce resources to satisfy alternative and often competing human wants.

Policy or institutional research is research for analytical and/or prescriptive purposes, examining public policy processes, public administration and program delivery, and the institutions wherein these operate (be these formal or informal, legal or economic, inclusive or exclusive, etc.). Clearly, this spans a large arena of research and of disciplines.

Legal research traditionally has been concerned with the discovery and explication of the law relating to a particular issue (what the law 'is'), including the identification of gaps and inconsistencies at a formal level, through analysis of the relevant legislation and case law. The 'law in context' movement goes beyond this, to investigate how law and legal processes operate in practice.

We also use the terms 'multidisciplinary', 'interdisciplinary' and 'transdisciplinary' in this report. We adopt the following definitions of these terms.

Multidisciplinary research refers to the non-integrated use of several disciplines to examine different aspects of a problem or question. For example, specialists in each component discipline undertake work in their area of expertise with little or

2. R&D is defined as creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications (ABS 1998).

no reference to other disciplines. This work is then combined or consolidated under some framework—for example, an environmental effects statement many contain statements on the impact of a development on flora, fauna, hydrology etc., and these statements are used to make an overall judgment of impact. While multi-faceted, there is no great attempt to *integrate* the different perspectives. Multidisciplinary research is relatively common.

Interdisciplinary research refers to the use of an integrating theory or framework to link two or more disciplines, such that experts in each field work together to address a problem, or such that a single researcher draws on the different disciplines to address a problem. For example, a hydrologist may work with an economist and an agricultural scientist to develop a model of how vegetation clearance affects agricultural productivity and profitability. A relatively low level of interdisciplinary research is conducted in Australia relative to single discipline and multidisciplinary work.

Transdisciplinary research is similar to interdisciplinary research, but has the additional objective of developing new theory, method or understanding that is not just a simple combination of the component disciplines, and is required to comprehend new problem types. In resource and environmental policy and management, disciplines may bring their approaches and methods developed in other policy fields and wield them against a new set of problems, but without fundamentally rethinking the underlying assumptions. To illustrate, neoclassical economics applies to NRM problems as resource or environmental economics, adapting to the issues but holding true to neoclassical assumptions such as consumer sovereignty or rational choice (but see Lockwood, Section 5). The limits of this in many regards have spawned the field of 'ecological economics', some of the practitioners of which seek markedly different theoretical explanations of human–nature interactions (eg. Common and Perrings 1992). Similar reorientating activity is taking place also (to various extents) in fields such as environmental ethics, environmental history and green social theory. Transdisciplinary research is relatively rare.

All three of these are appropriate for different purposes. For decision support in bounded cases or applications, multidisciplinary research can adequately inform. For different forms of problems, or for new problems, interdisciplinary research may be needed. Transdisciplinary research is not so suited to applied problems, as operational methods are generally only proposed, and the focus will be more theoretical. (Grounded theory proffers new theoretical insights in a different way—see Section 4.) Two important considerations emerge. First, many

Table 2.1 Simple characterisation of areas of research in natural research management

Area of research	Examples of substantive areas of concern	Examples of key disciplines in natural resource management
Social	Human organisation including group processes, communication, values, learning, adoption, knowledge, decision-making, conflict resolution, equity, power, social impact assessment, risk assessment.	Sociology, psychology, anthropology, human geography, history, philosophy, demography.
Economic	Identification and measurement of economic values, efficient allocation of resources, property rights, public goods, externalities, economic role of government, macroeconomic policy.	Economic theory, environmental and resource economics, ecological economics, econometrics, microeconomics, macroeconomics, institutional economics, political economy, public finance.
Policy and institutional	Policy and political processes, institutional settings, organisational arrangements, program evaluation.	Planning, history, political science, public policy, public administration, law, economics (public choice), institutional theory.
Legal	Analysing/describing what the law is, clarifying interrelationships between different pieces of legislation, identifying gaps between law/legal processes in the books and in practice, defining role of law/legal processes as an instrument of social policy in comparison with alternatives.	Law, justice and legal studies, law enforcement, sociology, criminal justice studies, criminology, public policy, public administration.
Biophysical	Land and water management including living resources (flora/fauna), rehabilitation of degraded environments, ecological processes, environmental impacts.	Environmental sciences, agriculture, horticulture, ecology, information systems, soil and water science.

people now believe that significant inroads into R&D and its application in resource and environmental management can only occur with greater inter- and transdisciplinary work. Second, and as a caution in this regard, approaches and methods in inter- and transdisciplinary disciplinary R&D are almost universally still evolving and rarely uncontested (the latter meaning there are usually multiple methods with multiple advocates). These issues are taken up again in the next section, and in sections 4–7.

2.2 The role of social science in natural resource management

The social sciences have an increasingly important role to play in natural resource management. As Boggs (1992:33) notes, society's increasing concern for the environment and quality of life has been accompanied by the expansion of roles for social science beyond their traditional use in areas such as health and education. Having the ability or normative desire to interpret human behaviour is the prerogative of the social sciences and is as important to natural resource management issues as understanding our biophysical environment. In broad terms, the social sciences offer criticism and evaluation, and provide a context for human activity. That is, social sciences "frame the context in which other knowledge can be applied; questioning the fit between that knowledge and its context and evaluating its purpose; and providing a critique of science and technology which is valuable as an input to technological decision-making from the beginning, not just to explain what went wrong" (ASTEC 1993:13).

While there have always been tensions between the biophysical and social sciences, the apparent dichotomy between the *concerns* of these two scientific arenas becomes rather blurred in reality; historically, research in the field of geography, for example, and more recently the environmental sciences has focused on relationships *between* humans and their environments. At the same time, an increasing emphasis on multi/interdisciplinary research projects and programs has meant that there is not necessarily a sharp divide between biophysical and social sciences research. Nevertheless, it is LWRRDC's perception that its research portfolio has been biased toward biophysical research as described above, a perception that we confirmed for ourselves through scrutiny of the portfolio.

At one level, our report can be read as simply addressing this bias through delineation of social and institutional research areas which deserve attention. However, the issues that concern LWRRDC are much more complex than "filling some social data gap" (Patterson and Williams 1998:280) with social science research and we strongly caution against such an interpretation. In fact, LWRRDC's concerns regarding the utility and uptake of R&D are reflected in myriad critiques from stakeholders (researchers, managers, landholders etc.) about the *nature of science* as traditionally applied in natural resource management (eg. Wynne 1992; Chambers 1997).

Changing perceptions in this regard are mirrored in practical and intellectual activities and changes in NRM. There are various recently evolved approaches to both inquiry and management seeking to include the social, institutional, etc. elements now seen by many as just as, if not more important than the biophysical or technical elements of resource management. These go under many terms—integrated catchment management, integrated environmental management, ecosystem integrity, ecosystem health, adaptive management, ecosystem management—but all share some core characteristics. These characteristics include: integrating disciplines, integrating management and policy across landscapes and catchments, matching quantitative and qualitative forms of analysis, and balancing economic, social and environmental aspects. Failure to resolve NRM issues is a major reason for the emergence of different approaches, and the realisation that many NRM problems are not well handled by single approach, linear modes of analysis or prescription. It is doubtless the case that, in some areas, practice is well ahead of theory, in as much as community-based programs or catchment management arrangements are in place before any sound proposition of how they might best work has been formulated. This might suggest that examining existing practice thoroughly would be a first step.

The nature of the problems is worth emphasising. Funtowicz and Ravetz (1991) described three approaches to environmental problems, becoming more difficult as both the 'decision stakes' and uncertainty increase: applied science ('puzzle solving') in the face of technical uncertainty; professional consultancy involving more judgment in the face of methodological uncertainty; and post-normal science in the face of epistemological uncertainty. These equate to the well, moderately and poorly structured policy problems of Dunn (1981) or the micro, meso and macro-problems (in the face of risk, uncertainty and ignorance) described by Dovers *et al* . (1996). Clearly, the nature of the problem faced should be the main determinant of the R&D approach chosen.

Patterson and Williams (1998:282–283) argue that a frequent response to calls for change in NRM is one that is based on a rationalist assumption that the problem is one of methodology and we need to develop new techniques and incorporate these into our 'scientific tool kits' (eg. adding qualitative

methods). The scientific method or 'positivism' modelled after the biophysical sciences remains as the predominant philosophy. However, this response is seen by many to be inappropriate and inadequate given the unknowable and unpredictable nature of the 'poorly-structured problems' that characterise current issues in NRM. A supposedly superior alternative such as 'post-normal science', wherein judgment plays a recognised part, is attractive but has yet to been clearly outlined. However, consensus has it that such superior approaches will need to involve 'methodological pluralism' (Norgaard 1989).

Under this type of argument, we might deepen our analysis of LWRRDC's research portfolio beyond that of bias towards biophysical research and ask whether LWRRDC's general approach to research reflects unquestioned philosophical commitments about the position, practice and application of science in NRM. Such beliefs may *manifest* themselves in this case as a bias towards funding certain types of biophysical (and also social and economic areas of research), but it is the underlying philosophical commitments, the frames of reference in which they are embedded, and their implications that need to be understood by those who might wish to change existing structures. The danger, according to some commentators (eg. Boggs 1992), is that if applied social science is simply constructed within the constraints of an existing positivist model, it will be marginalised.

While the resources and Terms of Reference for our project did not permit such an analysis, we believe that this is a fundamental philosophical issue with practical implications for all research organisations in natural resource management. We raise it here to alert the reader to the much larger challenge that LWRRDC faces and to locate the recommendations of this report as just one aspect of the needed questioning and changes to models of research. We adopt a pragmatic problem analysis which is responsive to LWRRDC's perceptions. It can be stated simply in the following way: (i) research directed to social, policy, institutional, legal and economic factors influencing resource management is important but has been neglected and this neglect is hindering our efforts to manage resources consistent with the philosophy of ecologically sustainable development; and (ii) what role can LWRRDC play in funding and encouraging such research?

2.3 Approach to the study

Background and summary preparation

In the initial stages of the project, we compiled and summarised information from LWRRDC reviews as well as the general literature on R&D needs in NRM. In the latter case, our focus was on major national reviews rather than the broader literature which would include State, regional and local assessments of R&D needs. LWRRDC's mandate to invest in research on issues of national importance, combined with the short time frame of the study, necessitated this approach. Our intention was to evaluate the evidence for the first part of the problem analysis as outlined above. A summary of reviews is at Appendix B.

We also compiled a listing of LWRRDC's past and current involvement in social and institutional R&D to identify the extent of LWRRDC's investment in relevant R&D and to identify the main types of such research. This included identifying a number of LWRRDC projects and, in some cases, the collection of final reports if possible, for closer attention by individual members of the team. Our concern was to develop a fully informed picture of LWRRDC's previous investment before attempting to identify gaps or apparent areas of priority need.

This part of the project was more difficult and time-consuming than we anticipated for a number of reasons. These included difficulties in identifying projects which were framed as specific social and institutional research topics or addressed some social or institutional dimensions without having to locate a full project outline or final report. For management purposes, LWRRDC has a database based on a three-way classification of the 'area of R&D' that a project is aimed at: resource assessment and dynamics, sustainable resource use and management, and framework for policy and management. It is generally, but not always, the case, that projects categorised as belonging in the first two areas are orientated to biophysical research while those in the latter area will have social and institutional research components. However, it is not possible to query the database in such a way as to answer questions we would like to have posed about research disciplines, methodologies and specific targets of the research intervention. The ARRIP (Australian Rural Research in Progress) online database was useful as a finer filter as it provides more information about project objectives and methods than we could easily obtain from the LWRRDC database or their publication of Current Projects (LWRRDC 1997). However, ARRIP does not have a complete listing of LWRRDC projects and in many cases the information available was insufficient for our purposes. Given tight time frames for the project and the above issues, we were unable to explore LWRRDC's previous investment in social and institutional R&D to the extent initially intended. Nevertheless, we feel that we were able to gain a sufficient picture to address key issues for the report.

At LWRRDC's direction, we also consulted each of the members of LWRRDC's Board of Directors to gain their views on the need for LWRRDC to engage

more fully in social and institutional research and any particular areas that they saw were necessary. Their input helped us to clarify the desired outcomes of the project. In addition, in the early stages of the project we consulted a limited number of key individuals in other RDCs, academia, and government agencies for their perspectives on the issues of concern. The limited time frame and resources for the project did not permit a comprehensive stakeholder consultation process. In particular, we did not attempt to canvass the views of the numerous State agencies which have an important role to play in this area. The individuals and organisations contacted were mostly chosen because they had relevant experience or a role in the area of integrating social science and biophysical science inputs to important NRM issues. It is our belief that in the early stages of establishing any portfolio of social and institutional R&D, it would be essential for LWRRDC to conduct some targeted stakeholder workshops. We discuss this possibility further in Section 8. A list of those consulted during this project is at Appendix C.

All the above material, which is summarised in Section 3, was subsequently utilised by individual members of the team in the preparation of their commissioned papers.

Commissioned papers

In the second stage of the project, four papers were commissioned on more specific issues within the broad areas outlined in the following box. Our intention was to enable four people with expertise in the relevant research fields to provide broad and fresh perspectives on the issues.

The papers are presented in Sections 4, 5, 6 and 7. The common elements of each paper are: a statement of the major features and assumptions of the discipline/s; a summary of how the discipline/s currently contribute to sustainable natural resource management in rural Australia; LWRRDC's past and current support for this research; identification of research needs to further sustainable natural resource management in rural Australia; and opportunities for LWRRDC to address these needs**.**

Section 4. Social research, prepared by Dr Helen Ross.

Section 5. Economic and related research, prepared by Dr Michael Lockwood.

Section 6. Legal research, prepared by Professor David Farrier.

Section 7. Policy processes and institutional arrangements, prepared by Dr Stephen Dovers.

It is important to note that the potential fields of social sciences research that LWRRDC could usefully capture are as wide and evolutionary as the sustainability issues the Corporation seeks to address. Indeed, to adequately address the realm of R&D opportunities represented would be a task larger than LWRRDC's present coverage of biophysical dimensions of NRM. Inevitably, however, our individual perspectives on the relevance of social and institutional research to LWRRDC's mandate are partial, reflecting personal and professional experience in specific areas. We sought to complement our perspectives with the broad-ranging survey of literature referred to above, and also a two-day workshop held in October 1998. The workshop was held to discuss the draft papers, and identify any gaps or amendments to their content. Participants in the workshop included invited discussants for each paper, members of the project team, members of the LWRRDC project management team, and several other key individuals**.** Discussants were used to provide additional perspectives on each of the papers' topics, and as review and quality control. A summary of comments by the invited discussant for each of the commissioned papers is appended to the relevant paper. A summary of workshop themes and list of participants is at Appendix D.

Synthesis and recommendations

A synthesis was prepared from the above material and is presented in Section 8. It outlines the scope for encouraging interdisciplinary and synergistic R&D, priority areas of social and institutional R&D, and potential organisational options for LWRRDC to consider.

3 Perspectives from R&D reviews and consultations

In looking to expand its research portfolio to encompass new areas of social and institutional R&D, it would seem to be a prerequisite that LWRRDC first develops an appreciation of 'where it has been'. This section provides this background, placing LWRRDC's role and experience in funding research in a broader context provided by perspectives from LWRRDC program reviews and major national reviews of R&D. This is followed by a summary of the views of key individuals regarding LWRRDC's potential investment in social and institutional R&D.

3.1 LWRRDC's role and investment in R&D

Background

LWRRDC is a statutory body, one of 15 research and development corporations (RDCs) and one council established under the *Primary Industries and Energy*

Research and Development (PIERD) Act 1989, within the Commonwealth Primary Industries and Energy portfolio (now Agriculture, Fisheries and Forestry – Australia, AFFA). The Corporation began operations in 1990. It is governed by a Board of nine Directors and is directly accountable to Parliament, the Minister for Agriculture, Fisheries and Forestry, and two representative organisations (the Australian Conservation Foundation and the National Farmers' Federation). In the 1998–1999 financial year, the annual appropriated budget is $10.94m (LWRRDC 1998a).

With the exception of LWRRDC, the RDCs are all commodity specific or market focused. The rationale for their establishment was a co-investment partnership between industry and government, and accordingly they are partly funded by industry levies (up to 50% of budget). In contrast, LWRRDC was established specifically to tackle cross-sectoral sustainability issues such as land degradation and water quality, and is totally funded by Commonwealth appropriations (Lovett 1997: 24)[3]. A government discussion paper dated 1990 outlining arrangements to establish LWRRDC noted that interdisciplinary projects and partnership proposals addressing one or more priority areas should get particular support, and that, over time, the Corporation should develop a balanced and integrated research program for natural resources reflecting the close interrelationships between water, soil, vegetation, wildlife and habitat matters. The discussion paper also reveals the breadth of issues which were expected to attract the attention of the new RDC, including:

- the predecessor national soil and water research programs (NSCP and AWRAC);
- forestry and vegetation issues that relate to land and water management;
- wildlife and habitat management;
- social and institutional factors in achieving economic and sustainable land and water resource use;
- pricing policies to promote sustainable land and water use;
- implications of alternative irrigation policies for farm management, infrastructure requirements and regional change;
- options and processes for managing social and economic change at local and regional level; and
- more effective technology transfer; (and many others).

This very broad and rather unfocused mandate with which LWRRDC began operations reflects the nature of natural resource research and management arrangements at that time. The mandate given to LWRRDC can be interpreted better in historical perspective. Despite many decades of land and water management, it was only in the mid-1970s that a coherent national picture was sought of land degradation issues, through the collaborative State–Commonwealth soil conservation study (DEHCD 1978), and only some years later (as ever, after a drought) that this overview was made widely available (Woods 1984). At this time a realisation emerged that, although much had been done—mostly under a State level, soil conservation-through-extension approach—the problems required more and different policy interventions (and related R&D activity). The mid-1980s saw the first real statutory and administrative changes at State level to better integrate water and land/soil management, and the emergence and operationalisation of 'total' catchment management ideas. In the late 1980s, Landcare and the beginning of larger investment at the Commonwealth level in land/water degradation policy (Hawke 1989) emerged. It was in this environment that LWRRDC's role came about. In institutional terms, this is a very short history. It must be viewed as too short a time for a firm picture or consensus to emerge of the issues, the appropriate methods or the best policy approaches. An ongoing state of flux is the Corporation's operating environment, and this should not be ignored or regretted. For example, the tensions (and, hopefully, complementarities) between distinct but interrelated policy approaches to land and water degradation—community involvement versus top-down extension, regulation versus market-orientated reforms, or emphasis on scientific knowledge versus institutional strategies in the face of uncertainty—will take considerably more than eight years to work through, if they ever can be. At the time of LWRRDC's establishment, Australia was beginning to embrace the global sustainable development agenda, and like virtually all other agencies, LWRRDC subscribes to the principles of ecologically sustainable development (ESD) as the broad framework within which to organise its business (Commonwealth of Australia 1992b).

3. Charles (1994) outlines the role of government in funding rural R&D while Lovett (1997) provides a comprehensive background to and discussion of the corporation model for R&D. However neither discussion delves into the nature of LWRRDC's role in rural research *vis-a-vis* other RDCs. We suggest that it would be timely to clarify the research responsibilities of the RDCs particularly within the context of AFFA's current preparation of a national policy statement on natural resource management.

The Australian Science and Technology Council 1990 review of environmental research in Australia notes: "Historically, Australia's environmental research has been fragmented, uncoordinated, episodic, geographically concentrated, and hindered by divided government responsibilities and institutional competition. We have never developed a national strategy for environmental research" (ASTEC 1991:11). The creation of the RDCs and also the Cooperative Research Centre (CRC) model in 1991, was one important response to the lack of strategic coordination mechanisms for research in Australia, if not a 'national strategy' per se. The establishment of LWRRDC was particularly significant: it reflected an emerging appreciation of the complex nature of the 'sustainability' paradigm; it recognised that priority issues for research were not simply related to questions about biophysical processes, or the economics of production, or the issues as they emerge separately in specific commodity sectors (the latter being the remit of some other RDCs), but also questions about environmental protection and social processes and the linkages between all such issues; and, more fundamentally, it reflected the fact that there wasn't a pre-existing research body that could provide the national perspective that was deemed necessary and could take the lead on issues that were unlikely to be funded by industry focused RDCs. At that time the only national capacity for exploring new methodologies and approaches in a transparent and visible fashion was the Resource Assessment Commission (RAC),which, although it had wider methodological scope, could consider only issues referred to it by the Prime Minister. The RAC's application of contingent valuation and multi-criteria analysis, for example, led to a significant increment in common understanding of the merits (or otherwise) of such evolving methods. The RAC was discontinued in 1993 (see Stewart and McColl 1994; Economou 1996).

At present, LWRRDC plays a unique role in priority-setting, identification and support of R&D relevant to water, land and vegetation management. While many other public agencies and research institutions are active in this field to greater and lesser extents, there is little organised coordination across the ESD or NRM fields.

The current situation: a brief overview of how LWRRDC invests in natural resource management

Section 7 elaborates on the current and emerging policy environment for natural resource management and LWRRDC is familiar with this setting. Within this policy setting which provides more or less influential government goals and priorities, LWRRDC has needed to concentrate its limited resources on problems which are perceived to be the most severe and where investment of public funds can be clearly justified in the national interest (see Box 3.1 for specification of LWRRDC's charter and Figure 3.1 for an outline of LWRRDC's organisation structure). The following section provides an abbreviated summary of the decision-making process within the Corporation.

Box 3.1 LWRRDC's role

Goal: to direct and manage a limited amount of public funds to develop practical ways of preventing and reversing resource degradation.

Core business: protecting and enhancing the natural resource base that underpins rural Australia.

R&D objective: to develop, fund and manage R&D activities where the Corporation's involvement in leadership, design, funding and management will significantly enhance the sustainable use, productivity and conservation of Australia's land, water and vegetation resources.

Activities: include those which contribute to sustainability of resource use, increased productivity of land, improved land and water quality, better understanding of ecological processes and better management of natural resources as they affect, or are affected by, rural industries. Atmospheric, marine or urban issues are not funded.

Source: LWRRDC Annual Report 1996–97; Annual Operational Plan 1998–99; R&D Plan 1996–2001.

The majority of research supported by LWRRDC is managed under 'commissioned programs' (shaded area in Figure 3.1) which are aimed at meeting R&D priorities determined through extensive consultation with stakeholders. The programs aim to deliver agreed outcomes within a specified time, and reflect agreed major issues in natural resource management such as dryland salinity, remnant vegetation management, and pesticide management. The overarching framework of land, water and vegetation programs was put in place at LWRRDC's establishment but has become largely an administrative convenience (or inconvenience!) to apportion responsibilities for programs among LWRRDC management.

At the time of this study, LWRRDC is investing in 15 commissioned programs, all of which, with the exception of Integration and Adoption of R&D at the Catchment Scale Program and the Groundwater

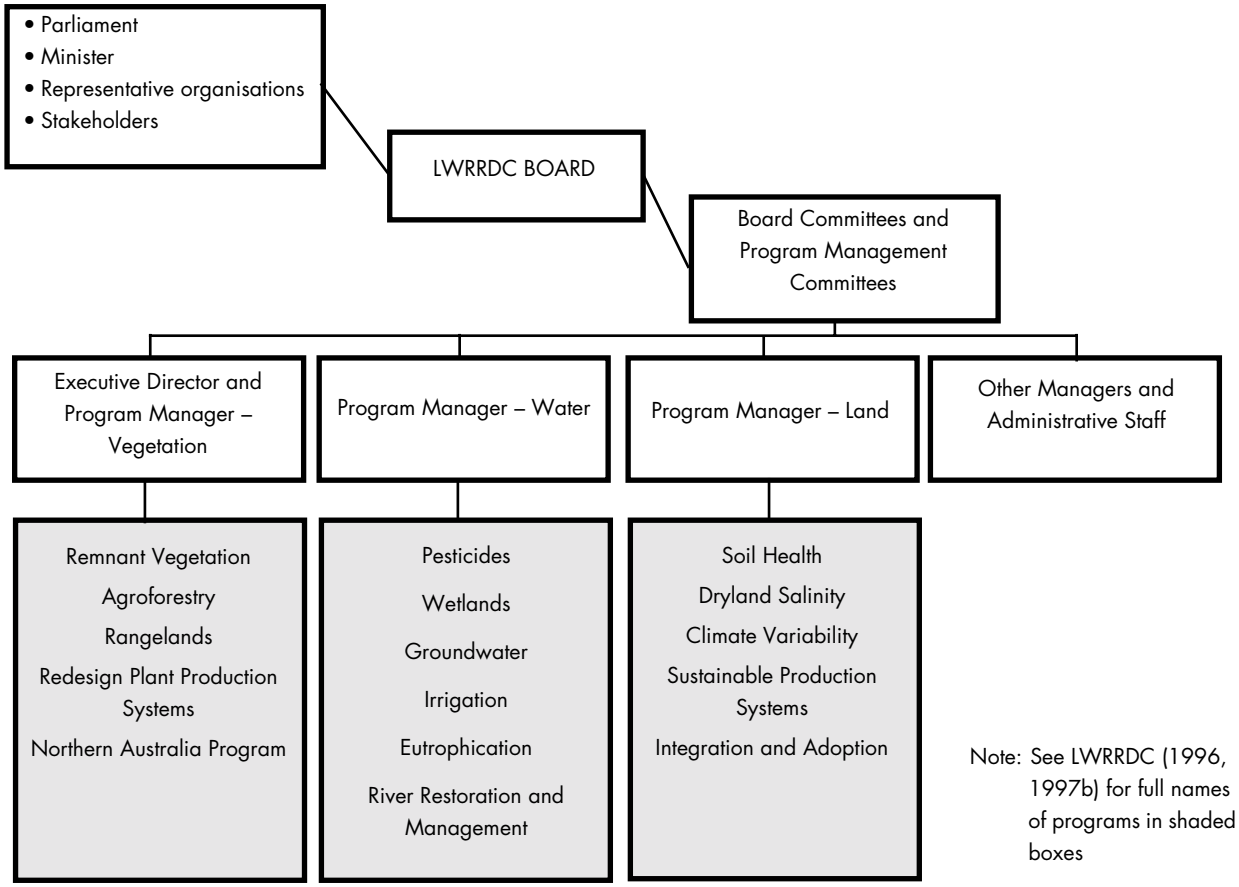
Program, are collaboratively funded and managed programs with other RDCs, the MDBC, CSIRO, and Commonwealth or State agencies. Partners in the Integration and Adoption Program are three community groups. Some programs are managed by LWRRDC's funding partners (eg. other RDCs, Environment Australia).

Within commissioned programs, research is supported in three ways: projects are commissioned from appropriate groups; tenders to conduct the research are sought from appropriate groups; or proposals are sought through an open call. During 1998–99 around 86% of expenditure was directed to commissioned programs. A mixture of basic, strategic and applied research is supported.

LWRRDC also funds research though an annual call for proposals (the *General Call*). General Call applications are seen as an essential counterbalance to the stakeholder-defined and outcome orientated commissioned programs. Research in the General Call may be innovative or more speculative proposals on any topic related to LWRRDC's charter. Funded projects in this call may be subsequently incorporated into commissioned programs (LWRRDC 1996:29). For the term 1998–99 around 6% of expenditure was directed to such research (LWRRDC 1998a:10).

Nearly all RDC funding, including LWRRDC's, is directed at achieving practical outcomes. This is reflected in the research mix across most RDCs, wherein for the year 1995 applied research had the largest investment, with an average of 62%, followed by strategic research with an average of 27% and basic research with an average of 11% (Lovett 1997:61). However, LWRRDC's investment mix in 1995 contrasted with this pattern (basic 15%, strategic 65%, applied 20%). This emphasis on strategic research is ongoing and reflects the general case that many of LWRRDC's activities are focused on *sustainability* issues which are poorly understood and cross-sectoral in their context. These issues are less amenable to the applied research focus of the industry-led commodity RDCs. LWRRDC says it does not expressly seek to balance its portfolio against these types of research. The Corporation's only concern is that the research it funds addresses the question at hand, and this will dictate the nature of the R&D (R. Price, pers. comm., 10/9/98).

Figure 3.1 LWRRDC R&D program structure



Note: See LWRRDC (1996, 1997b) for full names of programs in shaded boxes

The following broadly summarises LWRRDC's current approach to R&D investment decisions following the establishment of priority issues (LWRRDC 1996 provides more details):

- LWRRDC Board uses data sheets[4] and the template of questions (Appendix E) to rank and allocate funds to programs.
- A scoping review addressing the template of questions is commissioned to assess the need and potential for a new program.
- LWRRDC Board decides whether to proceed and funds are allocated. Management is subsequently devolved to a program management committee (which includes Board members and the relevant program manager); partners are sought (preferably true funding partners) and represented on the management committee.
- A program manager is appointed and a program management framework established. LWRRDC has experimented with formal investment decision analysis to assist program management decisions but has rejected this approach as too complex and the information requirements too intensive to be practical. Currently, program managers are relying on the outcomes of consultancies and scoping reviews to define objectives and priorities for a program and associated projects. In most cases, these initiatives involve a substantial level of stakeholder involvement, including through formal workshops, visits and call for submissions.
- Program managers seek R&D proposals. LWRRDC is experimenting with the 'logical framework matrix' approach in project applications to encourage a closer linkage between research and outcomes. See Sloane *et al*. (1997) for an example of this approach.
- LWRRDC Board approves or rejects proposals, or asks applicants to resubmit in response to solicited referee comments. The Board has sole responsibility for considering first and second-round proposals in the case of the General Call. In the case of Commissioned Programs, the Program Management Committees (PMCs) are responsible for recommending projects for support by LWRRDC and other partners. Often the LWRRDC Board will see only the final proposals, or in some cases summaries of final proposals, when they are asked to endorse the recommendations of the PMCs.
- The program is assessed every three years and at conclusion. With the establishment of a 'life of project' evaluation process, a random stratified sample of projects is also evaluated ex ante, at least once during the project life, and ex post.

Characterising LWRRDC's research investment

To what extent does LWRRDC currently invest in social and institutional R&D relative to biophysical R&D, and what types of social and institutional research have been supported? It is difficult to answer these questions definitively for the reasons noted in Section 2.3. The papers in Sections 4 to 7 provide some discussion of LWRRDC-supported social and institutional R&D, but the general picture can be characterised in the following way.

LWRRDC's major research investment in terms of funding and number of projects has been technical and biophysical in orientation. The results of a query of the LWRRDC database suggested that, of approximately 1000 research projects and consultancies funded since 1991, some 150 had been coded as those which addressed 'the framework for policy and management'. This generally encompasses the types of research that we have characterised as social and institutional in orientation, but it also includes many consultancies and projects which we do not consider fall within our definitions. A more realistic figure might be 120.

Of these projects, which represent approximately 10% of total projects, the primary emphasis has been economic research (particularly market value assessments), followed by a strong interest in very diverse areas of social research. Policy is often mentioned as a dimension of research but rarely substantiated as a major component. Research with a legal orientation has been supported the least. (See Sections 4 to 7.)

The geography of LWRRDC investment is also worth comment. The majority of research has been focused on southern Australia, in particular, the agricultural zone. It appears that areas such as the rangelands, particularly in northern Australia, and other ownership categories such as indigenous lands have been accorded lower priority. The current investment pattern is partly a reflection of LWRRDC's predecessor programs and the Corporation's location in the AFFA portfolio with its associated emphasis on rural industries, land degradation, and Landcare. It also reflects the way in which the commissioned program approach seeks stakeholder agreement on major forms

4. Since 1995, LWRRDC have published a set of data sheets on major NRM issues which outlines issues of significance, researchability and likely adoption of improved practices (LWRRDC 1998b). Apart from their role in assisting LWRRDC to make investment decisions, the data sheets have a communication objective and are designed to be updated and improved with the input of interested stakeholders.

of resource degradation at the national level, and the concentration of researchers in southern Australia.

The pattern of research funded is changing over time with a greater emphasis on research programs as opposed to individual projects. Research which explores various dimensions of economic, social and, to a minor extent, institutional issues in NRM has been particularly encouraged in recent General Calls, and some programs, for example, remnant vegetation, integration and adoption, rangelands, and the second phase of the dryland salinity program, now have significant social and institutional components.

To summarise, LWRRDC has largely operated in the traditional R&D mode for resource management wherein research tasks have generally been narrowly construed as technical problems which fall within the domain of biophysical science or neo-classical economics, tackled in isolation from other aspects of our society's evident failures to manage our natural resources sustainably. This pattern is certainly not confined to LWRRDC, extending to most organisations, research or management orientated, in NRM. Some, like LWRRDC, are now trying to address the multiple dimensions of sustainability through closer attention to diverse knowledge resources (eg. the Tropical Savannas CRC, see Section 3).

It is important to put these comments in the context of the long time it takes for a new institutional model to 'settle in'. Both Lovett (1997), commenting on reviews of the corporation model of RDCs, and Mercer and Stocker (1998), in their recent review of the CRC model in Australia, caution against too great expectations of these new approaches to the organisation and linkages of public sector research with users. In LWRRDC's case, the Corporation inherited the existing national soil and water research programs with *their* focus on a biophysical research paradigm. There was no pre-existing model of research which reflected the new Corporation's more holistic concerns. The Corporation has been engaged in a dynamic process of defining its own identity, developing approaches to tackle cross-sectoral resource management issues, and a research philosophy which encompasses the concerns of both biophysical science and the humanities and social sciences.

3.2 The need for social and institutional research in natural resource management: perspectives from reviews

This section of the report starts with some general observations on the findings of selected major national reviews of natural resource management which have relevance to our questions on social and institutional research needs. The second part of the section outlines the findings of LWRRDC review literature. The intent of both sets of observations is to identify the principal challenges for social and institutional research based primarily on published material.

National reviews

We begin our selective survey of national reviews with the recommendations arising from the Australian Science and Technology Council (ASTEC) 1991 report on Environmental Research in Australia, and close with the Industry Commission's 1997 Inquiry into Ecologically Sustainable Land Management. Box 3.2 illustrates the literature we consider here, while Appendix B, Table 2 provides more detail. This is not an exhaustive listing of relevant literature but is sufficient to identify the social and institutional issues that have emerged or have persisted over the past decade of attempts to formulate and implement ecologically sustainable resource management in rural environments.

There are some recurring themes across these reviews. First, the idea of ESD is widely accepted as the guiding framework for resource and environmental management, although still not well defined in an operational sense, but at its core combining inter- and intragenerational equity, protection of biodiversity and ecological processes, and integration of environmental, social and economic dimension of policy over longer time horizons. General agreement is evident that the ESD 'ideal' is far from being realised. There is also agreement that uncertainty pervades NRM issues and that more investment in research and monitoring is required. However, against this is a wide perception that increasing scientific/technical knowledge is an insufficient strategy in itself. Social, cultural, legal, economic and institutional barriers are recognised as important, although what to do about that is less clear. In terms of operational ways forward—methodologically or policy instruments—the picture from these reviews is somewhat more blurred.

In terms of social and institutional research needs, four major themes are evident. These can be characterised as technical capacity, integration/ communication, institutions, and policy instrument choice, especially between regulation and market-based mechanisms. Disturbingly, although perhaps unsurprisingly in an area which lacks any coherent national policy objectives apart from ESD principles, research recommendations are rarely specific enough to adequately guide any subsequent R&D program. Some comments on each of these four themes follow.

Technical capacity: the growing complexity of NRM and the growing use of ever-more powerful

computers, geographic information systems and other technologies is reflected in this theme. A number of reviews noted the need for analytical tools and methodologies including decision-support systems (DSS) that could equitably incorporate social, biophysical and economic considerations and facilitate comparisons and trade-offs between policy goals. A good deal of work is evident in this area, but as yet little in the way of clear directions has emerged, which is to be expected at this stage.

Box 3.2 National reviews relevant to R&D and natural resource management

Environmental Research in Australia: the issues. ASTEC (1991).

Ecologically Sustainable Development Working Group Chairs Intersectoral Issues Report. Commonwealth of Australia (1992a).

Bridging the Gap: the social sciences and humanities in Australia. ASTEC (1993).

Sustaining the Agricultural Resource Base. PMSEC (1995).

Australia: State of the Environment 1996. SEAC (1996).

Developing Long-term Strategies for Science and Technology in Australia. Findings of the study: matching science and technology to future needs 2010. ASTEC (1996).

Reimbursing the Future: an evaluation of motivational, voluntary, price-based, property-right, and regulatory incentives for the conservation of biodiversity. M.D. Young *et al.* (1996).

Commonwealth Natural Resource Management and Environment Programs. ANAO (1997).Sustainable Natural Resource Management in the Rangelands. CIE(1997).

A Full Repairing Lease: inquiry into ecologically sustainable land management. (Draft Report), Industry Commission (1997).

Integration/communication: the above problem area is also related to this theme which emphasises our continuing failure to integrate different kinds of knowledge, in particular perspectives from the humanities and social sciences with those from the natural sciences and technology. Several reviews suggest that not only do we have little capacity to be integrative in this way, but also there is still little evidence that social and institutional research is afforded the same priority as biophysical research in natural resource management. The ASTEC (1993:45) review notes:

> In recent years Australia, in common with many other countries, has looked to science, technology and research to help the nation to become internationally competitive, and has created government bodies to develop policy and programs in relation to these activities. However, Australia has yet to accept the important and complementary role of the social sciences and the humanities in providing new ways of looking at the world and new kinds of knowledge. Nor have we been effective in finding new ways to bring together different kinds of knowledge, in particular to promote the mutual interaction of the humanities and social sciences with natural sciences and technology.

Also in the integration theme are issues surrounding communication and adoption, with some reviews pointing to poor linkages between researchers and research users as evidenced in low rates of adoption. Given that the professional requirements of researchers do not often include communication with lay audiences, and that 'traditional' extension approaches have to some degree fallen into disuse, this should not surprise. 'Bottom-up' communication models are receiving more support, but again this is a new field with still evolving methods and nascent institutional recognition (despite the proliferation of community-based programs).

Institutions: The third major theme is an awareness of various institutional constraints on the pursuit of ecologically sustainable natural resource management. Dovers defines the use of the term 'institution' in this context in Section 7. Here we simply note that several reviews point to the lack of appropriate meta-arrangements such as a coherent national policy framework for the agriculture and pastoral sectors, and for R&D such that research organisations could coordinate their efforts.

Policy choice: The final theme of policy instrument choice could be appropriately incorporated in the previous theme, but is separated here because of the frequency with which it is identified as an issue for future research. Many of the reviews refer to the need for enhanced regulatory and/or market-based policy mechanisms to enable sustainable resource management (see Section 7 for an expanded discussion of instrument choice).

In addition to the major themes, a relevant minor theme evident in the reviews was that useful evaluation and monitoring of past and current research are still largely lacking. Finally, one review noted the potentially large-scale social and economic transformations that lie ahead for Australia, including the possibility that the world could move to a higher

valuation of the environment relatively quickly (ASTEC 1996). It was suggested that risk assessment, perception, valuation and management were critical areas for research and incorporation in decision-making.

LWRRDC reviews

Since establishment, LWRRDC has initiated a number of reviews of important resource management issues and also of their own programs established to address such issues. A summary of the salient themes in the LWRRDC literature is at Appendix B, Table 1. Looking across these reviews, the overwhelming message is concern that current R&D efforts are not capturing critical dimensions of the resource issue.

Clearly LWRRDC has a suite of powerful arguments to bolster its intention to establish a portfolio of R&D into improving the social and institutional environment relating to natural resource management. All the themes identified above are evident in the LWRRDC reviews, with some additional themes also emerging. The entire set of themes (very loosely reflecting the number of times mentioned from most to least) is as follows:

- Integration, communication and adoption: as above, with additional concerns about the effectiveness of mechanisms and processes devised to pursue the concept of integrated research and management. Several reviews query the nature of constraints to adoption and raise concerns about the failure of research projects to consider adoption in research design.
- Institutions: as above. Many reviews placed a high emphasis on institutional constraints or failures but these were usually expressed in vague terms such that it was unclear what aspect of the institutional environment was intended to be a target of research.
- Economic/environmental valuation and cost sharing: there is a general enthusiasm for more rigorous and transparent approaches to cost–benefit analyses, especially to account for non-market values, and also the development of cost-sharing principles.
- Policy choice: as above.
- Monitoring/evaluation: as above.
- Perceptions/attitudes: some reviews note the need to better understand how land managers perceive resource management problems, priorities and responsibilities, and how they make decisions.
- Technical capacity: as above, with additional concerns about the need for participatory and action learning approaches.
- Social impacts and structural adjustment: in line with recognition of the changes that are occurring and will occur within rural communities, some reviews raise concerns about the relationship between such changes and implementation constraints.
- Transferability and generalising from research: some reviews point to difficulties transferring lessons from research to new situations.
- Approaches such as integrated catchment management (ICM) based on devolution of responsibility to local/regional levels: noting the continuing emphasis in Australia on community decision-making and responsibility for resource management, some reviews query the assumptions underlying this philosophy. Other reviews emphasise the need to further develop and understand ICM processes.
- Role of groups: often related to the above theme, some reviews point to the importance of understanding the role of groups such as Landcare/farmer groups or total catchment management (TCM) committees in delivery of R&D.
- Risk assessment/management: as above.

3.3 The need for social and institutional research: views of the LWRRDC Board and other key individuals

In addition to scanning the literature, we consulted several individuals for their views on the topic. As noted in Section 2, the major focus of consultation was with each member of LWRRDC's Board of Directors. However we also consulted a small number of individuals from key organisations. These included: the Australian Conservation Foundation (ACF) and the National Farmers' Federation (NFF)[5]; several industry RDCs; Tropical Savannas CRC; Murray–Darling Basin Commission (MDBC); Bureau of Rural Sciences (BRS) and Australian Bureau of Agricultural and Resource Economics (ABARE); NSW Premier's Department; CSIRO Tropical Agriculture; and Integra Pty Ltd. The key points made by those consulted are reported in the following sections (in the above order, and using the spokesperson's words to the extent possible). The space devoted to the views of each organisation reflects the number of points the spokesperson wished to stress in the time available.

5. The ACF and the NFF are LWRRDC's representative organisations for accountability purposes.

LWRRDC Board

(NB: the views of the LWRRDC Board are only summarised here, as Board members will have the opportunity of sustained and crucial input concerning the topic of this consultancy at a later date.)

LWRRDC Directors are all supportive of the proposition that the Corporation has an important role to play in, and should invest in, social and institutional R&D. They perceive that R&D adoption has been frustratingly slow or non-existent because inadequate attention has been paid to the complexity of factors that influence decision-making, and all hope that by developing a more holistic perspective on R&D such problems can be better addressed.

The Directors identified different priorities for social and institutional research:

- guidance about the nature of and scope for legal instruments;
- adding value to existing and disparate R&D in this area;
- understanding how people make adjustment decisions, why not, and what to do about it (especially where signals of change are muted such as in rangelands contexts);
- different institutional arrangements for catchment management and cost sharing;
- water policy and specific guidelines for new irrigation developments;
- understanding how industry, biophysical and knowledge-based domains relate to policy realms and the nature of linkages and interplay of instruments that are needed;
- quantifying social and non-market values so that they are not neglected in trade-off processes;
- showing how instances of market failure can be corrected;
- helping to work through the issues when LWRRDC Board identifies and selects R&D; eg. are the template questions appropriate and useful?
- understanding what influences R&D adoption;
- understanding incentive structures and their influence on processes of land degradation;
- developing processes to enable/support empowered communities to manage public investment in resource management; and
- a critical review of institutions (eg. Agriculture Western Australia) to analyse the extent the different models support community empowerment or are they part of the problem?

In terms of perceived constraints or difficulties that LWRRDC might face in developing the proposed portfolio of social and institutional R&D, LWRRDC Directors were particularly concerned about policy/ institutional/legal areas of R&D. For some Directors, policy-related R&D is very risky and will be virtually impossible for LWRRDC to support without stepping on the toes of Commonwealth and State government agencies. These Directors stressed the need for such research to avoid prescription, to not cross the boundary into policy formulation, and where necessary to be conducted jointly with those agencies whose core business is policy development. Other Directors acknowledged the risks, but wanted LWRRDC to show the necessary leadership in this area and not avoid critical areas of inquiry.

In contrast, it seems generally the case that social and economic areas of R&D are not deemed controversial, rather LWRRDC's past investment in these areas is perceived to have been poorly structured, poorly integrated with other R&D, or too under-resourced to 'make a difference'. One Director added that, in his experience, disciplinary arrogance is still a fundamental constraint against inter/ transdisciplinary approaches to research, in that social and institutional research is not deemed 'real - science'.

With regard to potential organisational structures for social and institutional research, all except one Director saw a need for a separate program for such research so that it wasn't sidelined, as well as a need to incorporate relevant perspectives in existing programs. One Director was concerned that establishing a separate program would impose too high a cost in managerial terms and relevant expertise should be incorporated into existing programs instead.

The Australian Conservation Foundation

Broadly, the ACF is concerned that "current R&D is throwing money at 'improving agriculture' without really knowing whether it is doing any good in the long term". The ACF are very supportive of LWRRDC taking a leadership role in alternative research directions because it is the ACF's perception that no-one is coordinating such research at the moment. The ACF provided LWRRDC with a number of suggested issues for consideration regarding their 1998–1999 R&D priorities, most of which fall into areas of social and institutional research and are summarised here:

- Policy/legal research regarding collaborative Commonwealth/State implementation of the reforms identified in the Draft Industry Commission Inquiry into Ecologically Sustainable Land Management (ESLM). The

spokesperson suggested that current major policy instruments (funding programs and 'volunteerism') are inadequate and that LWRRDC should support a process of policy reform through research on relevant areas such as institutional change, legislation and regulation (eg. on 'duty of care'), monitoring and performance evaluation, and taxation and funding arrangements. The ACF also sees the need for work on competition policy aspects of the operation of State agencies such as forestry departments.

- Policy research on Council of Australian Government's (COAG) water reform agenda. ACF perceive that while Environment Australia (EA) and the National Competition Council are engaged in this process, neither body has strength and authority on policy detail. LWRRDC should support research on issues such as water trading, implications of water resource developments for estuarine, coastal and marine ecosystems, farm dams policy, and floodplain harvesting.
- Planning and EIS process research is needed to understand the implications of groundwater resource development threats to groundwater-dependent ecosystems.
- A range of research is needed in northern Australian wet–dry tropics, because of increasing pressures toward intensive land and water uses, and following the *Native Title Amendment Act (1998).* LWRRDC, AFFA and EA have little presence in this region. Social research areas include negotiation (cultural and native title issues) and the need for skills development within Aboriginal communities to undertake and manage the land use changes that are occurring. Similar research needs are evident in the arid and semi-arid rangelands, particularly as the National Rangelands Strategy has disappeared from the Commonwealth agenda.
- Social research into landholder information needs regarding natural processes to identify information, knowledge gaps, and misperceptions. The ACF believes it is important to assess the knowledge base of landholders in different regions or sectors, despite the tendency in farmer organisations to say "don't tell us how to suck eggs". Such research could help to better target education, awareness and involvement programs in Landcare, ICM, etc.
- Policy/legal research into vegetation management including comparing and contrasting vegetation clearance control approaches of different State governments and defining appropriate principles for vegetation clearance controls, the concept of 'no net conservation loss', and standards for vegetation management and revegetation initiatives.
- Economic research into 'direct approaches' of identifying attributable costs to the environment of land use activities and degrading processes (as opposed to contingent valuation type studies which the ACF believes are not very meaningful and are not used by policymakers). The intent would be to develop accounting systems that are transparent in terms of the costs involved in mitigating environmental damage and assist in the development of cost-sharing principles that can identify the public environmental benefits involved in the use of public funds.
- Policy/planning research into frameworks for managing the incremental loss of farm/bush land to urban and semi-urban subdivision, especially east coastal Australia.
- Monitoring and research into the environmental impacts of irrigation drainage schemes in the Murray–Darling Basin, and research into the ethics of publicly funding such schemes when the benefits are privatised.

The National Farmers' Federation

The NFF believes there are problems translating research into practical outcomes due to a lack of understanding social and institutional dimensions in the first instance, "we agree therefore that these social and institutional areas are targets of research in themselves; at the same time there is a need to involve people from these backgrounds in more traditional research, and involve stakeholders who have to implement any outcomes". The NFF acknowledges LWRRDC's existing efforts in the latter respect and believe they are, in fact, one of the most responsive of the RDCs. The NFF supports LWRRDC's recent efforts to work directly with commodity sectors in large scale projects—"this seems a more strategic approach than NHT [Natural Heritage Trust] funding which is 'itsy bitsy' and all over the place".

The NFF states that research design is critical and warns that many people working in the natural resource management area still approach design from the biophysical science perspective. The NFF acknowledges that it will be more expensive to incorporate social and institutional perspectives from the outset, "but if it helps to get results it has to be done". The NFF further acknowledges that there are dangers for LWRRDC in engaging in policy related research, "however this is definitely needed and it is an important role for LWRRDC to play in informing policy debates; the LWRRDC Board should keep a close eye on this research".

The NFF believes that there is probably a shortage of people with the necessary skills. Reflecting on a review of one of the CRCs working in the NRM field for example, the NFF spokesperson noted that the need to enhance the CRC's capabilities in these areas was one of the issues identified: "Often however research organisations don't perceive they have to employ specialists and don't accord this area significant weight. They seem to think that any 'human stuff' is easy, because it is not 'real science'. Some universities are now producing graduates with the relevant skills and LWRRDC should target these for research alliances".

Primary Industry Research and Development Corporations

Our perusal of the research portfolios of several RDCs suggested a primary focus on biophysical dimensions of resource issues and economic analyses to support productivity orientation. We consulted research program managers at three RDCs—Fisheries (FRDC), Grains (GRDC) and Rural Industries (RIRDC)[6]—for their views on the need for social and institutional research relevant to natural resource management and how they approach such research in their own portfolios.

None of the RDCs consulted can query its databases in such a way as to define or characterise its research projects as concerning social or institutional research areas (our definitions). With the exception of RIRDC, research program managers confirm that they do not have any comprehensive or strategic approach to social and institutional R&D, and very little work in these areas, apart from economic analyses, has been supported in the past. Some research managers suggest that this is partly a reflection of the applied emphasis of the industry RDCs (the industry contribution of 25% funds means that industry priorities must be reflected in their portfolios) and fairly narrow conceptions of RDC management bodies.

With regard to policy/institutional research, the research managers generally point to ABARE, BRS, Department of Foreign Affairs and Trade (DFAT), or other areas within AFFA as having the core funding and role to undertake such work. At the same time some research managers suggest that the work needed is not necessarily undertaken by these agencies or that the needed expertise is not located in these agencies.

The RIRDC position on social and institutional R&D is expressed somewhat differently to that of other RDCs. A spokesperson stated that they have always accepted their role in encouraging research outside the technical and biophysical sciences area (while they perceive that LWRRDC appears to have been more orientated to biophysical science from their inception). The spokesperson offered the following general description of RIRDC's approach to R&D.

The corporation has an organisational structure of four overarching programs. Three programs are industry orientated—Prospective New Industries, Emerging New Industries and Established Industries—and support a range of R&D from biophysical and economic analyses for specific industry sectors, to areas such as human health and resource management. The fourth program, Future Agricultural Systems, is designed to address strategic cross-sectoral issues facing the rural sector. The latter program with its three sub-programs of Global Competitiveness, Resilient Agricultural Systems, and Human Capital, Communications and Information Systems tends to support the majority of social and institutional research in RIRDC through the very nature of its agenda (see RIRDC 1997). That is, the concerns of these sub-programs necessarily invite social and institutional research perspectives.[7]

Sub-program objectives are currently in the process of formal development as strategic five year plans. These are developed through a review of past activities and by a formal program advisory committee in conjunction with the program manager and wider stakeholder or industry consultation. The latter is usually required with industry specific sub-programs. Responses to RIRDC's annual call for preliminary research proposals are evaluated against priority areas in the sub-program plan and the economic benefits to Australian rural industries or communities. Successful preliminary proposals are invited to submit a full proposal.

The Future Agricultural Systems program is an evolving area, but in broad terms RIRDC handles the cross sectoral elements of the sub-programs in two main ways. For the sub-program Human Capital and Global Competitiveness, an informal advisory group with broad sectoral and industry membership has been established to assist the program manager. The group offers advice on the program strategy and specific projects. Some members are paid a sitting fee. On occasion, research proposals are externally reviewed or their proposers requested to resubmit with the inclusion of some missing expertise or research component. (At this stage, the Resilient Agricultural Systems sub-program does not have an

6. Of the 15 RDCs, the RIRDC is closest to LWRRDC in terms of a cross-sectoral mandate for NRM issues.

7. Although it should be noted that perusal of RIRDC Current Projects 1997–1998 reveals that the sub-program with greatest affinity with LWRRDC's agenda—Resilient Agricultural Systems—is largely focused on biophysical R&D.

advisory group—a strategic plan is under development.)

The second strategy that RIRDC adopts occurs when it appears that the expertise of the advisory group is still insufficient to address all the areas that a research project may cover, or when it appears that decision-makers need to be more closely linked into a project. Under these circumstances, a project team may be advised to establish a steering committee with relevant expertise or stakeholders, and on which advisory group members may also sit.

With regard to future investment in social and institutional research areas, the RIRDC spokesperson pointed out that they are trying to extend research into issues of concern to rural communities. To this end they are funding a scoping review of 'rural social R&D' needs in conjunction with the Understanding Rural Australia program within AFFA. The situation with legal, policy and institutional research is less clear as it is difficult to define RIRDC's role in these areas in relation to AFFA, ABARE, DFAT, and other agencies:

> RDCs have to be cognisant of government sensitivities and the way in which any policy criticism or advocacy may be perceived. It is difficult, in fact, to do 'objective research'. Any policy and institutional research needs to have very good lines of communication with relevant agencies. This is an approach that should be adopted by all RDCs when they engage in such research.

The spokesperson made the point that if LWRRDC does establish an R&D program in this area, with time it may be perceived as another location of expertise by agencies. Finally, the spokesperson noted the difficulties of evaluating research programs such as RIRDC's Resilient Agricultural Systems which have an emphasis on non-market values. In the past RIRDC has tended to use traditional benefit–cost analyses of projects, an approach which captures non-market values with difficulty. They have recently established a new program evaluation approach and have left Future Agricultural Systems to the last stage in the evaluation cycle (year 2000–2001) in order to consider more appropriate evaluation tools and also in the hope that LWRRDC will have advanced its efforts in the evaluation of similar programs.

Tropical Savannas CRC

The Tropical Savannas CRC points out that it was established in 1995 and hence is still in the early stages of defining its role in sustainability research and developing a stronger relationship with organisations such as LWRRDC. For example, the spokesperson noted that the CRC is well placed to address the geographic bias in LWRRDC's portfolio. The CRC believes that LWRRDC has an important role to play in the social and institutional research areas, particularly to identify 'researchable issues'. The CRC also believes that education generally is an enormously important component of R&D but cannot comment on LWRRDC's role in this aspect.

The CRC states that its recent restructuring process was aimed "at getting away from our old approach which was very linear and sequential; that is, do the science, search for an application, consider an extension/education process. We are also trying to avoid a program structure which ends up boxing things into certain areas when there are clearly linkages that need to be made."

To develop a more-integrated research approach, the CRC is pursuing two strategies. The first strategy is the adoption of an interrelated 'thematic' research structure for the CRC's concerns following a stakeholder consultation process. There are four themes—North Australia Landscape (broadly, status and health of landscapes); Landscape Processes (broadly, how landscapes work); Ecosystem Management (broadly, intervention impacts); and Human Capability Development (broadly, enhancing knowledge and skills of stakeholders). The CRC aims to integrate its research projects through their identified contribution to one or more themes. Project management is deliberately separated from theme management. Each theme is managed by a leader who doesn't have any project management responsibilities but does have a responsibility to develop and communicate the 'big picture' and identify relationships and linkages between projects and themes.

The second strategy is to continue with and develop three large case studies, or 'management studies' including the Desert Uplands and the Victoria River District[8]. The studies will serve to focus and integrate CRC research for implementation in ways that are relevant and desired by the people who live in the regions.

Regarding the support of social and institutional research, the CRC states that, like LWRRDC, it has faced difficulties here. It identifies two major reasons:

> First, we have yet to work out how to frame social and economic research issues in such a way that they are 'researchable', that some pragmatic results eventuate that make a difference on the ground.

8. The CRC prefer the term 'management studies' as they believe that the term 'case studies' has unfortunate connotations: "it suggests that you are engaged in a once-off process, you can walk away when it is finished, and researcher and researched are separate. But we in the CRC are interested in a life-long continuous learning process. There are no ultimate or final answers, what can we do to progress in some way?".

> There are so many social issues that could be researched. There is a tendency to adopt the fishing expedition approach where lots of really interesting bits of knowledge about social issues are generated and the researchers hope that the results can be applied in some way. One response we have made in a social area is to deliberately employ a project manager who has a background in academia and working with the pastoralism industry. The second reason is we have found that there is a real shortage of good people in these research areas!

With regard to policy/institutional/legal research in particular, the CRC states that it does not directly engage in research that could be perceived as advocacy: "We'd quickly lose stakeholders. We have to tackle such issues very carefully and make an indirect contribution perhaps." The CRC gives the example that it would not overtly address land tenure as an issue but would instead provide opportunities for people to discuss and debate tenure issues. This is perceived as a step along the path rather than funding the framing of new legislation. The CRC states that they view policies and institutions as impediments and would encourage research that identifies "the nature of the impediment".

The Murray–Darling Basin Commission

The MDBC is very supportive of LWRRDC's proposed engagement in the area of social and institutional research. The MDBC spokesperson states that the Commission has been concerned about similar issues with regard to its own research models and investment, that LWRRDC has raised with this project: "the linkages between social/institutional circumstances and environmental dimensions are still very poorly examined and taken into account when resourcing decisions are made, whether for research or on-ground implementation".

With regard to their R&D needs, staff in the Commission have recently characterised relevant issues in the following way: (i) *external influences*: there is a need to analyse the position of the Australian agricultural economy in world markets to determine best options; (ii) *the people*: rural communities are not homogenous and there is a need to analyse the assumptions underlying structural adjustment policies; (iii) *trends*: there is a need to analyse how structural adjustment can take account of the needs of rural communities and the future impacts of adjustment on rural settlement patterns and rural community infrastructure; and (iv) *scales of inquiry*: there is a need for research which has global through to local dimensions.

The MDBC spokesperson noted that these R&D needs fall within the ambit of social and institutional R&D and added the following points about the need for such research:

> We need to question all our assumptions about the models we are adopting: the TCM model, Landcare, the model of devolution. This whole debate has been premised on community ownership and voluntary acceptance of responsibility and a blind faith in structural adjustment processes while major shifts are occurring, such as corporatisation and agribusiness. Governments need to understand the context in which restructuring occurs. If we can project likely scenarios of restructuring than we can more effectively design appropriate policy interventions instead of assuming 'one size fits all'. Neil Barr's work in this area is particularly relevant. We should also be asking: are we realistic when we put all our resource management eggs in the TCM basket? Where are the coherent policy measures and the improvements to institutional structures? For example, the COAG reform process is premised on efficiency, not equity socially and environmentally; is this model going to deliver the changes that we think are needed?

The spokesperson pointed out that, in response to the increasingly high profile of such issues in MDBC discussions, staff within the MDBC are currently working with MDBC Commissioners and the Community Advisory Committee to review their Basin Sustainability Program and its objectives. The Commission will be considering a proposal to develop a new sub-program with a 'human-centred' focus, tentatively titled the 'Basin Partnership Program' (BP), to work with existing sub-programs. The spokesperson outlined the following description of this potential MDBC scenario (see Figure 3.2).

Three sub-programs currently manage the Strategic Investigations and Education (SI&E) component of the Basin Sustainability Program: riverine, dryland, and irrigation[9]. As with LWRRDC, these sub-programs manage a range of research projects within several thematic or priority areas, and most projects (although not to the same extent as LWRRDC) have been orientated towards technical biophysical investigations. In theoretical or perhaps paradigmatic terms, the existing sub-programs are based in an objectivist or positivist model of MDBC's operating environment which has a traditional focus on 'the scientific method' (see Section 4). In contrast, the proposed BP sub-program is based in a social constructivist model: "it is concerned with relationship-building and a preference for context specific investigation, the recognition that *all* stakeholders are social actors in the creation and implementation of MDBC objectives, and relatedly that it is necessary to offer more support to Basin communities to achieve the changes desired by society". It is intended that the BP sub-program would have a dual role in that it would provide a more

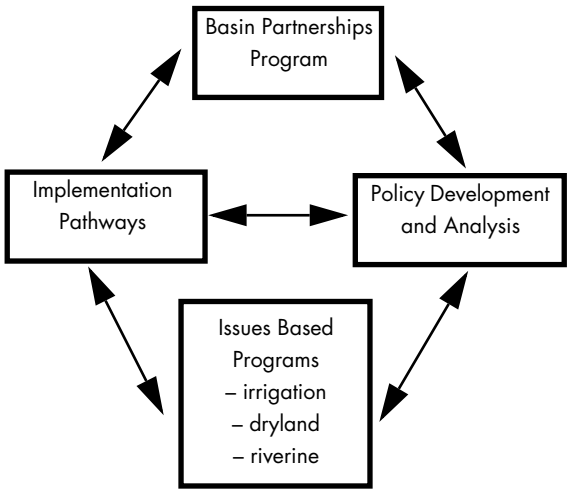
9. SI&E has the same functions as R&D.

appropriate foundation and integrative perspective for work conducted within the issues-based sub-programs, as well as the coordination of BP program specific projects. It would have two broad foci:

- Implementation pathways: including best practice for MDBC partnerships, communication priorities, integrating the human and biophysical dimensions across programs, testing the assumptions that frame MDBC initiatives, and analysing the need for policy, legislative, and/or regulatory shifts to address impediments to action.
- Policy development and analysis: including pursuit of policy as an 'informing system' (see Dovers, Section 7), purposeful, long term approach to integrate and coordinate across policies, sectors and disciplines), and wide participation in policy development.

In the short term, a number of priority project areas have been identified through a workshop process with Commissioners and the Community Advisory Committee, issues papers and a transfer and adoption scoping study (Integra Pty Ltd 1998), and it is envisaged that these projects may initially be supported via SI&E program funding.

Figure 3.2 Preliminary model of the proposed Basin Partnerships Program in the MDBC Basin Sustainability Program



BRS Social Science Centre and ABARE

The Social Science Centre is a new centre within the BRS and is very supportive of LWRRDC's intention to support social and institutional research. The BRS has established expertise in the biophysical sciences and contributes scientific advice and analyses to AFFA. The decision to develop a Social Sciences Centre is in response to an increasing recognition of the importance of the many social and institutional issues that affect the portfolio. One catalyst, for example, was the portfolio's experience in the Regional Forest Agreement (RFA) process. RFAs required the development of appropriate social assessment techniques and methodologies alongside economic and biophysical analyses. The spokesperson noted that following the RFA experience, the Social Sciences Centre: "are concerned with the creation of a conceptual framework for integration questions that is meaningful for both quantitative and qualitative social data and provides a platform for environmental and economic data". The spokesperson also noted a general lack of understanding of social research areas in natural resource management and sees that one important role the new Centre can play within AFFA is as a conduit for social science advice—eg. where can you go for help on a certain issue? In addition, the Centre will focus on developing expertise in a small number of areas including: developing social profiles, consulting with communities and managing social risks, assessing social impacts, social auditing, social research methods, and analysing institutions.

The ABARE spokesperson is also very supportive of LWRRDC's intentions. The spokesperson perceives that:

> The penny is finally dropping in a few areas that 'technical performance' is not the only answer. There is an absolute need for these other areas of research in NRM and they are hardly captured by RDCs. Although some are shaking off their dinosaur scales and moving away from narrow conceptions of research needs in the primary industry sector, others are still stuck in their old ways.

The spokesperson pointed out that AFFA and the RDCs could not rely solely on ABARE or BRS for policy-related research for example, because these research organisations can provide advice only in certain areas of expertise. The spokesperson also urged LWRRDC to consider carefully how to 'sell' the new research direction to their constituency and, for example, to explore the use of new types of communication strategies and outlets.

Special Adviser on Natural Resources, Premier's Department, NSW

This person is an adviser of the Director General of the NSW Premier's Department. He is an economist and is involved in the NSW land and water management planning process and the assessment of the social and economic impacts of water reform in that State.

This spokesperson believes that social and institutional issues are fundamental in NRM, they should be targets of R&D, and that LWRRDC should

have a clear role and responsibility to support such research. With regard to activities such as land and water management planning, the spokesperson noted that much of the necessary work has to be location specific because of the great variety of circumstances existing in different locations. Despite this, "one could conceive of significant areas of research into more generic institutional and property rights arrangements". Reflecting on the experience of working with community groups in the NSW Land and Water Management Planning process, the spokesperson made the following points:

> Planning resource management is very difficult and challenging both with regard to engaging communities (which is a slow and evolutionary process while politicians want quick decisions) and working across disciplinary borders at the government level. In the former case for example, a cultural issue is that many communities have to come to comprehend the nature of the task that has been set in this process. A typical initial response is to wait for government to do the job for them. In the latter case, it is clear that land and water management plans are initially defined and analysed in biophysical terms; it is only after a plan is devised that it is evaluated in socio-economic terms. This approach is fundamentally flawed but this sort of thinking seems embedded in our general approaches to resource management issues. I believe that a socio-economic perspective must inform problem-definition at the outset because the issues are fundamentally about human values. Social sciences are the disciplines which focus on and comprehend values, not the biophysical sciences. There is scope for some very interesting and worthwhile R&D in this general area because the resource degradation problems are so serious and we really need to be questioning our institutional arrangements. Interstate comparisons would be useful. One useful area of research, for example, would be to compare the NSW planning process with the Victorian process.

With regard to potential organisational arrangements within LWRRDC, the spokesperson believes that social and institutional R&D must have a dedicated program: "if it is tacked onto existing problem areas it will be 'killed' because resource management areas are invariably driven by biophysical science and prejudice against social science is still evident".

CSIRO Tropical Agriculture

Staff within this division of CSIRO have been engaged in ICM processes and interdisciplinary research programs. The spokesperson was concerned that there were many issues emerging which require research in the policy and institutional areas but which were not being adequately 'picked up' through existing research channels. The spokesperson was very supportive of LWRRDC's interest in these areas and identified the following issues as relevant:

> Regarding ICM processes, there is a big emphasis in Queensland on the voluntary community driven approach (in contrast to Victoria), however along with all the devolution of responsibility is not coming devolution of resources in the broadest sense. All the emphasis has been on developing plans, but they are stalling at implementation. In addition, representatives on community committees feel that they are finally working out how to cooperate with each other but are finding that government agencies cannot cooperate with each other! Government agencies are fundamentally at logger-heads and give out conflicting messages to the community.
>
> Furthermore, we still have little idea about how to develop and use integrated process, tools and methodologies. This is not only an ICM issue, but extends right across natural resource management areas, as do the implications of COAG 'efficiency' and water reforms for allocation processes, property rights, equity, impacts on social welfare, and the inevitability of structural adjustments and land use changes. How can we anticipate these situations better, and learn from other areas where reforms driven by trade liberalisation and other market policies have or will occur? Some research is already happening; eg. the work by Roy Rickson in the LWRRDC Integration and Adoption program is looking at how the market determines the nature of the product chain right back to the farmers and the implications for their decisions about resource management. Such research is fundamental in helping us understand all the external factors that influence decision-making.

Integra Pty Ltd

'Integra' is a facilitation and training consultancy firm which has worked with the MDBC, LWRRDC, and other organisations on research communication and adoption issues. Based on this experience and the recent completion of a scoping study for the MDBC on the improvement of transfer and adoption (Integra Pty Ltd 1998), an Integra spokesperson stated that he believed that MDBC, LWRRDC and similar organisations are generally caught in a biophysical research paradigm (ie. the key is to develop 'good science') although they are slowly recognising that investing in biophysical research alone is not going to produce a sustainable future.

The spokesperson believes there are two key messages for LWRRDC which have relevance to the broader question of addressing social and institutional issues in resource management:

> (i) A greater proportion of internal funds should be allocated to communication. LWRRDC allocates less than 1% of their operating budget to communication and the MDBC is similarly low.

> Such an amount would be considered ridiculously low by other sectors such as health or manufacturing programs.
>
> (ii) The potential for adequate transfer and adoption begins way back in the commissioning of research. It is critical that LWRRDC address the design and management of programs and projects such that they strategically commission R&D, rather than just fund it. This requires that program managers have the ability to critically analyse research outputs and outcomes. It also means that their perceptions should not revolve around the biophysical sciences because any question of social or institutional factors will not even enter the process. The process of defining a 'project' also needs attention. An overly narrow definition of projects is reductionist and you end up with a huge number of projects which are very expensive, difficult to administer and difficult to integrate the outputs.

The spokesperson warned against treating the task of integrating biophysical with social research dimensions simplistically, as has occurred, for example, where NRM agencies have tried to integrate their production and conservation departments: "Even though they have been amalgamated, the way that they are organised means that they are still kept separate in practice. People may accept on an intellectual level that production and conservation should be integrated, operationally they find it difficult to achieve. Exactly the same issues arise for RDCs and integrating natural and social sciences". Finally, the spokesperson encouraged LWRRDC to tackle this important issue: "in a sustainable manner, take the time needed to create the right context for the new direction to be effective, and be aware that they are not alone in their efforts".

3.4 Concluding comment

Overall, the reviews looked at, and the perceptions garnered through strategic interviews, confirmed the relevance of the consultancy task. All sources agree that 'social and institutional' issues are very important, and that reliance of scientific/technical approaches to either R&D or policy and management will be insufficient. This judgment arises equally from theoretical or abstract reasoning and from on-ground experience by researchers, policymakers and community and industry stakeholders. It is worth noting that many research organisations contacted have recently restructured or are contemplating restructuring their approaches to research, in part to address the types of problems discussed in this report. At the same time there is uncomfortableness as to what especially 'policy' research might entail, and how that fits with the role of governments and the appropriateness of policy advocacy. Further, there is widespread, although not universal, agreement that the field and therefore the R&D task (not to mention the eventual policy and management task) is very large and thus requires strategic intervention on the basis of careful choice. However, it is also clear from the majority of sources that current thinking on the nature of the problem and on what options can be taken up is fairly vague. Many of the recurring themes in written reviews and interviews are, as noted already, not articulated in ways useful as R&D questions or as policy options. They are more in the nature of 'areas of concern' than answerable questions—issues to debate rather than problems to be solved. Finally, there are markedly varying terminologies and apparent understandings of what central terms and notions mean, such as social research, institution, policy, and market mechanisms.

In summary, we seem to be at the point of increasingly common understanding that 'social and institutional' dimensions of NRM are crucial and that increased R&D activity in this regard is needed, but not a great deal of agreement on precisely what that should entail (and, clearly, too little available resources to adequately invest across the problem field).

These perspectives have guided and informed the four commissioned papers and the subsequent synthesis and recommendations.

Part II The Commissioned Papers

The following four papers were commissioned as part of the consultancy to allow more detailed analyses of the basis and prospects of R&D across the field of interest, and to introduce some perspectives perhaps not so often evident in LWRRDC R&D or discussions. The division of the field into legal, social, economic, and policy-institutional is an arbitrary one, but covers the field in a reasonably complete fashion. (The constraints of time and resources for this consultancy task limited the degree to which multiple perspectives and detailed discussion could be entertained.) The four papers are original reviews in their own right, containing analysis, perspectives and suggestions that cannot be reflected fully in the synthesis and recommendations. Thus, it is recommended that readers do not rely on the summary and recommendations for an overview of the large, diffuse and complex field covered in Sections 4–7.

4. Social R&D for Sustainable Natural Resource Management in Rural Australia: Issues for LWRRDC

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4.1 Introduction

The scope of this paper

Delineating the 'social' for a task such as this consultancy is a slippery matter. Any choice of definition depends on context and contrasts: whether one is considering the social sciences and humanities as opposed to the biophysical sciences, or distinguishing among aspects of the 'social' sciences and humanities.

'Social science' is a general term covering all the sciences dealing with interactions between people: principally anthropology, economics, political science, sociology and social psychology (Sutherland 1989). Within the social sciences, 'social' is usually used to refer to relations of the individual to others, or aggregates of individuals forming more or less organised groups, or tendencies and impulses towards others (Drever 1964).

The 'humanities' incorporates history, philosophy, religion, classical studies, English, European languages and literature, the arts, linguistics, prehistory and anthropology (Reference Group for the Australian Academy of the Humanities 1998). While this paper does not attempt to address the humanities comprehensively, the history of Indigenous and European land use in Australia, Aboriginal studies, environmental philosophy and gender studies, are closely related to our interests. Prehistory and archaeology contribute to our knowledge of Indigenous land uses.

This paper offers an overview of possibilities for LWRRDC-sponsored research in the social sciences. It identifies key themes in LWRRDC's areas of interest, including:

- themes in which the social sciences can make a dominant contribution;
- themes where the 'social' domain of this consultancy links to the other consultancy themes—policy and institutional arrangements, economic and legal studies; and
- where social and biophysical science integrate.

Some of the suggestions made below have also been made in other reports to LWRRDC, especially Reeve and Hayes (n.d.), VCG (1997) and CIE (1998). The

high degree of concurrence between this and previous reports, as well as Sheridan Coakes's comments (this report), suggests that many in the environmental social science research community are thinking along similar lines.

Disciplines which contribute to the 'social' domain

Among the social sciences, the main disciplines able to contribute to LWRRDC social R&D are sociology, psychology, anthropology, and human geography. Demography may also be able to make contributions in matters of structural adjustment.

Sociology studies the development and principles of social organisation, generally group behaviour as opposed to the behaviour of individuals in the group. At a micro scale, it may link closely to psychology in the study of small groups. At a macro (whole society) scale, it deals with major processes of social change, such as the roles of power relationships and conflict. Relevant branches for our purposes are rural sociology and environmental sociology.

Psychology deals mainly with individuals, and individuals as they relate to social groupings. It is particularly concerned with people's thinking, and behaviour. Relevant branches for LWRRDC themes are:

1. organisational psychology, which studies the design and functioning of institutions, with a focus on social processes in institutions;
2. environmental psychology, which deals with relationships between people and their environments (thinking about environments including perceptions, attitudes, beliefs, values; behaviour towards environments, interactive effects between environments and people's behaviour);
3. community psychology, which seeks to understand social change, promote empowerment and encourage community development; and
4. social psychology, which deals with the behaviour of people in groups (and also attitudes and values).

The main focus of *anthropology* is on the study of societies (ethnography), usually societies with non-western cultures although it is also engaged in the study of western societies (Acciaioli *et al* . 1998 point out its similarities to sociology). Its main concept is 'culture'. It is a holistic discipline, which has maintained a stronger recognition of environment–society interactions than sociology and psychology did during the middle years of this century. Its main methodology, 'participant observation', could be used much more in resource and environmental studies in Australia. Among the branches of cultural anthropology, economic anthropology (which studies the correspondences between social relations and resource use) is potentially relevant to LWRRDC's interests. While anthropology has made central contributions to Indigenous studies in Australia, its role and methods could well be extended to non-Indigenous Australian society.

Human geography has become a flexible field, often barely distinguishable from other disciplines engaged in the study of people–environment interactions. Its focus remains space, with an emphasis on interactions between social structure and space. It has substantial overlaps with anthropology (through cultural geography) and environmental psychology (sharing interest in environmental cognition), and with sociology (through the factoring of power relations into analysis of people's use of space) (see Fagan and Jacobs 1998.) There are also overlaps with demography, in the changing distribution of populations. Geographers' participation in planning is now extending from the urban and regional planning field into environmental planning and management. Geography's interest in globalisation and social change connects with the issue of structural adjustment discussed below. A particular strength of geography, from the point of view of LWRRDC's interests, is its combination of physical with human geography. This is one of the few disciplines in which graduates may have a strong training in both biophysical and social research.

Political science is the science of politics, and the organisation and conduct of government. Zetlin (1998) describes contemporary Australian political science as including public administration (represented in policy studies, organisation and management theory), and international relations (including globalisation of institutions, information and power). It links to other social sciences in its interest in patterns of human behaviour, and to law through concern with rule-governed systems and the problems of order and justice. For the purposes of this consultancy, political science contributes most strongly to the policy and institutional theme (see Dovers, Section 7) by examining the nature of political and bureaucratic decision-making, and reflecting on the structure of institutions.

Among the humanities, philosophy and history are most directly related to the task of this consultancy. The humanities, and philosophy in particular, have done a great deal to influence social scientists' thinking about scientific paradigms, and have been active in the development of the postmodernist paradigm (see below). Philosophy also contributes strongly to our evolving understanding of the nature

of 'knowledge', as well as underpinning developments in scientific methods. History gives an understanding of past and present forms of human ecology, and attitudes to environments. Environmental history has some potential offerings to our fields, either alone or as part of other social studies. It can reflect trends in resource use and management, cumulative impacts, and social history affecting current land management practices. It could complement attitudinal and social construction studies (see below) well.

To these strongly established disciplines, we need to add some applied and theoretical fields that are emerging as interdisciplinary fields within the social sciences and humanities, sometimes linking with the physical sciences. *Human ecology* focuses on the processes and consequences of interaction between human groups and their habitats (Hughes 1994). *Education* is an applied field drawing on social science theory, especially in psychology. *Communication* shares much common ground with education, particularly in the study of how people learn, and how any encouragement of their learning experiences should be fostered. Education and communication are thus highly important for LWRRDC's concerns with 'adoption' and communication (see below). *Planning* and *social impact assessment* contribute practical experience in public participation methods, including group-based processes such as Landcare and total catchment management (TCM). They also contribute theory about politically versus technically defined issues, and about people's responses to changing circumstances. *Risk assessment* is pertinent to this consultancy for its recognition of technical and social dimensions of risk, and people's responses to perceived risk.

There is much to learn from *development studies*, an interdisciplinary field which has long dealt with people–environment relationships, and confronted the recognition that what western, scientifically-trained 'experts' believe is good for another place and society may often prove misguided, unacceptable, or unworkable. We owe much of the literature on adoption, and on local land users' systems of knowledge, to development studies (eg. Chambers *et al*. 1989, Scoones and Thompson 1994).

LWRRDC concerns in the social domain

Most broadly, LWRRDC is concerned with R&D to improve the long-term productive capacity, sustainable use, management and conservation of Australia's land, water and vegetation resources (mission statement). While the three resources in question are biophysical ones, the mission focuses on the *source* of land degradation problems—their management. In this sense, all of LWRRDC's concerns are social, since it is the nature of human use and management of natural resources which creates the concerns LWRRDC is tasked to address through R&D. Apparently, 'biophysical' processes are set in train by human management (eg. agricultural practices), may become troublesome to particular human purposes (eg. threats to agricultural productivity, water resources), and are socially defined as being worthy of attention (see below).

The remainder of this paper outlines some of the areas and issues in management of natural resources that deserve LWRRDC's attention.

Social science paradigms and methods

Paradigms

To understand contemporary research in the social domain, it is vital to understand the changing nature of paradigms and theories in the social sciences and humanities. Paradigms, after Kuhn 1962/70, refer to sets of linked assumptions, concepts, and common language about the way the world works. Kuhn (1970: 4) described these as received beliefs, or ways of seeing the world, within which a scientific community practices. While paradigms have sometimes been confounded with theories, including by Kuhn himself, they are generally considered to arch over theories. Patterson and Williams (1998) offer a useful discussion of the use of social science paradigms in natural resource management.

The best known paradigm, created and still dominant in the biophysical sciences, and reformulated for the social sciences, is known as 'positivism'. Briefly, it holds that the universe operates according to simple, discoverable laws (leading to a search for regularities, causes and effects), that there are universal 'truths' available for discovery (it does not admit multiple truths, as postmodernism does), and emphasises empirical methods such as controlled experiments and sampled surveys using statistical analysis.

Alternative paradigms to positivism include:

- Postmodernism (particularly in the humanities and geography). This is essentially anti-paradigmatic, as it argues that there is no way of seeing the world which is ultimately better or best, most accurate or truthful (Newman and Holzman 1997:23).
- Social constructionism or constructivism. These hold that 'knowledge' is socially constructed, and take an interest in how people construct their knowledge and otherwise construe their situations. (See its relationship to attitudes below.) This paradigm is active in the social sciences, particularly sociology and psychology.

- Complexity. This emerging body of theory, an evolution from 'chaos theory' (Waldrop 1992:131–2) emphasises high complexity among phenomena, which tend to order themselves spontaneously and reorder themselves differently after upheaval. Key ideas are disturbance and reorganisation, complex adaptive systems, and attractors, which do not follow cause-and-effect rules but create a 'pull' or attraction towards certain patterns. This is an interdisciplinary paradigm, originating in mathematics and pursued particularly in computer simulations of behaviour. It is now transferring to economics (Anderson *et al.* 1988) and the social sciences, including organisational behaviour (T. Barry, ANU, unpublished data). A LWRRDC project (CWE11) Patterns of Sustainable Use of Rangelands for the 21st Century is informed by complexity theory.

Other paradigms of interest for the subject of this consultancy are:

- Political economy. This paradigm (with origins in the work of Marx and Engels and the classical economists) has been maintained and developed in the social sciences, especially in geography, sociology and anthropology. It makes holistic analyses of how the organisation of economic production (including 'resources') interrelates with social organisation and ideology. It places strong emphasis on power relations, such as vested interests driving or manipulating resource use and production systems. In recent decades its theoretical development has been stimulated by challenges from feminist and race perspectives (Fagan and Jacobs 1998).
- Political ecology. This recent derivation from political economy focuses more specifically on environment and access to resources than political economy, which considers resources as aspects of the 'economy'. It is particularly concerned with how environmental and resource use arrangements are shaped by power relationships in each society, and globally.

Across most of these paradigms (less so with respect to social constructionism), the idea of *systems* is strong. Connections and interactions among all sorts of phenomena are expected, and the 'system' is expected to have properties which amount to more than the sum of their parts. The identification of 'systems' could be viewed as a social construction, but is a useful heuristic in both social and biophysical science.

It is not productive to go into social science theories here, since so many abound within these paradigms. Some, especially in psychology, have quite tight foci, such as 'attitude', 'motivation' and 'learning' theories. A wide range of these is pertinent to LWRRDC concerns: some will be mentioned later in this paper. Here, however, it is worth noting the term *grounded theory* (Glaser and Strauss 1967). This is not a theory, but a qualitative method of theory building. Rather than using theory at the beginning of a study to develop hypotheses for testing and further theory revision, this approach takes an open-minded look at data and uses a systematic set of procedures to develop theory inductively from the data (Strauss and Corbin 1990:24).

Methods

The paradigms sketched above are associated with different research methods (or more broadly, research approaches). There are also many methods that are used in more than one paradigm. While it is not productive here to go into detail on the huge range of social science methods available, some appear particularly pertinent to the development of LWRRDC's research in the social and institutional domains. I emphasise some newer or less well known methods, which offer new possibilities in LWRRDC's R&D.

To this author's mind, a key distinction among methods is those which maintain a professional distance between researcher and those studied (experimenter and subjects), and those in which interaction and mutual influence between researcher and those studied is an explicit part of the research design. The former methods are most common under the positivist paradigm: the researcher experiments or observes, in what is essentially a one-way relationship. These approaches also stress the 'objectivity' of findings, sought by controlling variables to enable close scrutiny of a few variables of interest. In the latter, the relationship tends towards collaboration, cooperation, and mutual learning. While soundness of research design is still stressed, 'objectivity' is regarded as a misplaced goal: the objective here is to reach a deep understanding of a situation, often through the eyes of the participants (constructionist and postmodern approaches). The parties may aim to change behaviour, or design new options based on shared understanding, through the collaboration.

While the social sciences appear to be moving towards a preference for interactive modes, each has relevance for different purposes and has potential roles in a LWRRDC portfolio of social research.

Methods which involve maintaining professional distance

Laboratory experimentation is uncommon in the applied fields of LWRRDC's direct interests, but experimental methods continue to underpin much theoretical development, for instance in learning,

small group behaviour and decision-making behaviour. While LWRRDC is unlikely to have reasons to support such research directly, because there are doubts about how well such findings transfer to complex 'field' or 'real-life' situations, there may be occasions when it might illuminate important issues. Literature reviews of experimental findings can contribute well to the development of theory.

Surveys developed under the positivist paradigm can be adapted for use with newer paradigms. They are becoming less common because of their cost and difficulties with return rates, but well-designed surveys continue to have a role in the issues in which LWRRDC is interested. In commissioning research, LWRRDC needs to be aware that in order to be useful, surveys require very thorough design through preliminary stages of qualitative, exploratory research which illuminate the issues and people's ways of thinking about them. In new research fields, such as people's views on land and water issues ('new' compared to the decades which have gone into research on attitudes about race, for instance), surveys can miss their mark unless founded in or following up sound exploratory research. They should not be attempted by the inexperienced.

Attitude studies (see below) involve a variant on survey methods, in which questions are combined to form a 'scale'. A new scale (survey instrument) needs careful development, preferably across large samples, but a proven scale can later be used with subsequent, smaller samples. (Note, however, that the term 'attitude' is often used more loosely, to refer to various descriptions of people's thinking.)

Not all methods maintaining a distance between researcher and those researched are founded in the positivist paradigm. Critical inquiry, an analytical method closely associated with postmodernism, entails critique of concepts—often analysing texts, but this is not essential (Parker 1989 produced a critical inquiry of the practice of psychology). A feature of critical inquiry is that it often draws out meanings other than those intended by the authors of texts.

Some methods sit between distanced and collaborative modes of research. They may involve extensive interaction with people, such as in anthropological participant observation (see below), or in-depth interviewing, yet the relationship between researcher and those studied may still be structured so that the researcher maintains an intellectual distance in analysis.

Participatory and collaborative methods

Participatory methods are extremely diverse and continually evolving. Many elaborate the standard social science repertoire of qualitative research methods, especially interviews[10]. Two increasingly common approaches which encompass a range of research methods are participatory, and action, research.

Participatory research has many variants, including participatory rural appraisal (Messerschmidt 1995), and participatory environmental monitoring. It involves participants directly in the research, preferably in defining the research issues, conducting the research (collecting the data), and drawing out and learning from the findings.

Action research involves studying things through changing them and seeing the effect. Stringer (1996) advocates participatory action research as a way of researcher and beneficiaries of the research learning together. This approach is beginning to appear in the LWRRDC 'general call', and holds promise of breaking the 'barriers to adoption' dilemma posed by research emanating in the distanced modes (see below, Shulman and Penman in press, and Coakes, this report).

Participant observation, the approach developed and preferred in anthropology, is a suite of methods in which the researcher becomes closely involved with the community of study, participating in its activities. Researchers recognise that whatever role they adopt in the community influences what they observe and are told, and have ways of factoring this into their interpretation. Participant observation involves (preferably) immersion in the setting, opportunistic and structured observation through participation, combined with casual and formal interviewing. Other data collection, such as collection of statistics and study of documents, may be used also. Its requirement for immersion ensures that participant observation can never be treated as a 'distanced' mode of research, yet until recent decades considerable emphasis was placed on the researcher analysing their data in a 'distanced' intellectual mode. It may be combined very effectively with action research.

Participant observation can be adapted to settings which do not lend themselves to a 'live-in' arrangement. Jacqueline Tracey (1995) for instance adapted participant observation to suit her role as Field Officer for the New South Wales Logging

[10] Types of individual interviews range from unstructured and 'in-depth' interviews, to semi-structured, and fully structured interviews with less depth (as in survey questions and attitude scales). There are some special structured formats, such as the Repertory Grid Technique (Fransella and Bannister 1977) used by Brett (1984) in a study of farmers' viewpoints on growing trees on farms, and also by Salmon (1981). Among group interview techniques, the 'focus group' (Morgan, 1988) is becoming popular in environmental research.

Association. (This study is also interesting for its gender analysis and use of the political economy paradigm.)

Rapid, and participatory, rural appraisal are related suites of methods, designed to approach the in-depth understanding possible with participant observation without the same commitment of time and resources. Unlike the use of participant observation in ethnography, which is typically practised by lone researchers or married couples, these are interdisciplinary team-based approaches (applied particularly in development studies). The participatory mode emphasises collaboration with the community studied, and their contributions to the outcomes.

The important point about paradigms, theories and methods is that there *are* alternative paradigms and theories within which to explore the issues which concern LWRRDC and its cognate R&D associations. Further, that these alternatives offer very different methods and insights. For example, 'what people think' about an issue can be considered from the perspective of attitude theories, traditionally (but not exclusively) associated with attitude scale questions in a survey approach. Alternatively, it can be tackled within the constructionist paradigm, in which researchers see no need to make sharp distinctions between attitudes, values, beliefs and opinions. In this paradigm one might expect to find studies designed around unstructured or semi-structured interviews, although structured approaches (eg. Abel *et al.* 1998) are certainly possible.

It is therefore unwise for LWRRDC and its stakeholders to consider any issue to be sufficiently studied, or the disappointing results of past research to have indicated that an issue is intractable. Another paradigm may offer quite different, useful insights to such issues, or may indicate that an apparently resolved issue remains problematic.

It is also important to use a variety of methods, both within and among studies. Any social science research method has strengths and inadequacies. Social scientists have long recognised the value of using 'triangulation' (Webb *et al*. 1966), comparing and synthesising the results of several methods. This can apply across a portfolio of research, as well as within each study, especially since science builds its understandings cumulatively. For instance, a variety of both attitude and constructionist approaches to landholders' viewpoints on a particular issue could be tried and compared fruitfully. Innovative and otherwise uncommon methods, such as personal construct psychology's 'repertory grid' methods (eg. Salmon 1981, Brett 1984), focus groups, and participant observation should prove useful in generating new insights and combining cumulatively with the more common methods.

4.2 Adoption of new technologies

Adoption of new 'technologies', which may be considered generally to refer to ways of doing things, is a great concern of LWRRDC, especially where they believe they have sufficient knowledge of what needs to be done, but need to communicate and apply it.

Learning and communication theories are particularly pertinent to LWRRDC's concern with the adoption of good environmental management practices. At a very simplistic level, they can be characterised by 'one-way' and 'two-way' approaches to learning. The former focuses on a useful finding (such as a new agricultural practice) that should be communicated and taught to (adopted by) the audience capable of implementing it. This is sometimes referred to as the transfer of technology (TOT) approach (see Shulman and Penman, in press). The latter suggests that learning and communication work best interactively, so that new practices should be explored collaboratively between researchers and implementers, taking account of and incorporating the implementers' existing knowledge or understandings, interests, and ways of working (cf. the 'farmer first' perspective: Chambers *et al.* 1989; Scoones and Thompson 1994).

In applications to LWRRDC and its review reports we see evidence of both one-way and two-way communication and learning paradigms with respect to the questions of adoption of technology (Shulman and Penman, in press, offer a more elaborate typology):

- 'One-way' perspectives expect willing adoption of established biophysical 'facts', and look for 'barriers' when adoption does not occur.
- 'Two-way' perspectives seek a collaborative building of understanding of both the biophysical situation (without presumption of 'facts') and the social situation of the land managers (as 'knowers' and potential adopters). They seek to devise approaches which are both environmentally valuable and socially and economically viable for the users.

The first paradigm gives pre-eminence to the findings of biophysical research. Roles for social research are confined to the techniques of communication and adoption, and the exploration of social and institutional (including economic) 'barriers' when adoption rates are disappointing. This paradigm apparently underpins the second of our terms of reference, and LWRRDC's 'template of questions'.

The second leans towards the collaborative modes of research described under methods above. It seeks to develop the technology collaboratively with the users, only later promoting technologies which appear sound from both biophysical and social/institutional points of view. What formerly might have been seen as 'adoption failures' thus become 'design failures'. LWRRDC is currently encouraging inquiry under the second paradigm (Shulman and Price, in press).

The timing of and responsibility for adoption

In recent years there has been a tendency by R&D corporations generally to presume that the findings of each research study should be promoted and adopted. This ignores the cumulative way of building of scientific understanding. Series of research findings on a topic may sometimes confirm, and sometimes contradict one another. Further research may be required before one has sufficient confidence in making recommendations for practical implementation. Expecting adoption of the findings of *each study*, on a one-by-one basis, therefore appears premature and unwise.

Further, since the decline of extension staff positions in State agricultural agencies, unrealistic reliance has been placed on the research teams themselves to promote their findings. This makes potentially unrealistic presumptions about the abilities of a biophysical science research team to communicate. Few are skilled communicators: this is not part of their training or job selection. Even if suitably skilled, they are unlikely to have sufficient budget and time left at the end of their study to do so (see case studies in Shulman and Price, in press). Also, do they have the trust of land managers, to accept their message readily? Successful communication is related to trust of the source.

An ancillary issue is that some applicants are encouraged to show at the design stage how their findings will be adopted. The best feature of this strategy is that it can encourage collaborative partnerships between researchers and research consumers, although sound relationships are difficult to build up hurriedly just before applications are due. The negative feature is that researchers may confine themselves to unadventurous designs, which will be adoptable by the end of the research program, rather than offering more forward-looking research. They may also feel pressured into making casual guesses about adoption, purely for the sake of the submission.

It would make more sense for LWRRDC R&D programs and their cognate agencies (eg. RIRDC), to choose the timing for promotion and adoption—when there is sufficient certainty and priority, and adoption will be cost-effective and worth the effort. As well as ensuring that findings are ready for active promotion (rather than merely informing the public), this would permit LWRRDC and other agencies to ensure integration with other considerations, in an ecosystem management approach. It is logically possible, for instance, that measures suitable to address one serious environmental issue may counteract measures being promoted to address other issues.

A useful, systematic approach for integrating two-way stakeholder communication with research is that used by the Consortium for Risk Evaluation with Stakeholder Participation (CRESP 1996) at the University of Washington, USA. This research centre considers stakeholder participation part of its 'core' business, and employs a full-time specialist in stakeholder liaison, as well as having a stakeholder outreach task force[11].

4.3 Social dimensions of land–water–vegetation (LWV) management issues

There is a bewildering array of potential for social research in LWRRDC's sphere of interest. The following selection is somewhat biased towards the author's experience in psychology and anthropology.

Perceptions, values, attitudes, beliefs, knowledge

While the main body of teaching in psychology makes a point of distinguishing among these types of thinking (see Manstead and Hewstone (1996) for some definitions), and explores them using somewhat different bodies of theory, constructionist social science does not dwell on such distinctions. Similarly, the field of environmental cognition (Moore and Golledge 1976) glosses the distinctions. Broadly they all refer to personal stances—strongly or weakly held, stable or transitory—towards issues or objects in our environments. While they are usually studied as individual phenomena, there are clearly social and cultural influences in their formation and change, and cultural similarities in their possession. A related concept, referring to shared patterns of thinking about an issue, is *social representations* (after Moscovici 1981). This also links to culture.

11. CRESP is an independent, integrating consortium with a mission to inform protective and cost-effective cleanup and enhance stakeholder understanding of the USA's nuclear waste sites. It seeks an approach to both research and assessment that generates scientifically valid responses to concerns expressed by diverse stakeholders (CRESP 1996). It also studies the role risk plays in the development and evaluation of other environmental management tools.

Research in this 'cognitive' field is relevant because

- Values are closely related to people's priorities.
- They provide guidance—however loose [12]—to people's likely behaviour, including their adoption of new 'technologies'.
- Further, there is much enlightening work on how these forms of cognition develop in each person. Researchers can thus consider what influences land managers' perspectives, and provide hypotheses as to how new viewpoints could be encouraged. (Since social influence is one factor in the development of environmental cognitions, peer interaction processes such as Landcare groups should offer promise. We could study in more detail whether this works, and how.)
- They offer approaches for assessing what policy options people will accept, or perhaps reject.

A special note is deserved on the issue of 'knowledge'. This illustrates well the differences between positivist and constructionist (also postmodern) paradigms. Where positivism equates knowledge with established fact (assuming there are such things as facts), constructionism views knowledge as socially constructed (cf. Berger and Luckman 1967), akin to belief (Harvey 1997:155).

This field underlines the importance of LWRRDC being open to different paradigms and research methods. The tradition of studying attitudes, beliefs and values somewhat separately is accompanied by detailed and evolving bodies of theory, each of which may produce useful insights into people's stances towards environmental issues, or changing their behaviour. On the other hand, the constructionist paradigm steps around the vexed question of how attitudes influence (or don't influence) behaviour, by viewing the relationships between cognition and behaviour in different terms (behaviour leads to new experience, which stimulates people to revise their cognitions). In this author's view, it also takes a less limiting view of what people think, without constraining its description into socially (scientifically) constructed terms. It also avoids the element of measurement artefact that arises from attitude scales. Environmental cognition draws on both, but often focuses on the origins, rather than the particular content, of the cognition.

An interest in behaviour, and prospects for modifying behaviour, is interrelated with the forms of social and environmental cognition discussed above [13]. How are thinking and behaviour related? How can one influence behaviour through influencing thinking?

Communication and learning

The 'one-way' and 'two-way' paradigms underpinning communication and learning have been described earlier in this paper, in reference to adoption. These open up a selection of research possibilities: for instance, which modes of communication best suit which audiences, especially given the lifestyle exigencies of most on-ground land managers. If social processes are most effective, how can these be supported cost-effectively, and information or new insights seeded into the learning networks? Can new media, such as information technologies, play a role for some, and if so how?

Group and other social processes (especially Landcare, TCM)

Social structures and processes in groups are fundamental to the structure and functioning of some of the new institutions emerging in land, water and vegetation management. In Australia, voluntary self-forming groups such as Landcare groups, and groups which combine land-users with government officials (such as TCM groups), rely strongly on group dynamics (Carr 1994). They are also central to peer-influenced learning processes. (Landcare is actually founded on an adult learning model, although this is seldom publicised.)

There appears to be a perception emerging in some areas that research on Landcare groups has been 'done to death'. This author does not believe that such groups are overstudied, indeed their study is in its infancy. There is also a need to build on what has been learnt, to generate new research questions. Key questions are:

- How do these group processes work, and how can they be fostered? (LWRRDC continues to receive good proposals in this area). Group processes may work differently in different settings. Carr (1994) found gender to have an influence on group functioning. Young *et al.* (1991:57–58) found that Aboriginal people have difficulty participating in Landcare groups, and also that in pastoral areas, physical isolation inhibits all landholders from forming Landcare groups.

[12] The field of attitude studies has long struggled with inconsistencies between attitudes and behaviour. Attitudes ought to predict behaviour, but in practice the correspondence is not always strong (Manstead 1997). Another psychological theory (Kelly 1955) posits that behaviour shapes attitudes.

[13] In the heyday of empiricism in Psychology, there was also a body of theory and experimentation known as 'behaviourism', which emphasised behaviour modification through a process known as 'conditioning'. While this had early influence on learning theories, the author sees no relevance for this field in contemporary resource management.

- Given the dynamics of Landcare, and the more formally constituted TCM groups, what are they capable, or not capable, of? How well can voluntary group processes redress the difficulty of encouraging changes in environmental management practices by private landholders (here a social, voluntary institution is being asked to compensate for features of a strong legal system)? Is too much expected of such groups? Is it realistic to expect high rates of membership and active participation, and does partial participation matter? If their influences and accomplishments are valuable, are the financial and other forms of support sufficient?
- How can their roles as routes to communication with, and influence over, private landholders, and as facilitators of adult learning about environmental management, be enhanced?
- What social processes actually operate in the transfer and alteration of 'knowledge' about environmental issues and environmental management, in the range of Australian settings in which LWRRDC is interested? Do these differ among different populations, for instance especially among Aborigines versus among other landholders.

Gender and ethnicity

Besides group processes, some other social processes or attributes are worthy of study for their direct relevance in influencing sustainable natural resource management. Little is known about gendered roles in land use and environmental management. This applies particularly to the respective roles of males and female partners in property decision-making. There are suggestions that women may lead domestic decisions to engage in environmental stewardship activities on farms, for instance. Gendered participation in catchment management is also relevant.

Little is mentioned about ethnicity in LWRRDC research projects and proposals, although at least one application in the recent calls has canvassed ethnicity. International literature (eg. the journal *Society and Natural Resources*) is beginning to distinguish ethnic practices in farm management (as well as other resource uses), and to examine ethnic differences in learning about the environment. Ethnicity is related to constructions of issues and knowledge, communication, and the design of acceptable policy instruments. Bruce Rose's (1992, 1995) work with Central Australian Aborigines is seminal in this area.

The nature of individual decision-making

The social sciences deal with a variety of theories of decision-making, from rational choice models to models that emphasise intuitive processes. The field has developed in an interdisciplinary way, drawing on economics, psychology, and statistics. Most of the research focuses on information processing strategies (Manstead and Hewstone 1996:168–172). One issue is when rational or intuitive processes are invoked. A related set of issues brings in the nature and role of information used in decision-making, and personal receptivities to that information. Smithson's work on 'fuzzy logic' (Smithson 1987) has attracted considerable interest in Australia with respect to decision-making.

Collaborative planning and decision-making techniques

New techniques founded in public participation, negotiation and conflict resolution have been making their way into environmental management over the last decade. Some interesting proposals are presented to LWRRDC on these issues. Negotiation techniques underpin the formation of partnerships and multi-party arrangements in environmental planning and management, between government, local and business stakeholders. The idea of 'partnerships' is emerging strongly through the influence of Agenda 21, making a welcome alternative to the 'top-down' versus 'bottom-up' characterisation of government–local relationships.

Co-management (cooperative management) describes a variety of partnership arrangements in resource management, usually between government and members of the public. The most familiar application in Australia is joint management of national parks. In North America the field developed in wildlife management and fisheries. This author is currently studying multi-party arrangements in North America focused on the management of private timber land, and on water resources (Ross, unpublished data). Each co-management arrangement is unique, as it depends on the interests and nature of the stakeholders, and of the resource they intend managing together. However, there is much to be learnt about techniques for fostering their development and maintenance, and about institutional forms that work well in different contexts. Co-management is attracting interest as a strategy to share management responsibilities between government and Indigenous peoples. A recent development is the concept of Indigenous protected areas (conservation areas created on Indigenous land; Smyth and Sutherland 1996; Thackway and Brunckhorst 1998). It offers great

potential in the resolution of native title claims involving shared management roles in natural resources.

4.4 Linkages among social, economic and legal research fields

Social processes and institutional arrangements

There is a rich field in the intersection between social processes and institutional arrangements, well informed by existing research in the social sciences though not necessarily with environmental studies applications. Many of the techniques and arrangements originate in the business management field, and are in the process of uptake in environmental management (stakeholder analysis is an example).

Legal domain

Another interesting set of issues arises in relation to the legal domain (see Farrier, this report). For instance, what are the respective implications of private property rights, water rights, land rights and native title for people's environmental behaviour? What opportunities might arise from possible changes to these rights regimes? Water rights are relevant to irrigation and its environmental impacts, including the recent interest in restoring 'in-stream flows' to rivers (an issue in the recent Snowy River Inquiry). How much do Australia's particular private property rights in land encourage or deter environmentally responsible land management? On one hand it is argued that governments have relatively little influence over freehold owners, whereas pastoral lease conditions give some leverage, if actually invoked. On the other hand, landowners argue that security of tenure invites more sustainable management than short-term tenures.

Native title has potential, and barely explored, implications for land and water management especially in the institutional context. To what extent, and in what ways, will indigenous land management rights and responsibilities be established as part of native title rights? What new approaches to environmental management (such as regional agreements) can evolve from a mixed set of stakeholders' rights in land?

Economic domain

Intersections between the economic domain and other social sciences arise with respect to:

- the development of research techniques for contingent valuation, citizen juries and the like (which rely on adaptation of surveys and other social science methods);
- structural adjustment;
- equity and justice considerations related to the effects of economic instruments, and the outcomes of redistributive measures (including planned structural adjustment); and
- whether or not (and why) people are comfortable using new economic instruments, especially tradeable rights.

4.5 The geography of LWRRDC's activities

This paper so far has concentrated on issues on which the social sciences can make important contributions. I also have concerns about the places and scales which receive detailed or scant attention, both in biophysical and in social and institutional research.

Places and ecosystems

Land, water and vegetation issues arise throughout Australia, in different permutations. Does the geographic dispersal of program focuses, and projects funded, pick up all such issues which might prove priorities for sustainability? LWRRDC insiders point to a perceived 'agricentrism' which derives from the organisation's predecessors. Indicative maps of LWRRDC activities in the 1997 Stakeholders Report suggest both an agricentric and a southern focus. One LWRRDC stakeholder we contacted raised the issue of LWRRDC's relative neglect of northern Australia.

Easily neglected land categories (viewed both in terms of land uses and land ownership forms) may include pastoral lands, Indigenous lands (in different ecological zones) which so far represent 14% of the land mass, Crown land, wetlands, rivers and their riparian zones, the coastal zone, and urban areas.

Scales

In biophysical research, much research takes place at plot and property scale, and there are problems with 'scaling up' to catchments and regions. Something similar is liable to occur in social research. In fact, one of the interesting underlying issues in social research is how individuals articulate with their face-to-face social groupings and the institutionalised aspects of the 'society' to which they belong (interactions between psychology, and anthropology and sociology).

For LWRRDC, there are some interesting issues in the interactions among social 'scales'. Where is the 'locus' of decision-making on a particular issue? Is it the practical responsibility of individual landholders, social groups, formal institutions? If more than one scale is relevant (for instance, where policy instruments or social groups are intended to affect landholders' actions) what is the nature of their interaction? Promotion and adoption can be wrongly targeted if these are not understood. In terms of actors' behaviour, what interactions are there among scales: such as farm actions to catchment impacts; regional or national policy to farm adoption.

Issues on Indigenous land

Indigenous land, and the environmental management needs of Indigenous peoples, can be raised here as a 'geographic' category worthy of consideration.

LWRRDC has made a recent commitment (LWRRDC 1996:14) to strengthen its focus on Indigenous issues. Given the extent of land currently under Indigenous ownership or leasehold (14% of Australia) and the potential implications of native title for land management, this is timely. Among the issues which need consideration are the following.

- What land, water and vegetation problems are apparent on Indigenous lands, and how severe are they? *Caring for Country* (Young *et al.* 1991) found that these lands had not been included in national surveys of land degradation, and that it was not valid to assume an absence of serious problems. Weed and erosion problems were certainly serious in some areas at that time.
- What are Indigenous people's aspirations for the management of their land, and how do these correspond with land capability? How can their interests in sustainable management be supported?
- Further information on Indigenous viewpoints on land degradation, in other regions (cf. Rose's 1992, 1995 studies of Central Australia).
- What can Indigenous management contribute to the sustainable management of different lands? Is there substance to the observation that destocked pastoral lands are regenerating well in Aboriginal hands? How can traditional ecological knowledge complement western science in the evolution of land management methods? [14]
- What other environmental opportunities can be developed from common interests between Indigenous and other Australians? (See, for example, the Indigenous Protected Areas proposal, above.)

4.6 Integration between social and biophysical research

LWRRDC's focus on sustainability recognises the degree to which people's livelihoods ultimately depend on the quality of their land, water and vegetation resources, and hence the quality of their management. LWRRDC priorities reflect particular vulnerabilities in Australia's resource use and management.

Structural adjustment issues

However, there are real issues for rural sociology and rural economics, in the flow-on effects from these human–environment dependencies. They often show up as unplanned restructuring—incremental changes in the rural population as people leave the land and their absence undermines the viability of social services and other businesses, or create a requirement for planned structural adjustment. It appears that RIRDC, BRS and MDBC are taking a lead in considering these issues (see Section 3). How far LWRRDC also contributes to this area is an emerging question for its consideration, and that of its partner agencies. Applicants to LWRRDC clearly recognise structural adjustment as a priority issue. Potential LWRRDC research topics, such as the development and use of new economic instruments, will surely contribute to future structural adjustment.

From the social point of view, LWRRDC may therefore wish to consider:

- structural adjustment issues: improving matches between people, their practices and the environment and identifying how these link to the economic domain (see Lockwood, Section 5);
- theoretical frameworks for understanding the processes of adjustment (see Coakes, this report);
- the social impacts of land degradation;
- equity and social justice issues in redistributive measures, including structural adjustment; and
- social and economic indicators of community's capacities to manage change (see Coakes, this report).

[14] It is important to recognise that traditional ecological knowledge is not a discrete set of techniques which can be transferred for adoption elsewhere: it is embedded in a complex belief system, associated with particular protocols for knowing and use, and subject to intense 'intellectual property' debates (see Young *et al.* 1991, Ross *et al.* 1994).

Integrated catchment and integrated resource management

A different pivot for integration between the biophysical and social sciences is in the intellectual examination (as well as the management arrangements) of integrated catchment management (ICM) and integrated resource management (IRM). These domains seek to overcome the sectoralisation of environmental studies, and to include human needs and behaviour with the study of environmental processes. For instance, the field of ecosystem management has moved from a purely biophysical process, to one in which human needs and behaviour are considered interactively, often through stakeholder participatory processes (eg. Lee 1993; Dorcey 1986).

Key questions are:

- how to combine participatory processes effectively with biophysical science analysis in ICM and IRM;
- how to integrate social, institutional or policy, and economic information with biophysical information in these strategies; and
- learning processes within ICM and IRM groups and organisations.

Information technologies

Computer-based information technologies are growing in importance in environmental management, as greater sophistication becomes possible in software, and demand for organisation and integration of information become stronger. Cost and accessibility of the hardware are also factors.

Email networks now play an important role in information sharing. Councilnet, sponsored by the Commonwealth Environment portfolio, was one of the first to be created explicitly to support the information needs of environmental managers (local government in this case). One feature of such networks is their egalitarian nature—social hierarchies are not evident in this type of exchange. Similarly, the World Wide Web increases the convenience of access to information, at least to those with the necessary hardware, know-how, and reliable phone lines.

The development of geographic information systems (GIS) and decision support Systems (DSS) was led by computer science and biophysical science capabilities. Though there has long been some demand for social information in such software, its incorporation was slow owing to the paucity of social data which lent itself to this form of presentation (demographic data were most amenable). This situation is changing rapidly. There are now at least two sets of considerations:

- stakeholder participation in development of the software. Whose decisions are the systems supposed to support, and how can users and developers collaborate to produce more relevant and useable software? Does the nature of the technologies, and differentials in stakeholder access to them, exaggerate power imbalances in resource management (Wong 1997)?
- social information content in software. How can relevant social information (much of which is qualitative) be represented? What are the equity considerations in the selection and omission of social information, and how can these be ameliorated (Wong 1997)?

Dovers (Section 7) also raises the issue of information technologies.

4.7 Conclusions

My arguments in this paper can be summarised in terms of the question,

> 'What do *we* need to *know* in order to *manage land, water and vegetation more sustainably*?'

'*We*', the managers, should be construed as including all participants in natural resource management: landholders, policy-makers (and creators of policy 'instruments'), researchers and other advisers, and the general public as consumers of environmental products and benefits. Our roles are very different, and there are different things we need to know. Further, we represent a variety of decision-making units: individual or family units, formal and informal organisations, often cross-linked by other institutions. What is more, we may engage with land, water and vegetation in a variety of user and custodial roles. We are all direct or indirect consumers of land, water and vegetation R&D.

What is *knowing*? Once simple assumptions that facts awaited our finding out, and pointed to the types of practices which need to be adopted, are now contested. While the role of western biophysical sciences in exploring certain questions empirically remains, other forms of knowledge, such as Indigenous peoples' traditional ecological knowledge are also gaining recognition and roles (Thackway and Brunckhorst 1998). What happens when western scientific knowledge conflicts irretrievably with the received wisdom of other knowledge bases (a question causing strife in the USA as fundamentalist Christians dispute scientific perspectives)? Recognition of the socially constructed basis of knowledge does cast doubt on the prescriptiveness of

western science, and also extends to the social construction of issues and priorities (Hannigan 1995).

What do we mean by '*managing*'?

As well as our behaviour patterns in using and physically shaping the environment, we need to consider the institutional arrangements, including legal frameworks, economic instruments and other incentives (or disincentives) used to shape that behaviour.

Which *land, water, and vegetation* do we wish to manage?

'Land degradation' is defined in terms of the use people wish to put land to (Young *et al.* 1991). Is the construction of 'land degradation' somewhat agricentric, so that potential priorities in other parts of Australia go unrecognised? While LWRRDC's efforts clearly have to be targeted, is the basis of priority-setting sufficiently broad?

Advice

LWRRDC is among the first R&D organisations to include social dimensions seriously in its research portfolio, and over just a few years has attracted and funded many excellent proposals. Indeed, funds are far from sufficient to fund the strong proposals[15]. It is still 'early days' for this type of research.

Responses to the 'general call' provide a good indicator of the maturation of this field.

- We see more research within the constructivist paradigm. Positivist research is becoming less common (or identifiable as such).
- We are seeing the first glimmerings of a critical theory deconstructionist (postmodern) approach, questioning the construction of issues and priorities. While this cannot be the foundation of a whole program, it performs a useful role in checking our assumptions and priorities.
- We do not see the whole breadth of social science paradigms, and their related methods, which could offer useful insights. There is scope for political economy, political ecology, and potentially other paradigms to contribute, particularly to highlight power relationships and equity. These are pertinent in structural adjustment and the design of policy instruments.
- We see both projects informed by theory, and (perhaps more commonly) grounded theory approaches (Glaser and Strauss 1967).
- There are promising examples of integration, or at least collaboration, with the biophysical sciences.

I believe LWRRDC should resist any temptation to think some topics are 'covered' and abandon them at what is an early stage on the way to further useful understanding. Three to six social science studies, especially in different social and geographical settings, do not saturate a research field, any more than they would in a biophysical field, such as hydrology. As Coakes (this report) points out, resource management issues occur in a wide range of local contexts, in which individuals and groups operate within different combinations of political systems, institutional contexts and cultural styles.

There is room for LWRRDC to increase its breadth:

- geographically and ecologically, to ensure that particular regions, ecosystems, land uses and land tenures are not neglected in terms of potential priority issues. All involve land, water and vegetation, although the issues there may differ somewhat from those around which LWRRDC current program streams were composed; and
- in welcoming different paradigms and their associated theories and methods. The general call is attracting proposals from the newer paradigms and approaches: it is up to the LWRRDC Board, staff and committees to be receptive to their value.

Program options

The main design alternatives for strengthening social, policy/institutional, legal and economic research by LWRRDC are a new program stream versus integrating this type of content within each of the current (separate) programs. The former option would ensure a designated quantity of funding was devoted to this type of research, and increase the likelihood of findings about different social and geographical settings building cumulatively. It also increases the prospects for networking among researchers participating in the same program. The latter would increase the prospects of integration between social and biophysical research within each of the program streams, but at possible risk of disadvantage in access to funds, compartmentalising of the issues (sectors) available for study, and lack of integration and learning across the social and institutional field.

I propose a third alternative, a network or 'hub' model, in which there is a main social/institutional program with identified funds, a coherent approach to the research, and aggregated learning; but it has links to the other programs to ensure linkage to the

[15] The consultancy team has been able to review first-stage proposals (two pages) and the titles of proposals from the most recent call, but not full proposals. Our judgment of quality necessarily rests on the level of detail provided initially to LWRRDC, and on our background knowledge of the researchers and topics.

biophysical research in particular problem areas (eg. drylands, remnant vegetation) and that learning from the social stream is shared intensively with those programs. Note that Curtis *et al*. (1998) argue the need for a funding program to have a 'program logic'.

Attracting suitable researchers

Applications to LWRRDC, especially in the last two years, appear apposite and strong. On current funding levels it has been possible to support only few, but in time there may be greater scope to support more social, legal, economic and policy projects. Currently, there is a relatively small, though gradually increasing, pool of social scientists active in various aspects of Australian environmental research. Much of their work is interdisciplinary, across the social sciences, or combining social and biophysical sciences. Few if any of the current researchers operate from a narrow disciplinary base. Those with the broadest training have the advantage of easy entry into the environmental field, but at occasional risk of getting out of their depths when dealing with some social science theories and methods. These researchers are the core of any expanded program.

Lateral recruitment of researchers who have strong disciplinary backgrounds, but no previous familiarity with environmental studies, is a more difficult course. The challenge for new researchers taking up aspects of environmental research is to learn the new social and biophysical context required. The extent of this challenge should not be underestimated. Though strong in their disciplines, they will take time to become familiar with the environmental applications and literature, and to expand from a single discipline to a multidisciplinary base within the social sciences. Such inputs could be solicited where particular deficiencies are seen, in which case I suggest the following support to help the transition of researchers from their familiar areas:

- a strategy like the ARC small grant scheme, whereby researchers are offered $10,000 for a year to conduct a preliminary project, which will allow them to become familiar with the literature and fields, and network with existing researchers. A senior academic would be at liberty to use this in supervision of juniors, including PhD students;
- offering mentors (people experienced in environmental social science research or practice) in conjunction with the funds above;
- encouraging collaborations between established researchers in environmental social science fields, and new researchers capable of injecting different bodies of theory and methods.

A service to all researchers, not just those newly entering LWRRDC's fields of interest, would be some commissioned literature reviews, to compile the 'state of the art' on certain social questions, such as adoption and experience with Landcare groups.

Research questions

Research issues are suggested throughout the text of this paper. This section summarises some key research questions which stand out as being important in the development of a social and institutional research portfolio.

- *The extent, nature and effectiveness of social influence in learning processes and the alteration of environmental cognitions, among Landcare and TCM groups. If social processes are effective, how can these be supported cost-effectively, and information or new insights seeded into the learning networks? Can new media, such as information technologies, play a role for some people, and if so how?* This topic assesses then expands upon the potential 'adoption' role of group-based processes, and consolidates the existing research on group processes.
- *Action research on adoption in given biophysical theme areas, using a 'two way' learning paradigm of exchange of views, information and knowledge. Do different populations, for instance Aboriginal people and other landholders, landholders engaged in different rural industries, favour different ESD strategies after such action research projects?* This topic provides a basis for 'adoption', founded in landholders' as well as researchers' perspectives and situations.
- *The nature of individual decision-making in resource management: when rational or intuitive processes are invoked, the nature and role of information used in decision-making, and personal receptivities to that information.*
- *What are the respective roles of male and female partners in property decision-making, in different rural industries and among different social groups* (where, for instance, different ethnic groups are significant in particular rural industries)?
- *To what extent, and in what ways, are Indigenous land management rights and responsibilities likely to be established as part of native title rights? What new approaches to environmental management (such as regional agreements, co-management) could evolve from the resulting new set of stakeholders' rights in land?* Overseas, regional agreements, co-management, and other forms of partnership among stakeholders have

arisen from newly recognised Indigenous resource management rights. These new institutional arrangements hold great promise for sustainability.

- *What are the respective implications of private property rights, water rights, land rights and native title for people's environmental behaviour? What opportunities might arise from possible changes to these rights regimes? How much do Australia's particular private property and leasehold rights in land encourage or deter environmentally responsible land management?*
- *What are Indigenous people's aspirations for the management of their land, and how do these correspond with land capability? How can their interests in sustainable management be supported?*
- *What can Indigenous management contribute to the sustainable management of different lands? How can traditional ecological knowledge complement western science in the evolution of land management methods?*
- *How can participatory processes combine effectively with biophysical science analysis in integrated catchment management and integrated resource management? How can we integrate social, institutional or policy, and economic information with biophysical information in these strategies?*
- *How can users and developers of decision-support software collaborate to produce more relevant and useable software? Does the nature of the technologies, and differentials in stakeholder access to them, exaggerate power imbalances in resource management?*
- *Development of suites of social indicators for natural resource management, to give a more comprehensive understanding of community processes and adaptability to changing resource demands.*
- *Research on values that guide and influence resource management decisions and behaviours.*

In considering the establishment of a social and institutional research portfolio, LWRRDC is making an important national contribution to the evolution of environmental management R&D. It is necessary both to strengthen this type of research in its own right, and to improve the synthesis between the biophysical and the social and institutional issues involved in land, water and vegetation management. In these endeavours LWRRDC should find willing partners among its cognate R&D agencies.

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Commentary on social R&D paper

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The paper by Helen Ross provides a comprehensive overview of possibilities for LWRRDC-sponsored research in the social sciences. As highlighted by the

author in the paper, 'delineating the "social" for a task such as this, is a slippery matter'. This is because it is difficult to box social issues into a separate category or area of consideration, due to the overarching nature of the issues at hand. As Ross outlines in the paper, while the three resources in question are biophysical ones, LWRRDC's mission largely focuses on the management of these resources—that is human use and management. Therefore, all of the concerns that LWRRDC attempts to address are social concerns.

Disciplines that contribute to the social domain

The paper outlines a range of disciplinary areas that may contribute to the social domain and thus may be useful in researching and addressing natural resource management issues. The fields of education, communication, planning, social impact assessment, risk assessment and development are of particular relevance because of their applied nature and often multidisciplinary emphases. For example, the field of social impact assessment brings together practitioners from a range of multidisciplinary backgrounds.

In regard to psychology, the area of community psychology is also immediately relevant to LWRRDC's themes. Community psychology, places emphasis on understanding social change. The area emerged in the early 1970s in Australia and New Zealand with a push, by many psychologists working in the more traditional field, for the application of psychological principles for the betterment of society. Community psychologists acknowledge:

- the influence of values on research;
- promote empowerment through both processes and outcomes;
- value human diversity;
- promote the use of innovative techniques and approaches to deal with recurrent social problems;
- emphasise the importance of evaluation as an essential element of social change and innovation;
- encourage community development and participation; and
- foster collaboration and partnerships in the research process.

Ross's review highlights that there is already an extensive amount of research and literature that may be directly relevant to LWRRDC's concerns. For those who may be more unfamiliar with the literature in the social sciences, these issues may appear novel. However, it is often the case that many of the concepts have been researched quite extensively in other contexts, and may not be perceived as immediately relevant in the current context, without prior knowledge of these particular research areas. For example, when I attended the World Forestry Congress in Antalya last October, I was amazed to find that many researchers working in the area of social and community forestry were quite unaware of the insights offered by work in the social sciences. Therefore, we need to be very conscious of broadening our 'disciplinary gaze'.

Furthermore, we are currently involved in a project looking at rural re-establishment for the Rural Division of the DPIE portfolio and in undertaking a review of work undertaken in the adjustment area. In regard to this project, we are finding that while quite an extensive amount of work has been undertaken in the area of farmer adjustment, this work has tended to be fairly descriptive, cross-sectional and piecemeal. In addition, much of the work has been economically driven, and while the economic factors have been strongly theorised, this is not the case for the social factors. What appears to be lacking is a clear conceptual framework for understanding the transitional process of adjustment—an area in which the social sciences, and psychology in particular, could contribute greatly. Furthermore, we are attempting to address some of the institutional factors (finance sector) influencing the adjustment process, identifying what adjustment processes have been successful and why, and investigating how can such research be communicated more effectively to policymakers and the rural sector.

Social science paradigms and methods

Ross provides a solid discussion of particular social science paradigms and methods. This discussion is very important, as it highlights different ways of viewing the research process. For example, grounded theory is suggested as a method of theory building. I would add to this, 'substantive theorising' (Wicker, 1979, 1989). A substantive theorising approach suggests that theory building should be both conceptually and substantively driven. One facet does not take precedence over another. Substantive theorising outlines a much closer and dynamic interplay between conceptual frameworks, methods and data—theory building and empirical research are not seen to be distinct activities, and research is driven by substantive issues.

In this vein, it is important for the Research and Development Corporations to be guided by the issues of importance and relevance to the Corporations' stakeholders.

I have worked in the policy domain for the past three years at a Commonwealth level, and it is evident to me that there is often a gap between research and policy implementation. While DPIE has emphasised the need for evidence/research-based policy, it appears that

many policymakers are quite unaware of the research outputs of particular R&D corporations, and the relevance of such research in policy development. Therefore, it is important that the RDCs are fully aware of the policy issues of relevance to the portfolio, so that research endeavours can be tailored to meet policy objectives. This may require more comprehensive consultation with stakeholder groups before priority setting, and better communication of research results.

The other important point in this section of the paper relates to the research process and the use of more distant versus participatory research methods. Ross highlights the strengths of constructionist and postmodernist approaches that emphasise the development of shared understandings between researcher and participant through collaboration and research partnerships. Such methods support the integration of local and scientific knowledge bases, and concede that there may be different levels of knowing or knowledge. Schon (1987), for example, talks of four different levels of knowledge: knowing in action; reflection in action; reflection on reflection in action; and reflection on that account. This view stresses the importance of obtaining knowledge at different levels by means of multiple paths and acknowledging alternative knowledge bases. Much research in this area would benefit greatly from the use of approaches such as triangulation (Patton 1990); that is the use of multiple theories, data, methods and investigators in the study of a particular problem. As Ross has outlined, LWRRDC should resist any temptation to think that some topics are covered, and abandon them at what is an early stage on the way to further useful understanding. The important point about paradigms, theories and methods is that there are alternate paradigms and theories within which to explore the issues of concern to LWRRDC and these offer very different methods and insights, but ultimately lead us to a greater notion of so called 'truth'.

Adoption of new technologies

The paper goes on to highlight an important aspect of LWRRDC's agenda, that is the consideration of adoption of new technologies. I agree with the author that learning and communication theories are particularly relevant to LWRRDC's concern with the adoption of good environmental management practices, and that two-way approaches to learning are far more preferable and ultimately will result in greater uptake by potential adopters. Too often, we go into a context presuming we, as the so called 'experts', have all the answers, without acknowledging the 'facts' of the knowers, that is those with knowledge and expertise in a particular area. Therefore, it is good to see that LWRRDC is actively encouraging inquiry under this paradigm.

In relation to the point made about the timing and responsibility for adoption, it is critical that LWRRDC review the timing of adoption carefully. Maybe it is more appropriate for adoption strategies to be developed once the research process is under way, in order to involve potential adopters in the development of such strategies. The implementation of approaches such as action and participatory research offer considerable advantages in this particular area.

Social dimensions of land, water and vegetation management issues

In the section of the paper relating to social dimensions of land, water and vegetation management issues, Ross outlines a number of salient research areas of direct relevance to LWRRDC's mission. All the areas highlighted provide a tremendous scope of potential research areas for LWRRDC to pursue, so a detailed overview of these areas is not provided. Issues of particular relevance to those working in the policy environment are outlined below and would benefit greatly from research in the areas defined by Ross. These include:

Indicator development. There is a significant trend, at the policy level, to identify social indicators to assist in identifying communities adaptability and response to change. While a substantial literature exists in the area of social indicators, the application of these indicators in a natural resource management context is yet to be fully realised. Development of indicators of sustainability—social, economic and biophysical—to guide policy initiatives and highlight areas requiring further investigation and study.

Structural adjustment. A better understanding is required of the linkages between resource use and communities in order to assess and predict the likely impacts of changes in resource use and management. In this regard, we require a more comprehensive understanding of community processes and adaptability to changing resource demands. At a more individual level, research on values that guide and influence resource management behaviours would also be informative.

Evaluation. There is still much to be learned in the policy arena about the effectiveness of particular policy initiatives and programs. With a push in the government sector toward greater consideration of social issues, detailed evaluation and monitoring of programs is required to inform future policy development. Therefore, we need to examine partnership and co-management programs that have been successful—what elements make such programs successful and why, as well as assessing other policy

initiatives, eg. RFA process, Rural Communities program.

Decision-support systems/frameworks. One of the areas where there appears to be a lack of research is in the development of decision-making platforms to integrate social, economic and biophysical data within a natural resource management context. Furthermore, we need more information about how stakeholders can be effectively involved in developing DSS that are both user friendly and facilitate the decision-making process. A further area that requires attention is developing appropriate systems and frameworks for resource managers to integrate social data.

Training and development. Lastly, I believe there is a definite role for LWRRDC in the area of training and development. Many resource managers and policymakers are unaware of the relevance of theories and methods in the social sciences, and thus there is a need to develop training programs to facilitate a greater understanding of how social issues can be considered in a resource management context.

Integration of social and biophysical research. The integration of social and biophysical research is also a critical issue, and is highlighted in the priority areas outlined above. Many researchers and policymakers are grappling with the issues of how to successfully integrate social, economic and biophysical data. For example, as part of the regional forest agreement process attempts were made to link social and biophysical data using geographic information systems and spatial analysis. The work undertaken to date has been very successful in presenting social information in a manner that is more meaningful to other scientists, decision-makers and local communities. Similar developments have occurred in regard to decision support systems. However, as Ross outlines, there are still many questions as to how such systems are developed and how social data should be represented?

Again, what is clear is that these issues are far from new—we could learn a lot from examining models of integrated resource management and the application of participatory rural appraisal methodologies in developing countries, to assist us in addressing how human needs and behaviour can be successfully integrated with the study of environmental processes.

Conclusion

It is evident from reviewing the paper that there is tremendous scope and opportunity for LWRRDC to consider social issues in its research agenda. In selecting areas of investigation in the social domain, the following themes summarise the main points highlighted in the paper:

- Ecological approach to the understanding of natural resource management issues—recognition of the importance of environmental and situational processes in maintaining social problems; that is, acknowledging the range of environmental influences on behaviour through interaction with other disciplinary areas eg. environmental psychology, human geography.
- A dynamic and adaptive understanding of the social environment—acknowledgment of multiple causation, multiple levels of analysis and the operation of processes and interventions at the level of organisational, institutional and community systems. In addition, greater emphasis needs to be placed on longitudinal rather than cross-sectional research designs.
- Community competence and empowerment—fostering research that emphasises the development of strengths, competencies and skills of target populations and builds constructively on these positive aspects. Greater facilitation of partnerships in the research process.
- Consideration of the importance of context—acknowledgment of the context in which resource management issues occur. That is a consideration of local factors such as local political systems, cultural styles as well as the institutional context in which individuals and groups operate.

Views on program options

In relation to the design of a social research stream for LWRRDC, Ross presents a number of three models for consideration:

- a new program stream for social, institutional, legal and economic research;
- integration of these content areas in existing program streams; and
- network or ‘hub’ model.

The latter two options appear most appropriate for the consideration of social issues, but all have advantages and disadvantages in their approach. One of the main difficulties for many social scientists working in a natural resource management context is that they are often required to work in isolation. This is not just physical isolation, but structural isolation. In other words, there is often limited structural support for integrating social and biophysical dimensions. Consequently, because of a limited institutional base, social issues are often left off the agenda or only partially considered.

In developing a new research stream or component that addresses social issues, LWRRDC is giving official recognition to an area, which although important, has found it difficult to articulate its

message clearly. LWRRDC has taken the important step of recognising the value of including a social, economic and political program in its research agenda. The true success of such a program rests on the ability of the corporation to successfully integrate these issues with more mainstream programs and develop a new narrative for the assessment and study of natural resource management.

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5. Environmental Economic R&D for Sustainable Natural Resource Management in Rural Australia: a Potential Role for LWRRDC

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Summary

Environmental economic R&D can make a significant contribution towards achieving sustainable natural resource management (NRM) in rural Australia. Two important aspects of this work are: (i) identifying objectives in terms of the level of environmental protection society should choose (using social benefit–cost analysis and various economic valuation methods); and (ii) examining how a given objective might best be achieved (involving exploration of economic instruments such as tradeable rights, taxes and subsidies).

NRM issues and objectives provide both motivation and context for economic work. Economists can provide basic value data as a direct input into developing policy options and informing NRM decisions. Economists also have a role in identifying economic issues that either impede landholders and others from making sustainable resource use decisions, or fail to provide a suitable environment in which such decisions can be made. Five classes of economic issue can be identified: (i) establishment of markets to facilitate efficient use of resources; (ii) addressing market failure to reduce negative externalities; (iii) informing markets so that they better reflect underlying economic values; (iv) assessing new technologies; and (v) establishing incentive mechanisms to facilitate supply of public-good benefits. Addressing these issues often requires measurement of economic value components. Economists have a role in documenting these values and assisting decision-makers in both market and nonmarket contexts to gain access to them. Economists can also support psychological and sociological work directed at understanding the factors that influence stakeholders' behaviour and decisions with respect to NRM issues.

LWRRDC already has a diverse portfolio of economic work. However, the distribution of work across research topics and issues does not necessarily reflect their relative importance. For the 67 (approx.) past and current projects, market value assessments and assessments of new technology have been the most well researched topics. Work on assisting the formation or functioning of markets, reducing negative externalities, and nonmarket valuation was evident in about one-fifth of the projects. There has been little economic work done on incentives for provision of public goods. There is a need to redress the current imbalance by placing a greater emphasis on nonmarket economic aspects of achieving sustainable NRM, and the role economic factors play in individuals' decision-making. This shift in emphasis is necessary to provide: a sound basis for cost sharing; justification of public expenditures on provision of public-good benefits; and suitable tools for evaluation of policy options. Other areas that could be given more attention by LWRRDC in the future include: institutional issues in adoption of economic methods and instruments; the transferability and scale of economic data; and clarifying the role of economics in relation to other environmental decision-making approaches. Several of these topics require integration of economics with expertise from other social sciences, in particular psychology and sociology.

5.1 Introduction

This paper addresses the contribution environmental economic research and development (R&D) can make to achieving sustainable natural resource management (NRM) in rural Australia. Environmental economics is a large and diverse subdiscipline that deals with the economic aspects of ecologically sustainable development, pollution control and waste management, disaster compensation, optimal harvesting of potentially renewable resources such as fish and timber, and the use and management of natural areas. Most environmental economists work at the micro-level on solutions to particular problems of resource allocation and land use. A smaller group is also active in macro-level work such as incorporating environmental indicators into national accounts; integrating environmental variables into macro-economic models; analysing how phenomena such as globalisation of capital and finance impact on our ability to achieve sustainable development; and exploring the structure of economies and economic

institutions, seeking those that can best deliver the necessary degree of environmental protection (Jacobs 1995). Since many macro-level concerns are at a scale that is beyond the control of most stakeholders with an interest in LWRRDC work, this paper deals principally with the micro-level, although some consideration is also given to institutional issues.

Neoclassical micro-level approaches tend to focus on either:

- identifying objectives in terms of the level of environmental protection society should choose (using social benefit–cost analysis (BCA) and valuation methods); or
- taking a set of objectives as given, and examining how these objectives, from an economic point of view, might best be achieved (involving exploration of instruments such as tradeable quotas, taxes and subsidies) (Jacobs 1995).

There is also a property rights school which pursues the line that, as far as possible, decisions should be made by bargains struck between actors in markets, so that property rights should be allocated to environmental goods and services to enable such markets to be created. Such an approach can be particularly effective when applied to the allocation of common property resources such as water. The lack of external constraints on economic activity, and the practice of discounting future values, means that neither the property rights nor the neoclassical micro-level approaches guarantee sustainability, which, in economic terms, can be understood as a requirement that natural capital stock should be maintained over time (Jacobs 1995).

Concerns that environmental economics does not take sufficient account of the sustainability constraints and the interdependence of economic and ecological systems has led to the emergence of ecological economics. Ecological economics is not a new subdiscipline, in that it is generally considered to include environmental economics (Costanza 1989). Rather, it takes into account the linkages between ecological and economic systems in a more inclusive manner that conventional economics. Neoclassical economic accounts of how firms produce goods and services exclude the recognition that the necessary extractions from and insertions into the natural environment are constrained by a thermodynamically closed system with a fixed energy input (Common 1995). Common (1995) also argued that, unlike environmental economics, ecological economics takes human psychology seriously. However, these distinctions can become somewhat artificial. Certainly, some environmental economists who work principally within the neoclassical framework are happy to incorporate insights from psychology and other disciplines into their work.

This paper is based on neoclassical environmental economics, but also addresses what might be termed ecological economic concerns such as identifying constraints on economic activity at the micro-level, and the need to make a serious attempt to incorporate psychological realities into an expanded economics.

For the reader with no background in economics, I first present a brief overview of economic thinking, and locate environmental economics within a wider value framework. I then examine economic issues associated with achieving sustainable natural resource management, and identify the R&D requirements to address these issues. Recent work in the area funded by the LWRRDC is considered in relation to these R&D requirements, and important areas for future work identified. Finally, recommendations are made on the role the LWRRDC could play in meeting the R&D needs. Several of the points in the paper are exemplified using the issue of conserving remnant native vegetation on private property (RNV), but are also relevant for other issues such as dryland salinity.

5.2 Economic value, markets and public goods

Neoclassical economics relies on the behavioural assumption that individuals maximise utility under constraints imposed by scarcity of time and money. In general, an individual demands certain quantities and qualities of market goods and public goods such that their utility is maximised subject to a budget constraint. Measurement of changes in economic welfare relies on individuals expressing their values according to preferences that satisfy a set of technical conditions (the axioms of completeness, reflexivity, transitivity, nonsatiation and continuity). This preference structure requires that individuals are willing and able to make trade-offs between different goods and services.

Money is both a medium of exchange, and a measure of the exchange (trade-off) value of a good or service. The exchange value of a good is measured by the amount an individual is willing to pay for it, or willing to take in compensation for giving it up. The price of a good in a perfect market is determined by individuals' willingness to pay, together with the cost of producing the good.

Market economic values are determined by the exchange of goods and services in organised markets through the price mechanism. Price is thus an indicator of relative value, though where markets are distorted, adjustments need to be made to yield so-

called shadow prices. A market will function efficiently only when certain conditions are met. An ideal market requires perfect competition between the actors in the market; availability of full information in relation to the goods being traded and the mechanisms of trade; and allocation of property rights such that all goods in the market can be exclusively owned by individuals, and 'non-paying customers' can be excluded (Kneese 1977).

Economic rationalism advocates maximising the role of the market as a mechanism for determining the production and allocation of resources. The justification for economic rationalism is based on welfare and micro-economic theory, as well as experience with actual economic outcomes arising from market exchanges. Theory shows that maximising the economic welfare of society can be achieved though economic efficiency. Perfect markets will tend to be efficient, in that goods will be bought and sold until the point is reached where everyone involved in the market can gain no additional benefit from further exchange—that is, the net benefit has been maximised.

However, not all goods can be exchanged in a perfect market. 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. Individuals may use a public good, but may not be willing to contribute to its cost of production or maintenance, or there is simply no mechanism in place to capture individuals' willingness to pay, or to fund the cost. When this happens the contributions are not large enough to finance an efficient supply of the public good. Markets under-supply public goods such as biodiversity conservation over which individual property rights cannot meaningfully be allocated. Under-supply of public goods constitutes a failure to maximise economic welfare.

Public and common property goods are often discussed in terms of the nonmarket values they provide. Nonmarket economic values are most commonly classified into use and nonuse components (Freeman 1993). Use values of natural areas, for example, are the benefits that accrue to visitors who use an area's facilities and enjoy its amenities. These benefits are often not directly bought and sold in organised markets, but are economic in the sense that people are willing to give up scarce resources such as time, or invest in market goods such as travel, in order to obtain them. There may also be vicarious use benefits which accrue to individuals who derive enjoyment from the park indirectly through media such as books and films (Randall and Stoll 1983).

With respect to natural places, nonuse values are pure public goods that reflect the value people place on the existence of such an area, regardless of the importance of other values related to consumption, either of products (such as timber), or experiences (such as recreation). Such values would be under-supplied by private nature reserves, since management would be only orientated towards providing consumptive activities from which revenue could be generated, and the area required to do this would, in general, be insufficient to satisfy the demand for nonuse values. Nonuse values have often been divided into existence and bequest value. Bequest value arises when individuals value some current or proposed condition because they want to reserve the right for future generations to gain benefit from that condition. Existence value is the benefit received by those who derive satisfaction from knowing that a site is preserved in a certain condition irrespective of use or potential use by the individual or others.

Conserving an area of remnant native vegetation (RNV) on private property, for example, involves both market and nonmarket economic values. Market values relate to the direct on-farm benefits and costs to the landholder associated with conserving RNV. Such 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. Nonmarket benefits include the nonuse value of biodiversity conservation, and enhancement of scenic amenity. Costs may include foregone agricultural production from the areas to be conserved, the materials and labour associated with fencing, and the ongoing management of the remnant.

Clearing of RNV by a particular landholder can also produce negative externalities. That is, clearing imposes productivity losses on downstream landholders arising from impacts such as increased salinisation and reduced water quality. Upstream landholders have no incentive to consider these costs as they do not affect their profitability. Private returns therefore diverge from public returns. Those landholders who do take external costs into account will tend to be less economically viable than competitors who do not. Government intervention is therefore justified in order to establish efficient and equitable distribution of costs.

More generally, since a market system cannot perform all economic and social functions, the public sector has a role in establishing institutions to:

- regulate the market to ensure that as far as possible conditions of perfect competition and full information are maintained;

- manage situations where externalities arise that affect social welfare;
- protect and enforce the honouring of contracts (by way of the legal system);
- provide those public goods and services required by the community for which the market is an inefficient producer or unable to produce in sufficient quantities;
- ensure social values are upheld (for example, redistribution of wealth); and
- regulate the economy to ensure price stability and socially desirable levels of employment and economic growth, none of which is guaranteed even in a perfectly operating market system (Barkley and Seckler 1972, Musgrave and Musgrave 1982).

Governments can control the trading of natural resource attributes in terms of their quality and quantity, or they can control their prices, either directly by setting prices, or indirectly through charges, taxes, subsidies and other economic incentives (James 1997). Governments can also provide expertise, information, and education to address the lack of appropriate and sufficient knowledge of individuals within the market system.

Of course it must also be demonstrated that government intervention will lead to improved allocation outcomes over those of the free market. The ensuing benefits should exceed the costs of intervention, including those of enforcement and market distortions (Panayotou 1992). It is widely recognised that past government policies have contributed to poor land management and resource degradation. Perhaps the best examples of this are in the government support for inappropriate irrigation schemes, and vegetation clearing promoted by taxation incentives.

Unlike market values, nonmarket values cannot be readily quantified, and hence many environmental assets and ecological functions are unpriced and perceived to be 'free'. However, this does not mean that they do not have a value, or that the value cannot be translated into monetary terms and compared with other things that are valued and priced (Markandya and Richardson 1992). If resources are not individually owned or are unpriced, they tend not to be recognised like other assets and there is no incentive to protect them. Consequently, they tend to be overused or abused, thereby resulting in environmental damage at both regional and global scales (Young 1992). Environmental economists see a part of the solution to environmental problems in terms of ensuring that the environment is properly valued to reflect the relative scarcity of natural resource benefits.

Economists use two classes of techniques to assess individuals' preferences—revealed preference (RP) and stated preference (SP) methods. Conventional RP approaches have relied on measurements based on behavioural expressions of value. People reveal the value they place on a good or service through transactions they make in a market. For some goods, such as recreation undertaken in natural areas, direct markets may not exist, but visitors still reveal their value though their willingness to spend time and money in order to gain access to a site. Such revealed preferences for recreation can be measured using indirect market methods based on travel cost.

Recently, economists have also developed methods based on what people say about, for example, their willingness to pay for nature conservation, rather than what they reveal through their behaviour. Such SP methods are particularly important with respect to natural areas, because many of the potential benefits provided by such areas are not revealed in markets, and cannot be recovered through indirect market techniques. At present, the most significant SP technique is contingent valuation (CV). Since a valid and widely accepted SP method is required for a complete economic assessment of environmental policy options, there has been an enormous effort has been directed by economists, as well as psychologists and other social scientists, towards developing CV. Other SP techniques that have been explored include contingent rating, contingent ranking, paired comparisons and choice modelling (Mitchell and Carson 1989; Morrison *et al*. 1996).

CV, in its simplest form, asks people how much they are willing to pay (or willing to accept as compensation) for some change in the provision of an amenity, usually a nonmarket good. The willingness to pay (WTP) valuations are determined in the context of a hypothetical market which is constructed in the survey. This hypothetical market typically comprises a description of the amenity, the change in its provision, and the means (payment vehicle) by which the participant can purchase a particular allocation of the amenity. When applied with care, CV has gained some credibility in the United States as a tool for valuation of nonmarket commodities. An expert panel (Arrow *et al*. 1993) convened to review the state of the art, concluded that CV could provide reliable valuation data provided the survey used, among other things, a dichotomous choice referendum elicitation format, in-person interviews, and explicit reminders of substitutes and budgets. The method has been recommended for use under the U.S. *Comprehensive Environmental Response, Compensation and Liability Act 1980*. However, the

technique remains controversial. It is beyond the scope of this report to review this controversy—some of the major contributions to the debate have been Cummings *et al*. (1986), Mitchell and Carson (1989), Cummings and Harrison (1992), Arrow *et al*. (1993), Hausman (1993), Smith (1993), Hanemann (1995) and Smith (1996).

The theoretical underpinning of economic welfare measures obtained from CV is provided by the set of axioms listed above. These axioms constitute limits on the manner by which individuals express their preferences. The plausibility of applying the axioms of completeness, transitivity and continuity to nonmarket valuation situations has been subject to little empirical assessment (Blamey and Common 1992). The continuity condition, for example, means that any change in the quantity or quality of one alternative can be compensated for by a change in another alternative. However, in some circumstances, such trade-offs may not be made.

Contrary to neoclassical principles of utility maximisation and continuous substitutability of goods, some people may be reluctant to exceed certain thresholds when moral decisions or essential goods are concerned. A person may consider a certain minimum level of environmental quality as essential for supporting themselves, other people and/or other elements of the natural world. Such essential functional values have no substitutes, and cannot be traded for other goods or services. It is rational to respond to choices involving such values through some hierarchical and noncompensatory expressions of value. Moral commitments (for example, a belief in the intrinsic rights of animals) may also give rise to noncompensatory preferences. Noncompensatory preferences associated with a particular level of an environmental good define a threshold below which environmental values should not, from an individual's perspective, be traded for other things of value, such as improvement in economic welfare. Noncompensatory preferences can be related to notions of a safe minium standard, or a minimal acceptable level of supply, that need to be maintained regardless of economic consequences.

Most work on noncompensatory preferences has focused on lexicographic preferences (see, for example, Edwards (1986) and Spash and Hanley (1995)) in which a good with a particular value or attribute is always preferred to any amount of another good. Lexicographic orderings satisfy the axioms of completeness, transitivity, reflexivity and nonsatiation, but not continuity. If the amount of a lexicographically preferred good is reduced, there is no amount of another good that can compensate for the change. Lexicographic preferences for environmental goods will generally apply to only a limited range of circumstances. For example, a person may believe that an animal has intrinsic value, and would oppose economic development that would harm it, but only if the development does not reduce that person's wellbeing below a certain minimum acceptable level. Though intrinsic value may not tradeable, preservation of one's self may (and probably will) override preservation of an animal. In general, a person's value expressions for various levels of two attributes such as personal wellbeing and the wellbeing of an animal, can be mapped into up to three regions: (i) noncompensatory expressions based on intrinsic value of self; (ii) noncompensatory expressions based on some intrinsic value in nature; and (iii) exchange expressions where trade-offs are made between the two (Lockwood 1998a). Economic tools can only be meaningfully employed in region (iii).

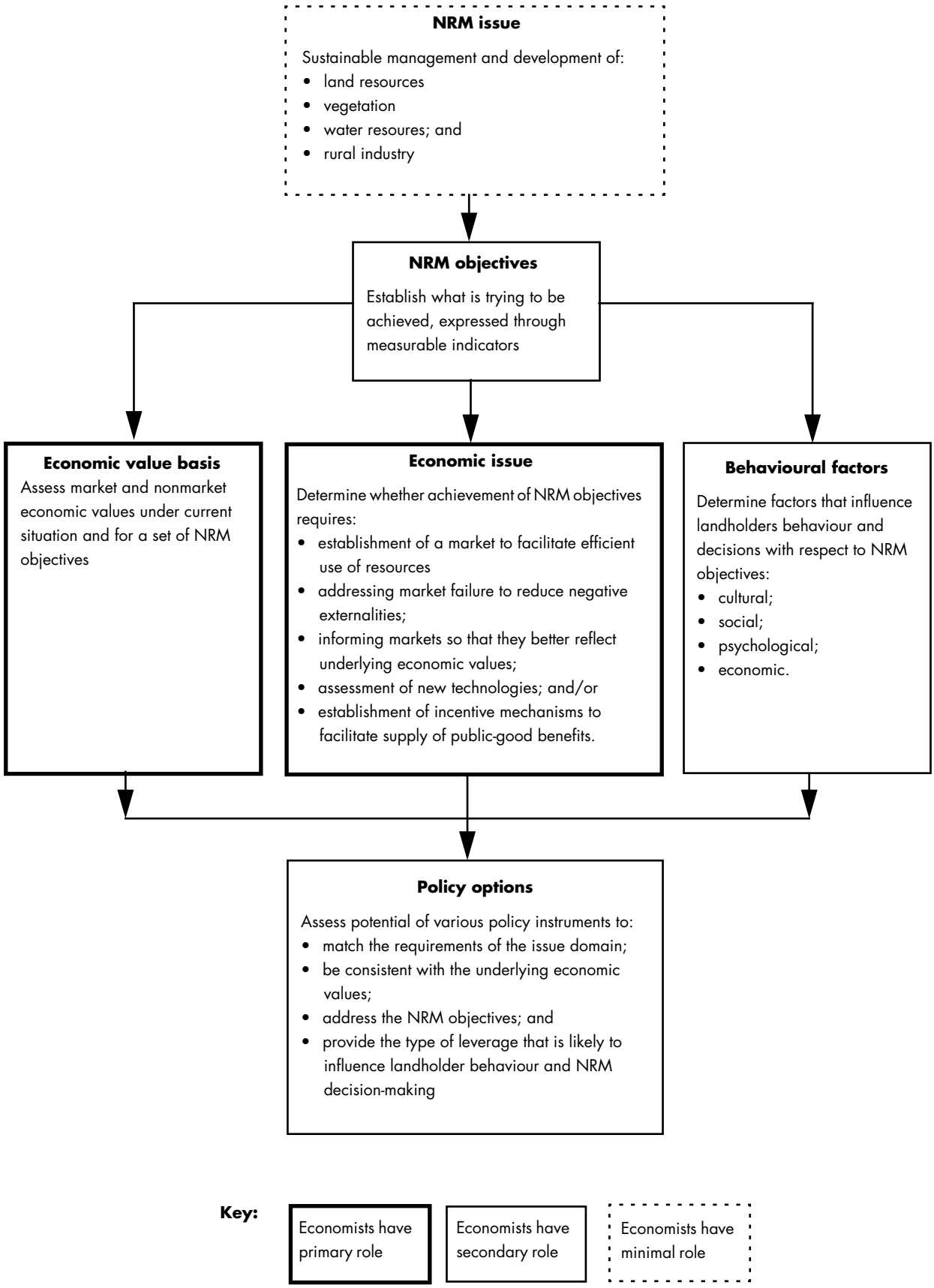
5.3 The contribution of economics to achieving sustainable NRM decisions

The scope of an environmental economic contribution to achieving sustainable NRM in rural Australia is indicated in Figure 5.1. NRM issues and objectives provide both motivation and context for economic work. Major NRM issues have been identified by LWRRDC (1996), and these provide a basis for establishing objectives that can be used to assess progress towards sustainability. Identification of NRM issues and development of objectives is most appropriately undertaken through political and participatory processes, augmented by advice from biological, physical, agricultural and social scientists, including economists.

Though a somewhat artificial separation, it is useful to distinguish two primary roles for economists in addressing NRM issues. Economists can provide basic value data as a direct input into developing policy options and NRM decisions. Economists also have a role in identifying economic issues that either impede landholders and others from making sustainable resource use decisions, or fail to provide a suitable environment in which such decisions can be made. Five classes of economic issue can be identified (Figure 5.1).

1. Current nonmarket mechanisms used to allocate some goods may not reflect their true value, and limited markets may do a better job. The Council of Australian Governments (COAG 1994) recognised this when they established an agenda for major reform of water allocation mechanisms in Australia. Water has private good attributes that can be efficiently provided though a rights market.

Figure 5.1 Roles for economists in achieving sustainable NRM decisions



A rights market is a legal arrangement that allocates a property right to an individual, and allows that individual to transfer or trade that right to someone else. Rights markets can be used in the place of political processes to more efficiently allocate resources. Institutional reform that allocates individual property rights over common property resources may diminish the need for government involvement and investment in NRM. Water rights markets can enable redistribution of water to highest value uses, and create an incentive for people to use water more efficiently (Young and Evans 1997). Constraints can also be built into the market to ensure that the use of water also takes into account public good benefits (issue 4) and production of negative externalities (issue 2). Economists can play a major role assisting in the design and evaluation of such markets.

2. Markets can give rise to behaviour that produces negative externalities inconsistent with the achievement of sustainable NRM outcomes. Causes of land degradation such as salinity are external products of a market system that rewards upstream landholders for productive activities that impose costs on downstream landholders. Markets will tend to cause an oversupply of salinity and result in a net loss of economic welfare, as well as having non-economic impacts. It has been recognised by many authors (eg. Chisholm 1987; Young 1992; Milham 1994; MDBC 1996; OECD 1996) that one solution to overcoming externalities is for governments to establish mechanisms that effectively internalise these external costs. Internalisation will help equate private and social costs, thereby improving the likelihood that a socially optimal rate of resource use will occur. Resource users will have an incentive to minimise environmental damage. Internalising externalities can be achieved through the use of charges for environmental damage, or prices paid for providing environmental benefit. Economic instruments such as price-based measures can make environmental damage more costly, thus encouraging higher quality environmental management. Attaching a price to an activity which has an adverse environmental effect may influence the behaviour of individuals because it can make environmental best practice the most cost-effective alternative (Young *et al*. 1996). This cost-sharing approach may help address the externalities that arise when there is no pricing mechanism to reflect the incidental effects one landholder's activities may have on others.

3. Market signals may not adequately reflect true economic values, even in the absence of negative externalities. While the influence of productive capacity has been shown to affect property prices (King and Sinden 1988, 1994), the same cannot be said for the costs and benefits associated with RNV (Walpole *et al*. 1998). The failure of the property market to reflect the current productivity and long-term sustainability of land may be because buyers and sellers fail to recognise relevant information. They may be unaware, for example, of the documented crop protection benefits afforded by RNV. More commonly, such information is simply unavailable. Economists can therefore assist the property market to reflect the full economic benefits and costs of property attributes, including those related to sustainable productivity, by generating the required information.

4. The costs and benefits of new technology, and the market performance of such innovations, are of course unknown before their introduction. I am using the term 'technology' to refer to either products or techniques. Economists can provide advice on whether the new technology is likely to yield a net economic benefit to potential clients. Where the motivation for the new technology has at least in part arisen from the need to address an NRM issue, assessments can also be made of its potential to, for example, enhance the supply of a public good, or mitigate the production of negative externalities.

5. Markets fail to provide appropriate signals for the provision of public goods. The failure of markets to value nonuse values means that inadequate resources are allocated to biodiversity conservation. While there may be some level of provision of a public good such as biodiversity that is a required minimum (see the above discussion on thresholds), above this level economic instruments can be used to help generate an efficient supply. For example, the supply of nonmarket values associated with RNV, including the conservation of native plant and animal communities, and the provision of scenic amenity, will be determined by private landholders, within any constraints imposed by legislation. While these constraints may restrict clearing, they do not ensure sustainable management in the face of activities such as forest grazing and firewood production. Decisions made by individual landholders, based on free-market principles, will result in an under-supply of RNV conservation. The combined demand for private and public values for conserving RNV is essentially much greater than the private demand

for conserving RNV. A landholder has no incentive to fence off and conserve the nature conservation values of RNV if the benefits to himself/herself are small, and the costs of building the fence and managing the area are large. This provides a rationale for government intervention in the form of economic incentives to conserve RNV on private land. Economists can help in determining: how much funding should be made available to support such incentive schemes; appropriate cost-sharing arrangements; and efficient allocation of funds.

Addressing these issues often requires measurement of economic value components. Market values are generally well recognised, and relatively easy to measure. However, for some goods, such as water or timber, market distortions mean that shadow prices may have to be estimated. Economists have a role in documenting these values and assisting the market to gain access to them. Nonmarket values are more difficult to measure. For many NRM issues these nonmarket economic data are a critical ingredient for a comprehensive economic analysis.

There have been relatively few studies addressing the need for nonmarket economic data to inform NRM decisions in Australia. Bennett *et al*. (1997) used stated preference methods to evaluate the impacts of dryland salinity on wetlands in South Australia. Morrison *et al*. (1998) valued environmental improvements arising from making more water available to the Macquarie Marshes in NSW. Lockwood and Carberry (1998) estimated the nonmarket value of RNV in North-East Victoria and Southern NSW. Economists can play a key role in generating further data of this kind, as well as addressing technical issues that surround the validity of nonmarket valuation methods.

Economists have a role in supporting psychological and sociological work directed at understanding the factors that influence stakeholders' behaviour and decisions with respect to NRM issues. Even if appropriate market institutions or signals are present, people may not behave as economic theory suggests they should. Numerous cultural, social and psychological factors can mitigate against economically rational behaviour. Economists can work with other social scientists to explore the reasons why people may not, for example, trade water rights in a manner that leads to an efficient allocation, or do not take up economic incentives to provide public good benefits such as biodiversity conservation. Such understanding is essential for the effective development and implementation of economic mechanisms to address NRM issues.

Economists also have a role in directly assisting the development and evaluation of economic policy instruments. Instruments vary in their ability to: address different types of economic issue; be consistent with the underlying economic values; address NRM objectives; and provide the type of leverage that is likely to influence landholder behaviour and NRM decision-making. Economic expertise is required to advise on the likely *ex ante* performance of particular instruments against these factors. Economists also have a role in the *ex post* evaluation of policy.

5.4 Past and current LWRRDC environmental economic R&D

The projects listed in Table 5.1 constitute a diverse portfolio that encompasses all the aspects of environmental economic work that have potential to contribute towards achieving sustainable NRM. However, the distribution of work across research topics and issues does not necessarily reflect their relative importance. For the 67 funded projects, market value assessments (76% of projects) and assessments of new technology (43% of projects) have been the best-researched topics. About a quarter of the projects have specifically addressed individuals' decision processes, or policy assessment. Work on assisting the formation or functioning of markets, reducing negative externalities, and nonmarket valuation was evident in about one-fifth of the projects. Although only a few projects focused specifically on informing market decisions, many of the market and technology evaluations potentially addressed this topic (that they were not categorised as doing so, was because informing markets was not an explicit objective of these projects). There has been little economic work done on incentives for provision of public goods.

5.5 Future requirements for environmental economic R&D

There is a need to redress the current imbalance in favour of research related to market analysis and technology assessment. That is not to say that more research of this type would not be worth while. There is a continuing role for economic research in determining, for example, the viability of new technologies for dealing with dryland salinity (VCG 1997).

Table 5.1 LWRRDC funded projects related to environmental economic research topics and issues (n = 67)

LWRRDC code	Project title	Environmental economic research topics and issues								
		Market value assessment	Nonmarket value assessment	Market formation	Reducing negative externalities	Informing markets	Assessing new technology	Incentives for public good supply	Decision behaviour	Policy development/ assessment
SLM1	Economic evaluation of conservation farming techniques	M	n	n	n	n	M	n	n	n
DAV14	Productivity, socioeconomic and natural resource impact of changing catchment enterprises	M	n	n	n	n	M	n	n	n
CSO167*	Soil indicators of changing land quality and capital value	M	n	n	n	n	n	n	n	n
ABA2	Quantification of the full range of costs of dryland salinity	M	m	n	M	n	n	n	n	n
ABA3	Development of approaches for assessing non-market values related to salinity	n	M	n	n	n	n	n	n	n
LPM2	Investment of programs and institutional arrangements for effective NRM	m	n	n	m	n	n	m	n	M
DAN10	Sustainability in a commercial context: the potential for innovative market based approaches	m	n	n	n	M	m	n	n	n
SRC3	Quantifying the socio-economic impact of harvesting residue retention systems	M	n	n	n	n	M	n	n	n
CWE16	Biological and economic consequences of managing water point distribution in rangelands	m	m	n	n	n	M	n	n	n
CSO2	Grassy white box woodlands: incentives and barriers to rural conservation	n	n	n	n	n	n	M	m	M
CSU10	Economics of remnant vegetation on private property	M	M	n	n	n	n	M	n	M
CTC9	Applying management principles in variegated landscapes: identifying production: conservation trade-offs	m	n	n	n	n	M	n	m	n
CWE13	Opportunities for the use of incentive payments to conserve remnant vegetation	n	n	n	n	n	n	M	n	M
UME25	Improving market outcomes: the case of native grasslands	M	n	n	n	n	M	n	M	n
UNE26	Building conservation strategies from stakeholders intrinsic and social values	n	m	n	n	n	n	n	M	n

Table 5.1 (continued) LWRRDC funded projects related to environmental economic research topics and issues

LWRRDC code	Project title	Environmental economic research topics and issues								
		Market value assessment	Nonmarket value assessment	Market formation	Reducing negative externalities	Informing markets	Assessing new technology	Incentives for public good supply	Decision behaviour	Policy development/ assessment
UNS19	Using choice modelling to estimate non-market values	n	M	n	n	n	n	n	M	n
USA2	Factors influencing the market value of native vegetation in SA	M	M	n	n	m	n	n	n	n
VCA2	Socioeconomic and ecological benchmarks for the evaluation of remnant vegetation	M	m	n	n	n	n	n	n	n
DAV74A	Trees for profit integrated economic model: farm level and regional study	M	n	n	M	n	M	n	n	n
DAV129A	Forecasting tree growth and yield, and financial returns of key agroforestry species across southern Australia	m	n	n	n	m	m	n	n	n
GAL-2A*	Farm forestry in Australia: integrating commercial and conservation benefits	M	n	n	n	n	M	n	n	n
UCS-14A	Market, economic and social assessment of low rainfall carob agroforestry in the Murray Valley	M	n	n	n	n	M	n	n	n
UNE19	Integrating environmental and irrigation water allocation under uncertainty	m	n	M	n	n	n	n	n	n
DAV21	Economic assessment of water market reform using the Water Policy Model	M	n	M	n	n	n	n	n	M
USA1	Do water trade policies achieve environmental and socio-economic goals?	M	n	M	n	n	n	n	M	m
UNE15	Development of support models deriving and implementing opportunity costs of environmental uses of water	M	n	n	n	n	n	n	n	n
CWN13	Determination of optimal irrigation intensity of irrigation areas	M	n	n	m	n	M	n	n	n
QPI27	Economic and environmentally sustainable use of various water supply sources for irrigation	m	n	n	n	n	m	n	n	n
CWE12	Potential rights markets for management of groundwater quality	n	n	M	M	n	n	n	n	M

Table 5.1 (continued) LWRRDC funded projects related to environmental economic research topics and issues

LWRRDC code	Project title	Environmental economic research topics and issues								
		Market value assessment	Nonmarket value assessment	Market formation	Reducing negative externalities	Informing markets	Assessing new technology	Incentives for public good supply	Decision behaviour	Policy development/ assessment
SCS4*	Agricultural opportunity costs of land degradation in NSW	M	n	n	m	n	n	n	n	n
UQL3	Developing alternative procedures for land evaluation	M	n	n	n	n	n	n	n	n
ULA2	Economic evaluation of dryland salinity control options on water resources in the Murray Darling Basin	M	n	n	m	n	M	n	n	n
DAW15	Economic and financial analysis for catchment planning and land management	M	n	n	n	n	M	n	n	n
ULA1*	Developing computer models for integrated catchment planning and conservation of soil and water resources	m	n	n	n	n	n	n	n	n
UNE14	Assessment of economic benefits of land management programs on a national, regional and catchment basis	M	n	n	n	n	M	n	n	n
USH1	Innovative approaches to environmental valuation in integrated catchment management	n	M	n	m	n	n	n	M	n
CTC3*	Market research for decision support for dryland crop production	m	n	n	n	n	m	n	n	n
UNE17	Analysing drought strategies to enhance farm financial viability	M	n	n	n	n	M	n	n	n
ANU4	Valuation of non marketed environmental attributes and resources	n	M	n	n	n	n	n	M	n
UNE16*	Economic monitoring/forecasting of rural business	M	n	n	n	n	n	n	n	n
ABA1A*	Survey of costs and benefits of planing trees on Australian farms	M	n	n	n	n	m	n	n	n
UME5*	Valuation of benefits of hydrologic information	M	n	n	n	n	n	n	n	n
UQL12	Review of existing participative action model projects and socioeconomic issues affecting adoption of irrigation technology	n	n	n	n	n	m	n	M	n

Table 5.1 (continued) LWRRDC funded projects related to environmental economic research topics and issues

LWRRDC code	Project title	Environmental economic research topics and issues								
		Market value assessment	Nonmarket value assessment	Market formation	Reducing negative externalities	Informing markets	Assessing new technology	Incentives for public good supply	Decision behaviour	Policy development/ assessment
W88/03*	Implementation theory and the privatisation of irrigation systems in NSW	n	n	M	n	n	n	n	m	m
47/91*	Development of procedures for more efficient monitoring and assessment of groundwater contamination	m	n	n	m	n	n	n	n	n
UNE11*	Integration of wetlands water supply and demand management in a market environment using capacity sharing	m	n	m	n	n	n	n	n	n
39/91*	Cost effective treatment of piggery wastes and disposal of residues	M	n	n	n	n	M	n	n	n
85/122*	Introduction of user pays domestic water pricing in Newcastle	M	n	M	n	n	n	n	n	m
P87/22*	Impact of capital works on rating for smaller country local councils	m	n	n	n	n	n	n	n	m
UAD2*	Reliability cost trade-offs for multiple reservoir systems	M	n	n	n	n	n	n	n	n
UNE3	Evaluation of transferability of water entitlements in Australia	n	n	M	n	n	n	n	M	M
UNE4*	Resource use efficiency and economic viability in the Murrumbidgee Region of NSW	M	n	n	n	n	m	n	n	n
UNE6*	Water pricing and allocation in random environments	m	n	M	n	n	n	n	n	m
UWR2*	Reuse of wastewater: economic analysis of community benefit	M	n	n	n	n	M	n	n	n
ACM1	Social and economic feasibility of ameliorating soil acidification	M	n	n	n	n	M	n	M	n
RMI2	Environmental accounting for the agricultural industry	M	n	n	n	n	n	n	M	n
CCM3	Effectiveness of incentives in changing landholder attitudes towards RNV	n	n	n	n	n	n	m	M	m
GCC2	Economic and ecological sustainability of current land use in Australia's rangelands	M	n	n	n	n	n	n	n	n

Table 5.1 (continued) LWRRDC funded projects related to environmental economic research topics and issues

LWRRDC code	Project title	Environmental economic research topics and issues								
		Market value assessment	Nonmarket value assessment	Market formation	Reducing negative externalities	Informing markets	Assessing new technology	Incentives for public good supply	Decision behaviour	Policy development/ assessment
CDF8	Economic assessment of effluent irrigated plantations for wood production	M	n	n	n	n	M	n	n	n
CWE18	Spatio-temporal effectiveness of natural resource and rural adjustment policies	m	n	n	m	n	m	m	n	M
UWA21	Innovative workshops to improve understanding of price and climate variability	n	n	n	n	m	m	n	n	n
ANU12	Sustainable resource management: consumers' preferences or citizens deliberations	n	M	n	n	n	n	n	M	n
ABA1	Drought and the economic performance of Australian agriculture	M	n	n	n	n	m	n	n	n
ABA4	Impediments to adoption of dryland salinity policies and programs in the Liverpool Plains	M	n	n	M	n	m	n	M	M
98/99 project	Land retirement as a conservation strategy	M	n	n	n	n	n	n	n	M
98/99 project	Sustainability with profitability: rural adjustment via water markets	n	n	M	n	n	n	n	M	M
98/99 project	Citizens juries for environmental management: an alternative to CBA?	n	M	n	n	n	n	n	M	m
	Percentage of projects rated M	55	12	13	6	1	27	6	22	16
	Percentage of projects rated m	21	6	1	10	6	16	3	4	10
	Percentage of projects rated n	24	82	85	84	93	57	91	73	73
	Total percentage	100	100	100	100	100	100	100	100	100

Key:M = major focus of the project, m = minor focus of the project, n = not a focus of the project

Notes: 1. Projects marked with an asterisk have been coded based only on title, because no other information was to hand. Allocation of the focus codes to other projects was based on subjective judgments made by the author based on descriptions of projects drawn from the ARRIP database and LWRRDC records.

2. For more details on the meaning of the research topic and issue headings, see Figure 5.1 and the associated text.

3. Many of the projects also addressed topics or issues that were not to do with environmental economics.

Economic assessments of alternative land uses must also continue, so that opportunities for changes in, and diversification of, current practices are recognised. However, there is a need to place greater emphasis on nonmarket economic aspects of achieving sustainable NRM, and the role economic factors play in individuals' decision-making. This shift in emphasis is necessary to provide:

- a sound basis for cost sharing with respect to externalities;
- determination and justification of public expenditures on provision of public-good benefits;
- an understanding of the major factors influencing individuals' decisions as an aid to effective policy design; and
- suitable tools for evaluation of policy options.

There are also issues of scale and transferability of data that need to be addressed. Support for the following areas of R&D should be a priority.

Methodological issues in nonmarket valuation

Some weighing of costs and benefits is unavoidable in our decision-making (Harris 1998). Environmental economics has made a major contribution to the search for more effective ways of making unavoidable choices, particularly in addressing problems of valuation, and extending on the capabilities of BCA. However, a widely accepted method for assessing alternative uses of natural resources is still lacking. As noted with respect to dryland salinity, a comprehensive economic methodology is required to help decision-makers choose between alternative approaches in a manner that takes into account full costs and benefits (LWRRDC 1992). Unless there is some form of agreed measure, resolution of conflicts that are based ultimately on individuals' value judgments remains problematic.

There has been some progress towards the developing SP approaches to enable comprehensive economic assessment of management options, but at present no particular methodology can be unequivocally recommended (VCG 1997). Some of the issues that need to be addressed are discussed in Blamey (1998) and Lockwood (1998b). Two crucial issues are: how to locate the particular issue of interest within the wider policy agenda (and the related problem of effectively incorporating substitute goods into the valuation problem); and ensuring that SP surveys are incentive compatible. To be incentive compatible, the rules and structure of the valuation method must, in conjunction with utility maximising behaviour of participants, produce a choice which is economically desirable in the aggregate according to a benefit–cost criterion (Cummings *et al*. 1986). Does the hypothetical nature of SP surveys mean that they fail to create an environment in which participants have an incentive to reveal their true economic preferences? The evidence on this question is mixed, and further work is required.

Though several LWRRDC-funded projects have addressed methodological issues associated with nonmarket SP methods (most notably projects ABA3 and UNS19), more work is required in this area. There is some risk attached to supporting such work, since there is no certainty that it will lead to development of the necessary methodology. However, if successful, the benefits of such research would be of national and international significance. Australian work in this area is already making an international contribution (Harris 1998), though it must be recognised that at present there is a relatively small pool of researchers with the necessary expertise.

Advancing SP methodologies also requires that economists work with researchers from other disciplines:

> effective use of the CV method [and by implication other SP approaches] in estimating the values individuals place on improvements in specific aspects of environmental resources ... requires a model of how individuals report choices for proposed objects of choice in response to alternative framing schemes. Clearly, such an effort extends beyond the confines of economics to psychology and other social sciences.
>
> (Smith 1996: 18)

Very few SP research projects have seriously attempted such interdisciplinary collaboration. One notable exception is LWRRDC project UNS19. In addition, successful development of a valid and reliable value assessment methodology does not guarantee that such a method would actually be used by decision-makers. Interdisciplinary research is also required to explore the barriers to adoption of formal assessment methods, and to recommend mechanisms for overcoming them.

One response to the difficulty of assessing the exchange value of nonmarket goods in dollar terms is to use some other index of value. The most widely used approach is multicriteria analysis (MCA). MCA is a label given to a family of methods that attempts to represent the performance of alternative projects against a set of criteria.

In its simplest form, the implications of each alternative in relation to each objective are specified in ways which are compatible with the nature of that

objective. The financial impacts of each alternative can be expressed in dollars, the recreation demand impacts in terms of visitor days estimated from a recreation demand model, and the nature conservation impacts in terms of some subjective rating scale. The advantages and disadvantages of each option are compared according to the selected criteria using an effects table. This information is used by decision-makers to inform their judgments. In more sophisticated applications, the performance of each option is assessed according to a common index of value. In this approach, numerical weightings are often also used to reflect the relative importance of the various criteria. The merits of alternative projects can then be assessed simply by calculating their scores according to the index. However, the choice of criteria, as well as the determination of scores and weightings, require the analyst to make subjective decisions. More research is required to determine appropriate procedures for scoring alternatives and weighting criteria. The Resource Assessment Commission's view of MCA was as follows (RAC 1992: 42):

> MCA was used by the Commission to evaluate broad-scale options for forest use at a national level in the Forest and Timber Inquiry. The analysis underlined the extreme sensitivity of forest-use strategies to the weights that are attached to economic or ecological goals, and the difficulty of formulating national strategies that avoid trade-offs between the two goals. It also highlighted the crucial importance of the nature of the options identified in the first place.
>
> 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.

Nonmarket data requirements

There is a lack of information on nonmarket external costs imposed by current and alternative land management practices. This is leading to a lack of rigour, for example, in the assessment of dryland salinity costs (Webb and Price 1994). There is relatively good information on the financial costs of dryland salinity, but only limited nonmarket data. This is hampering the development of cost-sharing and institutional arrangements (VCG 1997). The same point could also be made for the other NRM issues identified by LWRRDC.

Data on nonmarket benefits of investment in public-good provision are sparse. Morrison *et al*. (1998) used choice modelling to assess the value of investing in environmental watering of the Macquarie Marshes in NSW. Lockwood and Carberry (1998) used both CV and choice modelling to assess the nonmarket value of conserving RNV in North-East Victoria and the Murray catchment in the Southern Riverina of NSW. These LWRRDC-funded projects were concerned with both methodological development, and providing case study data. In the latter case, the values obtained were integrated into a wider economic assessment of RNV. As noted by VCG (1997), a broader array of estimates across a wider range of environments is required before data can be generalised, and before policy instruments can be developed.

One of the difficulties facing economists is the problem of applying current biophysical catchment models to assess the economics of externalities. For example, models of the Goulburn–Broken catchment in Victoria are designed to assess the impacts of various production-orientated land use practices, but do not enable the analyst to predict the marginal impact of clearing a particular area of RNV on groundwater levels. Without such capability, the economic analysis of conserving versus clearing RNV is incomplete. Some progress has been made on integrating biophysical models and economics, for example, in the Liverpool Plains catchment, but this has been limited to market values (Greiner 1997). The only substantial study of nonmarket values was done by Bennett *et al*. (1997) to assess the impacts of engineering works mitigating dryland salinity on wetland ecosystems in the Upper South-East of South Australia. Again, the VCG (1997) comment on the need for studies across a wider range of environment is pertinent.

To a large extent, the lack of data is a consequence of the methodological issues noted in the previous sub-section. However, even in their current forms, CV and choice modelling have the capability to provide useful data. Nonmarket economic data are most particularly needed on the value of public goods and the external costs of current agricultural practices. Having some data on nonmarket values, as long as it is offered with suitable qualifications concerning potential limitations on its validity and applicability, is better than no data. However, it is important to recognise the danger that these qualifications may tend to be ignored by some decision-makers, and dollar values used without due consideration of their limitations.

Furthermore, the danger of encouraging poorly executed studies must also be recognised. Since SP surveys are based on the deceptively simply notion of directly asking people their WTP for an environmental good, there is considerable opportunity for 'quick and dirty' data-gathering efforts. There have already been several examples of such surveys in Australia. It is unlikely that the data provided by such surveys are an accurate reflection of participants' WTP because of a failure to determine, amongst other things: what information must be provided in order for participants to offer meaningful responses; whether the information that is provided is unbiased and understandable to participants; the effectiveness of the payment vehicle; the plausibility and specificity of the contingent market; and the range of substitute goods that need to be considered. The unfortunate result is that, as well as providing data of dubious quality, the credibility of all SP work tends to be tarnished.

An interesting variation of BCA that has probably been under-utilised in Australia is economic threshold analysis. Using this approach can, at least in the first instance, avoid the problems of quantifying the nonmarket components of economic value. Saddler *et al*. (1980), for example, used a threshold analysis as part of a BCA to assess the relative worth of two alternative means of increasing Tasmania's electrical power supply capability. The main project involved the damming of the Gordon River, with the consequential loss of existing recreational opportunities and a wilderness area of international significance. They calculated that the initial years preservation values must rise above $1,000,000 at a discount rate of 5% before preservation will be a better option than the hydro development. The study therefore avoided the problem of placing an absolute monetary value on the dollar value of environmental benefits in the initial year, but required decision-makers to judge whether the preservation values were likely to exceed the required threshold.

Understanding decision processes

Since the 1970s, a major area of economic research activity has been analysis of decision-making, including individuals' decision strategies, decision-making under uncertainty, and relationships between individual/organisational behaviour and government decisions (King 1998). These interests have yet to be fully reflected in addressing the problem of rural sustainability. There has been little quality research on the motivations that underlie stakeholders' behaviour. Of particular interest are decision-making processes adopted by landholders, catchment management committee members, local government officials, and key staff within State and Federal Government NRM departments. A more systematic appraisal is required of the key factors that drive stakeholders' decisions, and the levers that may be most effective in changing behaviour. In order to design more effective policy instruments, a better understanding is required of the extent to which economics drives landholder behaviour, compared with other social, psychological and cultural factors. Of particular interest is the extent to which economic incentives and water right markets operate as predicted by economic theory. Landholders may not respond as expected to such economic instruments. For example, an understanding of the social, psychological and cultural reasons why landholders fail to take up incentives for RNV conservation, when it is economically rational for them to do so, can assist the development of more integrated policy instruments that take such factors into account.

Transaction costs of implementing economic instruments

Almost no work has been undertaken on the administration, management, and structural adjustment costs associated with the implementation of economic instruments such RNV conservation incentives. Such costs may be significant impediments to the effective delivery of incentives.

Institutional issues

As noted above, one of the contributions economists can make to resolving NRM issues is to assist with the design and evaluation of rights markets. Effective implementation of rights markets also requires considerable institutional and legal support. Economists need to work together with law professionals and social scientists to identify the necessary form of these supporting institutions. As noted by Deacon *et al*. (1998: 386) the solutions to sustainable natural resource management:

> depend on factors such as education, governance structures, and the evolution of formal and informal social institutions. The forces that determine these factors,… the instruments available to alter them, and the way they combine to influence economic growth and the way the environment is used are poorly understood at present. A better understanding may require the profession [economics] to focus more on historical and institutional considerations than it normally does.

Current institutions at the local and regional levels have been slow to adopt sound economic approaches when tackling NRM issues. For example, the Murray–Darling Basin Commission (MDBC) developed a set of cost-sharing principles (MDBC 1996), but there has been little application of these

principles to the major NRM issues in the basin. Research is needed on institutional barriers to adoption of such principles. Some progress has been made on this issue, (for example, the work of Binning and Young (1998) and Cripps *et al*. (1998) on local government in Australia), but further research is required, particularly with respect to the capabilities and responsibilities of regional catchment management organisations.

As noted above, nonmarket economic methodologies are not yet established and trusted to the extent that they are likely to be used widely in policy analysis and development. While it is essential for comprehensive evaluation that such methodological development takes place, they may still be under-utilised, even if the technical problems are solved. Research is needed to explore the barriers to using state-of-the-art economic methods by decision-makers. SP surveys are costly, require considerable expertise (especially choice modelling), and may still fail to gain acceptance amongst some stakeholder groups. The legitimacy of 'putting a dollar value on the environment' is challenged by some conservationists, for example. In part this position is based on a misunderstanding of SP methods. They do not measure the total value of a forest, for example, but the value of a policy that may change the quality or quantity of the forest. There also seems to be a widespread failure to appreciate that the economic welfare measures produced by SP methods are not the same as a price. To some extent these misperceptions do point to a substantive problem with SP methods—their failure to allow for noncompensatory expressions of value. This issue is taken up below when considering the role of economics in informing environmental decisions.

Transferability and scale of economic data

A case study approach to economic problems is often necessary to allow sufficient attention to be paid to detail. However, economic data are not always collected at a scale that is useful for policy-making, and it is often difficult to generalise the results and aggregate them to the regional and national levels. On the other hand, data sets collected for large-scale applications tend to be ill suited to regional or local scale models, primarily because the values are not sufficiently attributed in terms of key biophysical and land use variables. As a consequence, analysts must either undertake their own primary data collection, or make 'guesstimates' of unknown reliability and validity based on existing data. Since obtaining high quality economic data is costly, every effort should be made in designing valuation studies such that transferability across scales is taken into account. For example, bioeconomic models are required that enable transfer of economic impacts of dryland salinity from one study area to another. For market values, the lack of national data prevents assessment of the national cost of soil degradation (Hayes 1997). The same problem exists for other NRM issues, particularly with respect to nonmarket values.

Australian research to date has also not paid sufficient attention to the need for benefit transfer from nonmarket valuation studies. Benefit transfer is the use of existing estimates of nonmarket values to a new population or site to examine the implications of a new policy issue (Boyle and Bergstrom 1992), thereby obviating the need for costly and time consuming primary data collection. Some of the issues in benefit transfer of nonmarket SP survey data are discussed by Morrison (1998). Research is needed into how SP surveys might be designed to optimise their benefit transfer potential.

Role of economics in environmental decisions

Philosophers have begun to develop the basis for a distinct environmental value theory (eg. Callicott 1987; Rolston 1989). Psychologists have examined individuals' value orientations toward the environment, and attempted to develop scales to measure the degree people believe in an intrinsic value in nature (eg. Stern *et al*. 1995). Benefits of integrating developments in these disciplines with economic work into a comprehensive approach to environmental valuation include:

1. integrating economic and non-economic values within a unified framework;
2. explicit recognition of the limits to economic valuation—as the ability of economists to measure values has increased, concern has been expressed by philosophers and social scientists about the appropriate boundaries of economic valuation (see, for example, Sagoff (1988) or Brennan (1992));
3. grounding of the valuation approach on a particular theory of value that is informed by both environmental philosophy and economic theory;
4. improving the correspondence between the underlying nature of individuals' values, and they way they are represented and processed in the evaluation procedure; and
5. improving the quality of value advice provided to decision-makers, in terms of both breadth of content and consistency with underlying theoretical constructs (Lockwood 1998c).

To date there has been little work of this kind. Some initial indications of how such an integration might be achieved is provided by the preference mapping work of Peterson and Brown (1998) and Lockwood (1998a). Further basic and applied research is needed if the five benefits identified above are to be realised.

Given the risks involved in SP research, it is also important that alternatives to nonmarket economic approaches are explored. More generally, the scope of, and limits to, the economic contribution to environmental decisions is a matter of some contention, and a potentially fruitful area of research. LWRRDC has apparently recognised this through its support in the 1998–99 grant round of a project examining the potential of citizens juries for assisting with resolution of environmental conflicts. Threshold-based alternatives, such as the safe minimum standard approach (see Berrens *et al*. (1998) for a recent application), are also worthy of further exploration.

Exploring alternatives to economic approaches is of particular importance where essential biological functions or intrinsic natural values are threatened (as may be the case if rising salinity threatens complete breakdown of ecosystems, or a species is threatened with extinction due to vegetation clearance). The performance of economic methods also needs to be compared with other approaches such as MCA with respect to:

- their theoretical soundness;
- the validity of the data they produce;
- the nature of advice they provide;
- their acceptability to stakeholders within particular institutional contexts;
- their cost; and
- their technical demands.

5.6 Opportunities for LWRRDC to address environmental economic R&D needs

LWRRDC is the only RDC with a broad national mandate to address sustainability issues with respect to the natural resource base that underpins rural Australia. As part of this mandate, LWRRDC has taken an important national role in planning and funding environmental economic R&D. As noted in Section 5.3, LWRRDC has already supported a diverse portfolio of environmental economic work, and is continuing to attract applications for environmental economic and related research. There is a need to maintain this research activity in market and nonmarket values; market formation and information requirements; negative externalities; technology assessment; incentives for public good supply; and landholder decision behaviour.

This domain differentiates LWRRDC's role in economic research from other rural R&D corporations and ABARE, that are more concerned with economic aspects of rural structural adjustment, and assessment of technologies regardless of their potential contribution to solving NRM issues.

The authors of a recent international review of research trends and opportunities in environmental and natural resource economics expect that SP research will 'remain vigorous, primarily in the testing of basic assumptions and reconciliation of existing inconsistencies' (Deacon *et al*. 1998: 383). LWRRDC has already made a contribution to development of SP methods, and further support for this area of research is warranted. The tools and institutional processes for establishing rational and equitable cost sharing, together with effective accountability for public investment, are still lacking. LWRRDC's funding has been an important element in developing the international standing of Australian SP research, particularly since this area is receiving little support from State NRM agencies, the Australian Research Council, or other funding bodies.

On the basis of the preceding, the following briefly summarises a number of research undertakings consistent with the discussion in this paper. These suggestions are illustrative of the types of R&D possible. Several of these topics require integration of economics with expertise from other social sciences, in particular psychology and sociology. The importance of interdisciplinary research is discussed elsewhere in this report.

Research possibilities

- Methodological SP research, building on the work of Jeff Bennett's team and others, that attempts to effectively locate the particular issue of interest within the wider policy agenda.
- Methodological SP research to further close the gap between stated and revealed value expressions. This is crucial to convince sceptics of the credibility of SP survey work.
- Development of a decision process model that can be used to understand and predict individuals' decision behaviour in NRM contexts. This will require collaboration between psychologists and economists.
- Systematic appraisal of the key factors that drive stakeholders' decisions, and the levers that may be most effective in changing behaviour.

- Measurement of the nonmarket external costs imposed by current and alternative land management practices. This will require further collaboration between biophysical modellers and economists.
- Measurement of the administration, management, and structural adjustment costs associated with implementation of economic instruments such as RNV conservation incentives.
- Determination of the institutional barriers to adoption of cost-sharing principles, including the capabilities and responsibilities of regional catchment management organisations.
- Development of principles for the design of valuation studies such that transferability across scales, populations and sites is taken into account.
- Development of integrated value methodologies that can address both economic and non-economic value expressions.
- Comparative testing of alternatives to nonmarket economic approaches.
- Determination of appropriate procedures for scoring alternatives and weighting criteria in MCA. At present the legitimacy of many of the procedures used to develop MCA analyses is uncertain.
- Comparisons of the performance of BCA with other approaches such as MCA with respect to theoretical soundness, quality and applicability of the advice they produce, acceptability to stakeholders, cost and technical demands.

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Commentary on economic R&D paper

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I support and commend the Lockwood paper with the suggestion that it be expanded to include discussion of the implications of the Arrow *et al.* (1993) NOAA Panel Report for the status of, and research into, stated preference methodologies.

My emphasis is somewhat different to that of Michael. If anything, it is rather neo-institutional and pays more attention to common property problems and institutions for their management.

The portfolio of R&D LWRRDC is contemplating carries political risks because it: explicitly addresses values, generates policy advice, and addresses the establishment of institutions for solving resource problems.

My comments are restricted to four areas. They are:

- the socio-economic assessment of policy;
- common property management, partnership and cost sharing;
- public administration of natural resources; and
- the role of social science in solving resource problems.

1. The economic assessment of policy: Economics enables assessment of the efficiency and distributional effects of policy. By and large the methodologies are well established and understood, as too are their weaknesses.

Government is becoming increasingly interested in assessing the socio-economic impacts of policy. If such assessments are to be comprehensive, limited resources mean that simplicity should be emphasised and that complex and expensive procedures avoided unless their use is compelling.

As well as the need for economic considerations to be built into most applied research, research is also needed into how economics can be used to best effect in assessing policy impacts (but with particular regard to the assessment of unpriced phenomena) and in the planning of resource management in general. In this respect, the strong complementarity in such work between economics and those other branches of social science discussed in the paper by Helen Ross needs to be appreciated. This is particularly strong when distributional impacts are being assessed.

2. Common property management: Deficiencies in common property governance underlie many of our resource management problems. There is considerable scope for research into specific and generic problems of this nature (eg. alternative institutional structures for managing the Liverpool Plains [a specific example], TCM as a problem in common property management [a generic example]). By their nature, problems of cost sharing arise; while, as the Land and Water Management Plans in NSW illustrate, the empowerment of common property management entities can be achieved through the use of contractual and licensing procedures. An array of economic, planning and regulatory instruments appropriate to this area awaits development and evaluation in generic and specific contexts. Virtually the full gamut of the social sciences is relevant to such research.

3. The public administration of natural resources: Public sector responsibilities in resource management can be grouped into five categories:

- the setting of standards for the condition of the resource;
- the stewardship of the resource to ensure that the standards are met (monitoring of condition, regulation of use);
- the provision of commercial services;
- monitoring; and
- auditing.

These functions are discussed further in the attachment to these notes. Research is needed into the organisation of the public sector to ensure the efficient and effective performance of these functions.

4. Social science in the solution of resource problems: The dictates of good management indicate that resource management should be conducted, at least implicitly, within the following framework:

- problem definition;
- objective setting;
- strategy identification;

- strategy evaluation;
- strategy selection;
- strategy implementation; and
- monitoring and evaluation.

The significance of this framework for research policy is that values are involved throughout. This calls for the involvement of the social sciences in research planning and implementation from the outset, not as a concluding step. The implications of this for research management are considerable.

Attachment

1. Standard setting—This is the determination of the desired balance of outcomes of water use from the viewpoint of society as a whole. This would include the specification of invariant standards (eg. for public health), or the determination of mechanisms (including markets, regulation and arbitration), through the operation of which socially desirable outcomes will be achieved. Standard setting must be the responsibility of government and is an adaptive process which responds to improvements in knowledge and changes in values.
2. Resource stewardship—This is the oversight of the resource to ensure that the standards are met and that the integrity of the resource is maintained. It involves the monitoring of the condition of the resource, the identification of options for consideration by the standard setter and the generation, through research, of new knowledge about the resource. The 'product' of the services of the resource steward is a public good which the private sector would not produce in optimal quantities, and so the function should be performed by the public sector. This does not, of course, deny the possibility of operations within the function being contracted out to private entities.

   The responsibilities of the resource steward also include control of access through licensing, the definition of rules and property rights to implement the standards set by government on the advice of the standard setter, and the enforcement of those rules and rights.
3. Provision of commercial services—This is the provision of market-based services for the active or passive use of water (urban, irrigation, recreation, navigation, pollution disposal) within the framework of rules and rights defined by the resource steward. The identification of non-attenuated rights structures enabling the creation of efficient markets is an important role of the standard setter. In the absence of such structures (because of lack of knowledge, high transaction costs or other causes of market failure) relevant service provision will become the responsibility of the steward. This creates a 'grey area' between the steward and the commercial service providers which blurs the distinction between them. It also calls for the creation by the steward of structures which minimise the risk of 'capture' by the consumers of the service in question.

   Commercial service providers could be in the public or private sector, with the latter expected to be more efficient in their provision. Regardless of the sector within which they might be located, the supervision of the regulators of commercial operations may be relevant to their operation.
4. Monitoring—This consists of the monitoring of the state of the resource by a state entity (probably the steward) with contracts to private and public sector bodies (mainly for measurement purposes) as is considered appropriate.
5. Auditing—This function is to assess the extent to which the outcomes set by government (the standards) have been achieved. Desirably it should be undertaken by the standard setter or some other body separate from the steward. Difficulty in measuring outcomes may mean that processes are audited rather than outcomes.

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6. Legal Research for Natural Resource Management

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Summary

In defining an appropriate role for legal research in the possible expansion of LWRRDC's research portfolio beyond the biophysical context, it is important to distinguish between research traditionally carried out by lawyers and research about law and legal processes.

Core research skills of lawyers have traditionally been perceived to involve the discovery and explication of law (what the law 'is'), particularly in areas where there are large elements of uncertainty because the law (the common law) is built on case-by-case decision-making by courts (precedent), rather than being set out in legislation enacted by Parliament. In areas of law dominated by legislation, with little case law, such as natural resources/ environmental law, these skills lend themselves in particular to research such as analyses of the division of legislative powers between State and Commonwealth Parliaments under the Australian Constitution, and detailed explications of the interrelationships between multiple interacting regulatory systems, which have resulted from the historical legacy of a culture of segmented resource management.

However, a full evaluation of the efficacy of natural resources/environmental law in a particular context requires the researcher to go beyond a description and analysis of the law in the books and to assess the law and legal processes as they operate in practice. This is particularly true of natural resources/environmental law, which is primarily procedural in character, setting up government instrumentalities and giving them powers to carry out broad strategic planning exercises, to make discretionary decisions in relation to specific development proposals and to intervene in specific contexts.

Some legal researchers, who have reacted against the traditional approach to legal research, and have advocated the study of law in context, or law in society, have taken up this challenge. They have focused on identifying gaps between the law in theory and the law in practice, employing theoretical and empirical material and, in some cases, research methods derived from the social sciences. While the identification of gaps between the law in the books and the law as it is implemented in practice may lead to demands that the practice should be brought into line, it can equally lead to conclusions that regulatory failure is a failure of regulation, or, at least the specific form taken by particular regulation, rather than a failure of the regulators. This has led to a broader interest in alternatives to legal policy instruments, including economic instruments.

While some lawyers have equipped themselves with the necessary skills, and carried out empirical research on such issues as the strategies employed by law enforcement agencies, and broader issues of self-regulation/co-regulation, a wider range of empirical research about the operation of legal processes is needed in the land and water conservation context. This includes research on the approaches taken by public decision-makers, including local councils, to making decisions on licences and other approvals, particularly in the context of requirements relating to ecologically sustainable development; research on community attitudes to regulation and regulatory agencies; and research on relationships between multiple interacting land use planning processes.

Examples discussed suggest that there are quite unrealistic expectations on the part of funding agencies about the time and resources needed to carry out research about law and legal processes which goes beyond a desktop analysis. Investigating the implementation of the law in practice is as expensive and time-consuming as other social research. These examples also reveal the need to carefully match researchers to the research task required of them. While there are instances where lawyers, operating within the traditional paradigm of legal research, can carry out projects on their own, where a project involves an evaluation of the law and legal processes, the lawyer's contribution should ordinarily be as a member of an interdisciplinary team with a broad range of social research skills. In this context, the lawyer can play an important role in defining the contours of the project from the outset, and in teasing out possible policy implications further down the track.

6.1 Introduction

LWRRDC has limited experience of research carried out by lawyers, and research carried out by others about the law. Our review found that LWRRDC had funded only a small number of projects identifiable as directly raising legal issues:

- M.D. Young, *Opportunities for the use of incentive payments to conserve remnant vegetation*, which is designed to develop and communicate a number of specific proposals to encourage the conservation of remnant vegetation, some of which would require amendments to existing tax and rating legislation;
- P.R. Day, *Model native vegetation legislation and policies*, which reviews existing legislation relating to the conservation of native vegetation throughout the Australian States and suggests amendments to the law (Slee and associates 1997);
- J. McKay, *Do water trade policies achieve environmental and socio-economic goals?*, which evaluates the impact in the community of tradeable water entitlements;
- Careers Unlimited, *Investigating legislation re riparian management*, which summarises the legislation of each State and Territory impacting on riparian land management
- R. Ledgar, *A review of land management legislation relevant to Australian rangelands* (Ledgar 1994).
- W. Erskine and M. Sant, *National framework for the management of Australian estuaries*, one of the objectives of which is to assess the estuary management process in Australia, and this includes the fragmented legislative regimes.
- J. McKay and H. Bjornlund, *Sustainability with profitability: rural adjustment via water markets*, which includes an examination of existing legislation underpinning water markets, to identify barriers to the achievement of efficient, ecologically sustainable and equitable water markets.

A number of other projects could potentially involve legal issues, but these are not specifically raised for investigation. For example, Warren Musgrave's *Evaluation of transferability of water entitlements in Australia* might conceivably look at the impact of legal barriers to transferability.

Given LWRRDC's limited experience in funding research by lawyers and research about law and legal processes, it is important to begin by looking at some of the key characteristics of research traditionally carried out by lawyers, and the new directions taken in recent years. We also need to explore the precise nature of natural resources/environmental law to identify the primary issues from a lawyer's perspective. Following this we can begin to look more generally at the sorts of research which can be done about environmental and natural resources law, and what skills are needed to carry out this research.

As a discipline, law has been characterised since the 1960s by a ferment over the precise nature of legal scholarship, legal research, and the limits of legal expertise. A number of legal academics reacted to what they referred to as 'black-letter law' or the 'expository tradition' (Twining 1995; Parker 1998) although the seeds of discontent had been sewn long before this (Hunt 1978). A significant feature of academic legal research in recent years has been the testing of traditional disciplinary boundaries. Larger firms of legal practitioners have also diversified into non-traditional areas, including the development of compliance strategies for industry and consultancy law reform work.

6.2 Core expertise of the lawyer

Courts and lawyers have long defined their task in terms of the interpretation and application of law rather than law-making. The formal position was that law-making was the function of Parliaments, and in this context lawyers viewed themselves as technicians, taking detailed drafting instructions from policy-makers, and translating them into legally acceptable language and statutory form.

Core legal skills have traditionally been perceived to involve the discovery and explication of law (what the law 'is'), particularly in areas where there are large elements of uncertainty because the law (the common law) is built on case-by-case decision-making by courts (precedent), rather than being set out in legislation enacted by Parliament. Under the strict expository tradition, critique of law focuses on judicial failure 'correctly' to interpret earlier decisions, or to follow broad legal principles developed by the courts themselves. This tradition contemplates that the law will gradually evolve through the application of existing legal principles to new instances, but until around 50 years ago, it maintained the fiction that courts do not make law. It insisted that, with the advent of parliamentary democracy, the courts were not the appropriate forum for debates about policy. Yet, inevitably, law is changed by the courts on an incremental basis, and in some instances there have been quite dramatic shifts in legal doctrine, in the absence of any transparent policy debate.

What was referred to as 'law reform' was assigned from the 1960s (1966 in NSW) to government-

appointed standing law reform commissions, comprised almost exclusively of lawyers, which depended on specific references from government. Although it is difficult to make generalisations, in the early stage of their development, these bodies tended to deal with matters perceived as narrow, technical legal issues, of interest primarily to lawyers, (for example, in NSW, the simplification and modernisation of Supreme Court procedure and the fusion of law and equity; law and procedure in personal injury actions) (NSW Law Reform Commission 1991).

This traditional model of legal expertise is the one practised by barristers, not only when making arguments before appeal courts, but when providing advice to clients, including governments, in relation to areas of legal uncertainty. This tradition continues to underpin much of legal education. However, it has little in common with the day-to-day practice of law by solicitors and the lower courts. It focuses on law as analysed in the appeal courts, not such things as conveyancing practice, the practical resolution of disputes resulting from family breakdown, the development of compliance strategies for industry, or pleas in mitigation of sentence, which are the day-to-day work of many legal practitioners.

6.3 Law in context

The initial reaction from legal academics dissatisfied with the expository tradition was to argue that law needed to be taught and studied in its social and economic context, the so-called 'law in context' or 'law in society' approach or, in a slightly narrower form, socio-legal studies (Cranston 1995). This was flexible enough to accommodate a wide range of perspectives. The unifying features were an interest in the historical and socio-economic origins and development of legal doctrine and the impact of law and legal processes in the community, as distinct from the law as it appeared in legal texts (case law and legislation). This inevitably led to legal academics drawing on the theoretical perspectives and empirical material of other disciplines, such as sociology, economics, history, psychology and political science, with a view to enhancing their understanding of law. Some became magpies. Others took the further step of borrowing research methodologies from these other disciplines, and engaging in empirical research themselves. Much of the early empirical work focused on the enforcement practices of the police and other agencies, the extent to which there were unmet needs for legal services in the community, and accident compensation.

The law in context or socio-legal studies movement was attacked from two sides. It was viewed with considerable suspicion from those who worked within the traditional legal paradigm. There were accusations that it was really sociology, not law. On the other hand, the focus on gathering empirical material about how legal mechanisms operate in practice and using this as a basis for law reform proposals was attacked as theoretical by those arguing for the development of a sociology of law, as distinct from socio-legal studies. The literature is reviewed by Hutter and Lloyd Bostock (1997). They argue that there is no demarcation between theoretical and empirical research as the latter must necessarily rely on middle-range theories, and that it is unrealistic for those conducting social scientific research to attempt to dissociate themselves from policy concerns.

Parker (1998) has discussed a number of attempts to develop classifications of legal research. For example, in Australia, the 1987 CTEC discipline assessment of Australian Law Schools (Pearce Report) categorised it as doctrinal, reform-orientated or theoretical, estimating that the bulk of it fell into the doctrinal category, ie. within the expository tradition. This report assumes a distinction between doctrinal research within law and research about the law from 'outside' the core discipline, but the 'critical legal studies' movement, which emerged in the late 1970s attempted to bridge this gap (Hunt 1993). Parker (1998) concludes:

> The insider/outsider (or subject/object) distinction is no longer seen as helpful, cordoning law off from other disciplines is problematic, and the nature of expository analysis… might have been understated.

The wide gaps which frequently became apparent between the law in theory and the law in practice inevitably led those approaching legal research from a law-in-context perspective to consideration of law reform. Law reform is now increasingly seen to be an aspect of policy development, particularly in newer areas of statutory law, such as environmental law and family law, but from the lawyer's perspective, law reform has generally rested on the assumption that legal responses are central to the resolution of social problems. More recently, however, some legal sceptics have begun to emphasise the limits of legal instruments in achieving behavioural change, and have begun to investigate the alternatives, particularly economic instruments as potential alternatives to legal regulation.

While lawyers do not have any particular expertise in policy development, they can legitimately lay claim to some understanding of the potential and limitations of law and legal processes as instruments for achieving policy objectives. However, the fundamental issue of the role legal regulation, as distinct from other policy instruments, can play in influencing social behaviour, demands the use of

research techniques which go considerably beyond those possessed by lawyers.

The audience to which the emerging body of empirical material on the law in practice has been addressed has been government, as a potential initiator of reforming legislation, rather than the courts. Although some members of the High Court of Australia, which is not bound to follow its own decisions, are now prepared to admit that the Court makes law, at least by filling gaps which Parliament has not had time to fill, they recognise the constraints which case-by-case decision-making, initiated by individual litigants, places on the Court's effectiveness in terms of defining the precise contours of problems and policy development (McHugh 1998).

Law reform commissions, on the other hand, as adjuncts to the legislative process, have had the flexibility to evolve into more effective mechanisms for policy development, by broadening their skills base beyond legal expertise (including, on occasions, the appointment of non-lawyer commissioners for particular references), commissioning empirical research about law and legal processes and opening up law reform processes to community input through submissions and public hearings. The NSW Law Reform Commission, for example, has commissioned public opinion surveys, used focus groups and carried out statistical analyses. Although it is currently comprised exclusively of lawyers, with a majority of judges, it obtains input on specific references from consultants and reference groups. However, although it has had references covering fundamental social issues (including in-vitro fertilisation, de facto relationships and accident compensation), it has had only one reference in the area of natural resources/ environmental law, on environmental enforcement. After a number of years, this has still not been completed, and is currently in abeyance. Rather than give references in the area of natural resources/ environmental law to law reform commissions, government departments are using legal consultants, sometimes as part of interdisciplinary teams, as one of a number of inputs into the policy development process. For example, the NSW Department of Land and Water Conservation has recently issued a consultancy "to examine the current legal and administrative arrangements and market mechanisms in relation to water transfers and trading; develop options for improving their efficiencies and effectiveness; evaluate these options and make recommendations for changes which will facilitate water trading".

6.4 Distinctive features of natural resources and environmental law

Environmental and natural resources law in Australia is now found almost exclusively in legislation, primarily State legislation. Where the common law had something to say about rights to natural resources, this has generally been replaced by legislation, eg. the abandonment in Australia of the common law doctrine of riparian rights to water in favour of a system of administrative allocation. The significant exception to this is the common law doctrine of nuisance, which allows primarily civil, rather than criminal, proceedings to be brought to restrain polluting activity or obtain compensation for damage caused. Even this has been rendered largely irrelevant in practice by statutory regulation through licences, orders and criminal prosecution.

In practice, case law interpreting natural resources legislation, such as water and mining legislation, is very sparse. For several reasons, including absence of a conservation presence in rural areas and reliance on tribunals, such as land boards, rather than courts, to deal with disputes, it has not been subject to close judicial scrutiny.

Legislation dealing with natural resources and environmental issues rarely conveys substantive legal rights. Its primary concern is with procedural rather than substantive justice. At a constitutional level, there is no equivalent of the fundamental environmental rights, supervised by the courts, found in some constitutions (eg. the Colombian Constitution). At least until recently there has been no suggestion that the Australian High Court would use the provision in the Australian Constitution which requires that acquisition of property by the Commonwealth Government be on just terms (section 51(xxxi)), to require the payment of compensation where mere restrictions are imposed on private land use, as has occurred in the United States under the Fifth Amendment to the U.S. Constitution ("nor shall private property be taken for public use without just compensation"). As a result, the role of the courts in interpreting fundamental freedoms is very limited. There are no property rights in water, defined and protected by the courts, as there are in some States of the USA. Nor are there many guarantees of environmental quality, in the form of absolute prohibitions against harmful activity, or generally applicable standards.

Rather, Australian legislation in this area constitutes organisations (eg. Ministerial corporations, public authorities, local councils), sets the broad parameters within which these organisations must work by

specifying objects and decision-making considerations, which increasingly incorporate ecologically sustainable development, and gives them powers to make discretionary decisions in relation to specific development proposals or to intervene in relation to specific circumstances. This includes procedures for assessing the environmental impact of proposals and ensuring that this is taken into consideration in decisions, as well as procedures for community consultation. Some legislation may also include formal procedures for planning at a strategic level, in order to set the broad parameters in which decisions on specific proposals will be made (eg. environmental planning instruments).

The courts restrict themselves to policing compliance with these procedures (judicial review of administrative action) rather than assessing the merits of the decisions themselves (merit review), unless legislation specifically invites them to assess the merits . There is nothing in legislation that allows the courts to intervene on the grounds that decisions made under these procedures are not ecologically sustainable. Provided that decision-makers *take into account* the factors that legislation requires them to take into account, including ESD principles, environmental impact statements and public comment where these are specified in legislation, the courts will leave it to the particular decision-maker to decide how much weight should be given to competing factors. While the ideology of ESD requires the *integration* of environmental and economic factors, the current approach of the courts would tolerate decisions reflecting a developmental imperative which pay little more than lip-service to environmental constraints. There is anecdotal evidence that this is happening in practice (Kelly and Farrier 1996), but this would not be documented in case law.

6.5 Research by lawyers

Explicating the law

What role can legal researchers be expected to play in the development of a LWRRDC socio-economic R&D portfolio? In the first place, there is a role for what have been identified as the core legal skills of interpretation and explication. Legal issues may, for example, arise as to the legal powers under existing law of government bodies/courts to take policy initiatives indicated by biophysical or socio-economic research. For example, as research by economists provides data relating to non-market valuations, questions may arise about admissibility in evidence before the courts (eg. in determining whether a proposal is likely to "significantly affect the environment", such as to require the preparation of an environmental impact statement). At one level, this is a pure question of existing law, although analysis of the existing position may give rise to proposals for reform.

In addition to its role in constituting regulation, law has a crucial role in setting up organisations and defining the limits of their operation. Increasingly, we are seeing the incorporation of broad policy statements into legislation in the form of objects clauses, and even strategies. Traditional legal analysis and explication has a role in assessing the significance of these developments for organisations (Rohde 1995).

Lawyers may also be called upon to carry out desktop analyses of the likely implications of recent or proposed legal initiatives. A recurrent question, requiring careful analysis of relevant decisions of the High Court, relates to the powers of the Commonwealth Government under the Australian Constitution to enact environmental/natural resources legislation (Crawford 1991, 1992). This has, however, become increasingly theoretical as successive Commonwealth Governments have made it clear that they see the Commonwealth's role as being a limited one. In this connection, recent complex proposals by the Commonwealth Government to revamp Commonwealth environmental legislation, and arguably to further restrict its role, required careful scrutiny by lawyers to explain the full ramifications of the proposed division of responsibility between the States and the Commonwealth.

A more fundamental question relates to whether the Australian Constitution should be amended to incorporate guarantees of fundamental rights, such as the right to an ecologically sustainable environment. It would then be for the courts, rather than the Parliament, to define the ambit of such rights. Comparative legal analysis might explore the approaches taken by the courts in jurisdictions which have constitutions that do incorporate such provisions.

If Australia becomes a party to an international convention, it has obligations under international law to implement its provisions. If the convention envisages implementation through legislation, this raises questions about whether existing domestic legislation is adequate, and, if not, whether new legislation is required. A possible project here might examine whether Australia has international obligations to apply the precautionary principle in decision-making processes, the extent to which it has been taken up in State natural resources/ environmental legislation, and how it has been applied by the courts. Farrier and Tucker (1998) have explored the extent to which private land has been

incorporated in internationally listed nature conservation areas in Australia, and the adequacy of management arrangements which have been put in place. However, a good deal of legal analysis of international conventions treats them as an end in themselves, and fails to bridge the gap between international and domestic law.

More generally, legal skills are needed to explicate the interrelationship between multiple interacting regulatory systems applying to particular activity. The law is frequently complex. This is not an inherent feature of the regulatory process, but principally the historical legacy of a culture of segmented resource management. In New South Wales, major legislation, introduced in 1979, which took a holistic view of the environment, did not subsume older legislation, based on a paradigm of segmented resource development (eg. *Water Act 1912*, *Forestry Act 1915*, *Mining Act 1973*), but was superimposed on it. This has led to an extremely complex web of regulation, with different histories and different objectives. This complexity has been reinforced by segmented, but intersecting, institutional arrangements in which agencies have overlapping jurisdictions, producing turf wars over which agency should have legislative responsibility for a particular sector. A proposal to open a mine, for example, could require:

- a mining lease from the Department of Mineral Resources;
- an environment protection (pollution) licence from the Environment Protection Authority;
- development consent from the local council or the Department of Urban Affairs and Planning, which may require the concurrence of the National Parks and Wildlife Service if threatened species are likely to be significantly affected;
- a licence to extract water from the Department of Land and Water Conservation; and
- a consent to clear native vegetation from the Department of Land and Water Conservation.

The fact that all of these agencies now have overarching responsibilities to take broad environmental considerations into account in their decision-making processes, necessarily leads to overlapping responsibilities and contrived attempts at demarcation.

In this complex scenario, the precise regulatory status of an activity may be quite unclear. For example, the precise legal status of forestry on private land becomes apparent only after careful analysis of a number of pieces of legislation (ESFM Expert Working Group 1998).

There is a wide variety of legislation concerned with the conservation of biological diversity, enacted at various periods, based on assumptions of the time about the shape and place of nature, which may or may not be sympathetic to the conservation of biological diversity. The interactions and overlaps between these different pieces of legislation at a purely formal level are technically complex.

Ledgar's survey of land management legislation relating to Australian rangelands does not reflect the painstaking work which is required to bring out the complex interactions between different pieces of legislation (Ledgar 1994). It is overly ambitious in trying to cover all of the rangeland States and the Northern Territory, and ends up summarising what are identified as the primary pieces of legislation, with isolated summaries of other relevant legislation set out in an appendix. There is no attempt to bring out the complex interrelationships.

While there is an important role for legal research in teasing out these complex arrangements, pointing to overlaps and gaps, it is important to note its limits. An analysis of the interactions, at a formal level, between different pieces of legislation is a desktop exercise, which may have nothing to say about how the existing arrangements operate in practice. The complexity of the arrangements on paper is assumed to speak for itself.

Evaluating law and legal processes

It is increasingly unlikely, however, that an assessment of legislation as it appears on the statute books, and of the interactions between different pieces of legislation at a purely formal level, will be seen by policy-makers as going far enough. What they are interested in is how successful legislation has been in achieving its objectives.

So, for example, a consultancy recently let to legal researchers by the NSW Biodiversity Advisory Council requires not only a summary of existing legislation as it bears on biodiversity, but also how it "impacts on biodiversity", "how it assists in implementing biodiversity conservation", and "how it directly or indirectly results in the loss of biodiversity". This clearly requires the consultants to go beyond the law in the statute books. But because of the absence of any substantial legal practice in this area, researchers cannot look to the experiences of practising lawyers or the activities of the courts. Even if they could, this would give a distorted picture of the operation of the law, because the cases which come to the attention of lawyers and the courts are atypical. What is needed is a detailed empirical study of the law as it is being implemented in practice, focusing in particular on how local councils are coping with the

significant assessment and regulatory responsibilities that have been thrust upon them. For example, how many species impact statements are being prepared, and what is the quality of the scientific input? How adequately are councils coping with the implementation of development controls relating to 'ecological communities', the boundaries of which are uncertain and mobile? Questions such as these are not simply 'legal' questions. Adequate answers require empirical research and scientific input. At a micro-level, for example, we could envisage a PhD project that would monitor populations of endangered species of protected plants likely to be affected by proposed development, and assess the adequacy of conditions attached to development approvals (eg. relocation, pollination corridors) in ensuring their long-term survival by monitoring the impact of the development (Brown 1998). The budget for the consultancy simply does not allow for research of this kind.

Difficulties in assessing the impact of particular legal strategies are magnified where researchers are expected to canvass alternative legal models derived from other jurisdictions. Under a recent invitation to tender from LWRRDC under the River Restoration and Management Program, the project (*Analysis of legislative frameworks for river restoration and management*) is required to:

> summarise and describe the legislative framework, as well as outline the legal obligations that exist in each State in relation to river management; this would include the Commonwealth legislation, and perhaps a sample of local government regulations. The study would also examine how the legislative framework in each State and Territory has been interpreted and operationalised, hence providing 'real life' information about the impact of legislation upon river restoration and management activities. …Based on this information, analysis and determination of legislative benchmarks for river restoration activities would be an important outcome of the project. The benchmarking component of the study may also consider the impact of applying some international legislative models to the Australian context.

This project demands not only a detailed desktop analysis of complex legislative arrangements within nine Australian jurisdictions, including a sample of diverse local government regulations, but also requires *evaluation* of the operation of these arrangements in practice. Ledgar's brief from LWRRDC required him not only to review rangelands legislation, but also "to provide an overview of how it operates and what gaps or weaknesses exist" (Ledgar 1994).

A desktop analysis of a wide range of different, interacting pieces of legislation, done properly, is in itself daunting. The reality is that, given the quantity and complexity of the law involved, Australian legal researchers focusing on environmental/natural resources law generally develop expertise in relation to particular State jurisdictions. Comparisons will rarely involve canvassing the law of each and every Australian jurisdiction, but will rather highlight path-breaking initiatives which have been taken in particular jurisdictions.

Apart from this, however, legislation as it appears on the statute books is likely to tell us very little about what is happening on the ground. If it is old legislation, it may be positively misleading. This would certainly be the case, for example, with legislation such as the *Water Act 1912* in NSW. Fisher (1995) gives a detailed analysis of water legislation in the States and Territories which is substantially confined to the legal texts.

The usual approach taken by legal researchers in these circumstances is based on qualitative interviewing of those charged with the task of administering particular pieces of legislation with a view to describing and evaluating the operation of the legislation in practice. A number of appraisals of the New Zealand Resource Management Act have been carried out by lawyers and others, based on short study trips and interviews (eg. Department of Land and Water Conservation 1998). Time constraints will generally mean that those interviewed will be managers rather than those working on the ground, but there are serious questions about the reliability of information derived from those who have a direct interest in presenting the system as working effectively. Interviewing a wider range of stakeholders within each jurisdiction is likely to produce conflicting versions of what is actually happening in practice. Material derived from interviews must therefore be cross-checked against primary documentation where this is available, and through direct observation. In the case of the LWRRDC tender discussed above, there should ideally be a number of case studies in particular catchments, focusing particularly on those jurisdictions perceived to have adopted innovative approaches. However, the maximum budget of $50,000, and, more significantly, the time limit of eight months, simply does not allow for this.

What skills can lawyers claim to have to carry out empirical research of this kind? Forensic skills, acquired through practical experience, have traditionally been regarded as a major component of the tool kit of legal practitioners. They are skilled in sifting through large bodies of information, including scientific information and the community has traditionally turned to practising barristers to head up inquiries to determine facts. Such skills will not,

however, have necessarily been acquired by academic legal researchers who come from the expository tradition in law. Legal education has not traditionally concerned itself with the development of interviewing skills. This is changing in some law schools with the introduction of client interviewing units into the undergraduate curriculum, but the focus here is on the professional lawyer–client relationship.

There is, however, a small number of legally trained academics who have supplemented their legal skills with postgraduate study, particularly in criminology, and have produced sophisticated studies of the law in action based on participant observation and qualitative interviewing. Initial interest stemmed from the apparent reluctance of enforcement agencies to use the full range of their powers, particularly prosecution. This is explored in more detail in the following section.

Gunningham's leading-edge work on self-regulation in the chemical industry (Gunningham 1995) and more recently on innovative regulatory solutions which foster in firms levels of environmental performance which exceed those required by conventional regulation, moves away from focusing on the rationales underlying strategies pursued by enforcement agencies and explores the perspective and experience of the regulated community. It employs a pragmatic 'hands on' approach to field research, relying on qualitative interviews with corporate executives, professional officers and other staff, identified by snowball sampling, cross-checked against interviews with enforcement agencies and non-government organisations, and supplemented by statistical information where available.

6.6 Research about law and legal processes

Research *about* law and legal processes is potentially much broader than the research which has traditionally been carried out by lawyers. However, not only have most legal researchers in the field of environmental/natural resources law been reluctant to employ the research techniques needed to explore the implementation and impact of law, but social researchers who are very familiar with these techniques have in practice shied away from using them to study legal phenomena in this context.

Law enforcement

The first step in any evaluation of the impact of legislation in the community is to explore the way in which it is implemented on the ground by responsible government agencies. One aim here will be to identify the gap between theory and practice.

Statements in legislation that those who engage in specified activity without having first obtained a licence/approval commit an offence, may not be reflected in commitment of agency resources to detection of those in breach or in prosecution practices. There is a body of empirical research in this area which indicates the apparent reluctance of enforcement agencies to use the full range of their legal powers, particularly prosecution, and the development of their own conceptions of fault and enforcement strategies, based on negotiation, and aimed at gaining compliance rather than focusing on punishment (eg. Richardson *et al.* 1983; Hawkins 1984; Grabosky and Braithwaite 1986; Hutter 1988, 1997). From one perspective, this could be taken to indicate agency 'capture' and 'regulatory failure'. The agencies themselves, however, depict their approach, as a more effective strategy for inducing change in the longer term than a policy of vigorous prosecution.

This begins to raise fundamental questions about the nature of law as an instrument of social control, and the complexity of what economists have labelled 'command and control'. Research, such as Gunningham's ongoing work on regulation (eg. Gunningham 1997, 1998a), is leading to a re-evaluation of the traditional relationship between government agencies and industry as it becomes clear that there are additional participants in the regulatory process, such as commercial third parties, financial institutions and community organisations. His current research on forest management points to the important role played at an international level by the non-governmental Forest Stewardship Council, and suggests that the appropriate role for law may be in accrediting such bodies rather than regulating directly (Gunningham 1998b).

It is now increasingly accepted that environmental agencies simply do not have the resources to police in the traditional manner a broad range of potential offenders in the environmental context. In the pollution control context, for example, there is a heavy emphasis on self-monitoring. It is clear that some legislation is so broad in its potential sweep as to invite the development of a strategic approach to enforcement, as for example, the very broad prohibition of unlicensed water pollution in NSW legislation. This leaves it up to agencies to identify and concentrate limited resources on what they define as the 'real problems', without adequate arrangements for ensuring public accountability. Difficulties can arise where formally illegal practices which were once regarded as relatively benign and tacitly approved by regulatory agencies, are, with increased scientific information, redefined as problems. For example, an amnesty has recently been

granted in NSW to unlicensed, and therefore illegal, dams intercepting water flowing down natural drainage lines. In the past these dams had been administratively exempted from regulation, but with increasing pressure on water resources they are now perceived as a problem which needs to be addressed.

Identification of gaps between theory and practice is crucial to policy evaluation. While, for example, the failure of 'command and control' regulation is taken for granted by many economists, the point can be legitimately made that 'command and control' has simply not been implemented in a convincing way. In other words, it is the regulators, or those responsible for funding them, who have failed, rather than the regulation. Early indications are that there will be equivalent gaps between theory and practice in relation to the introduction of economic instruments, such as tradeable permits. Characterisations of regulation as inflexible, in comparison with the flexibility of economic instruments, fail to recognise the wide variation in types of regulatory instrument, ranging from very specific demands to install particular types of pollution control equipment, at one extreme, to very general requirements to act with 'due diligence' at the other.

However, we should not assume that the identification of gaps between theory and practice will require adjustments to the practice, as, for example, by bringing it into line with an idealised conception of how criminal law should be enforced (detection–prosecution–punishment). It is likely that this research will raise as many questions about the nature of regulation through law—its potential and limits and perverse side-effects—than the failings of enforcement agencies. It is increasingly acknowledged that regulatory failure may well stem from inappropriate use of legal regulation, as distinct from 'capture' of the regulators. Alternatively, an assessment of failure based on, for example, the absence of a vigorous prosecution policy, may be the result of a failure on the part of the evaluator to grasp the fact that regulation is a shorthand expression which encompasses a wide range of policy instruments.

Even more fundamentally, careful analysis of the history of particular pieces of legislation may indicate that vigorous implementation of a particular piece of legislation may never have been intended—that the mere enactment of legislation was a symbolic victory for a particular group.

For the most part, empirical research on enforcement strategies pursued by agencies has focused primarily on the regulation of industrial activity in urban contexts, particularly pollution control. Little work has been done on enforcement practices in rural contexts, although statistics indicate that prosecution is again used very selectively (Farrier 1990). However, ostensibly one-off relationships, such as those between enforcement agency and landholders subject to land-clearing regulations, for example, would appear to be very different to the ongoing interaction which exists between agency and urban industry in the pollution control context. Anecdotal evidence suggests that different factors may be at work in relation to the former: in particular, difficulties in constructing proof beyond a reasonable doubt, combined with agency concern about the message that a failed prosecution will give to the regulated community. Yet the possibility of agency capture cannot be completely dismissed, particularly in situations where agency culture was originally formed in the context of non-regulatory soil conservation initiatives.

It is important, however, to be aware of the limits of regulation. Traditionally, it has been used to restrict particular activities. Where positive action is sought, on the part of landholders for example, regulation seems likely to have inherent limitations. There is a compelling argument that we will have to resort to alternative strategies involving appropriate 'mixes' of legal and other policy instruments (Young *et al*. 1996), perhaps involving stewardship payments for active management of land in the interests of biodiversity conservation (Farrier 1995a, 1995b).

Community attitudes to regulation

It is generally assumed that rural communities are hostile to regulation, as reflected in the public stance taken by farmers' associations to land-clearing controls, and that if legislation is not actively enforced by regulatory agencies, then non-compliance will be the inevitable result. The attitudes of communities to environmental/natural resource regulation have not, however, been explored in any detail. It seems likely that there will at least be support for regulatory initiatives in circumstances where there is immediate self-interest (eg. to protect irrigators' rights of access to water), but tolerance of regulation may extend beyond this, to include, for example, prevention of significant land degradation. There is also a suggestion that the degree of acceptance of regulation may in part depend on the legislative vehicle which is used to introduce it. In NSW, distrust in rural communities of initiatives taken under the *Environmental Planning and Assessment Act* are alleged to have been in part responsible for the enactment of special legislation relating to land clearing—the *Native Vegetation Conservation Act*. If this is the case, it would constitute a significant barrier to the use of the environmental planning legislation as the basis for any integrated resource management initiatives.

In some situations, such as land clearing, regulation may be made palatable if accompanied by some financial recompense, but the precise shape that this takes needs clarifying. So far as clearing controls are concerned, there is an assumption that landholders will be satisfied only if they are compensated for loss in land value, but a range of other instruments, including stewardship payments (Young *et al.* 1996; Farrier 1995a, 1995b), has been proposed, and landholder attitudes to these need testing.

Some very preliminary work has been done in this context by Slee and Associates (1997), with LWRRDC funding. He interviewed by telephone 42 landholders from all major primary producing districts in NSW, SA and Victoria (14 from each State) about their attitudes to land-clearing legislation, including the question of financial recompense. The sample is very small, and there are no details about how it was drawn. It does not appear that it was stratified to canvass possible differences in attitudes, for example, depending on the size of enterprises or whether or not land clearance was a specific issue for the landholder concerned. There is little attempt to capture attitudes to specific strategies (eg. compensation as against stewardship payments), but rather broad open-ended questions about "the legislation which seeks to control clearing in your State", with no attempt to assess the interviewee's understanding of that legislation. Once again, this appears to have been a low-budget project completed over a short time.

Apart from research on landholder attitudes to regulation, there is also a need for research into attitudes to regulatory agencies. Does the fact that an agency with a broad remit for nature conservation, such as the NSW National Parks and Wildlife Service, has regulatory back-up powers give it credibility, or, rather, does the existence of these powers create community hostility, undermining its functions as adviser, educator, advocate and facilitator?

Granting licences and approvals

Another aspect of implementation which has received less attention than enforcement in terms of empirical research is the licensing/approval process. This is intimately related to the issue of law enforcement, because successful applicants who comply with licence conditions are exempted from potential liability. The easier it is to obtain permission in advance on acceptable conditions, the less the temptation to operate outside the law. Raw figures do suggest that very few applications are refused by licensing/approval agencies, and that the main focus in terms of environmental protection is on the conditions attached. This has led to suggestions that, in spite of the rhetoric of ESD, agencies are locked into a 'culture of consent' in which immediate economic gains will consistently be given greater weight in the decision-making process than the threat of uncertain, and cumulative, environmental damage (Kelly and Farrier 1996) . This is particularly likely to be the case where the issue is one of private land use, and the agency has nothing to offer those who are refused approval. Agencies, on the other hand, argue that statistics indicating a large proportion of approvals do not take into account the fact that proposals which are quite unacceptable are discouraged by agencies before formal application.

The suggestion that environmental factors are being given less weight in decision-making processes has significant implications for commitment to ESD, and merits closer scrutiny in terms of empirical research. The claim to 'integrate' environmental and economic considerations in decision-making processes is a key feature of ESD. However, the approach which has traditionally been taken by the courts is that they will not become involved in ensuring that decision-makers give substantial weight to particular considerations. There are significant issues here relating to:

- what role experts play in decision-making processes, particularly at the local government level;
- how scientific uncertainty is dealt with, and, in particular, how the precautionary principle is operationalised where this is mandated by legislation;
- what use is made of cost–benefit analysis in its traditional form, and what attempts are being made to utilise non-market valuation techniques;
- the extent to which decision-makers rely on applicants for information, as distinct from collecting it themselves; and
- the significance of community input into decision-making processes, and the extent to which decision-makers are utilising alternative methods of community participation to the traditional one of exhibition and comment.

Decision-makers are increasingly placing reliance on complex conditions attached to approvals to deliver ESD. Consequently, greater attention needs to be paid to procedures for auditing compliance with conditions, and monitoring for environmental condition, to verify whether what are frequently scientifically contentious requirements (eg. corridors, plant relocation) actually deliver the promised environmental safeguards (Brown 1998). There are opportunities here for collaborative research with

ecologists who are prepared to work in disturbed ecosystems.

Land use planning

The significance of ad hoc approvals processes is reduced to the extent that there is effective land/water use planning. However, as segmented resource-based agency portfolios have expanded to incorporate the broader environmental context, significant overlaps have resulted at this level. Consequently, we have unnecessarily complex arrangements, with different agencies operating within different planning frameworks. In NSW, the range of land use planning instruments includes local environmental plans, regional environmental plans, land and water management plans, catchment plans, regional vegetation management plans and river management plans.

The provisions of plans made according to legally binding procedures, which ensure transparency, may not themselves be legally enforceable, but these two aspects of legal enforceability are frequently confused. In practice, there is considerable variation in terms of the legal status of plans, with the provisions of some plans being legally enforceable, others not legally enforceable, but made in accordance with legally binding procedures, and others made informally. For example, land and water management plans in NSW have no status under legislation, other than in very limited circumstances, although they may theoretically be enforceable through the law of contract. Local environmental plans, on the other hand, have both legally binding provisions, and are made in accordance with legally binding procedures. However, they can be amended to allow development to proceed. This raises the question of whether this is routinely occurring on the fringes of urban areas without adequate attention being paid to the issue of biodiversity conservation.

In some circumstances, complex legislative arrangements exist, spelling out the relationship between different types of land use planning instrument (eg. local environmental plans and regional vegetation management plans). But in other situations there are no such integrating provisions.

There is a place here for basic legal research which explores the relationships between these different planning instruments at a formal level. Beyond this, however, empirical research is needed to explore the interactions in practice both between different planning instruments and different planning bodies. For example, what is the relationship between local councils and catchment management committees, and what will be the relationship in NSW between local councils and regional vegetation committees? To what extent are catchment strategies being integrated into local planning instruments?

6.7 Conclusion

This paper has sought to identify the unique research expertise of the lawyer in explicating and analysing the current state of the law as it appears in the texts, and to provide examples of how this research might contribute to LWRRDC's research portfolio. In practice, however, LWRRDC's primary interest is likely to go beyond the law in the books, requiring research into the implementation and impact of existing legislation, and attitudes towards legislation and possible modifications. This may be only one aspect of much broader studies, comparing the role played by legal instruments in influencing particular behaviour, in comparison with other policy instruments. While legal expertise should play an important role in defining the contours of such projects from the outset, and in teasing out possible policy implications further down the track, this should ordinarily be by way of contribution to an interdisciplinary team with a broad range of social research skills. In this context, it is still important, however, to identify legal researchers who come out of a law-in-context tradition, and, as a result will be sensitive to the methodology and perspectives of other disciplines, have a sense of what can and cannot be achieved through law, and are aware of the potential of other policy instruments.

Several examples have been discussed where researchers have not been appropriately matched to research tasks. There appear to be examples of researchers with limited legal expertise carrying out analyses of legislation, and others of lawyers being funded to carry out what is essentially social research on law. In addition, there appear to be quite unrealistic expectations on the part of funding agencies about the time and resources needed to carry out research on law and legal processes which goes beyond a desktop analysis. Although it is possible to carry out an evaluation of the law in the books from the perspective of coverage, consistency, clarity and compliance with fundamental principles (eg. principles of ESD), a full evaluation inevitably involves investigating the implementation of the law in practice, and this is as expensive and time-consuming as other social research.

What LWRRDC is likely to find, however, is a distinct shortage of lawyers with the breadth of vision and commitment required to grapple with the complex relationship between biophysical problems and socio-political solutions, and the willingness to work as part of an interdisciplinary team. For the longer term, therefore, LWRRDC should be prepared

to make a significant investment in interdisciplinary postgraduate research. Undergraduate law students already graduate with joint degrees, which may include degrees in the natural and social sciences, but there is only a very limited tradition of postgraduate research in law faculties, and very little of this makes use of students' multidisciplinary backgrounds. On the other hand, there is evidence of an increasing interest among postgraduate students in environmental science in the intersection between biophysical research and environmental/natural resources policy, leading to cross-disciplinary supervision at the doctoral level (eg. Brown 1998). One approach would be to seek to better equip these students with a broader range of skills which would encourage them to refocus their scientific research so as to explore broader legal/policy implications. This could be done by way of a short bridging program before commencement of doctoral studies.

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Commentary on legal R&D paper

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I generally agree with the position taken by David Farrier in his paper, which is fair, balanced and comprehensive.

What can a lawyer contribute to LWRRDC's R&D program? The traditional role of the lawyer (academic or practitioner) is interpretation and explication. These are significant roles as regards natural resources management (NRM). For although the common law plays very little role in this area, statute law abounds. And as regards many NRM issues (eg. biodiversity) there is a large number of different statutes, often with undesirable and substantial overlap, often with different statutes pursuing different approaches and embodying different philosophies, often bringing about conflict/turf wars between different agencies, and tensions between different levels of government. Just identifying what the different laws are, what the conflicts, tensions and ambiguities are, is a significant contribution and a necessary building block for other types of research.

Similarly, traditional legal research could make a number of other contributions to NRM in terms of explication and interpretation. For example, in terms of the precautionary principle, what is the position in terms of international law, what treaties has Australia signed incorporating the principle and what are the implications in terms of domestic law, has the principle been included in domestic statutes and, if so, how has it been interpreted by the courts?

However a limitation of traditional legal research of this nature is that it is relatively unambitious in terms of LWRRDC's policy agenda and, more particularly, it addresses only the 'law in books' and not the 'law in action'. There is often a massive gap between the two as regards NRM. For example, there is often serious implementation failure, internal inconsistencies which may mean laws are incapable of effective enforcement, or perverse side-effects (eg. when a regulation provides that from a stated future date, all clearing is banned, with the result that panic clearing takes place before that date).

To overcome this problem it is necessary for lawyers to take a broader role, either taking account of existing empirical research in making policy recommendations as to how law reform is likely to actually work, or (in terms of a genuine research contribution) engaging in their own empirical research eg. interviews with stakeholders, combining qualitative and qualitative research methods, underpinning this work with some broader middle range theory (as in the development of grounded theory).

This is a tall order and only a modest amount of research of this nature is currently conducted in Australia in the NRM area—in part because research funds have not been accessible (eg. LWRRDC has not, as far as I am aware, ever funded research of this nature, which in turn means that potential applicants are unlikely to waste time on applications they anticipate would be unsuccessful). But it also reflects that there are only a few law-based researchers qualified to engage in this type of research (what Farrier classified as 'law in context' and which others would call 'law in society' or 'socio-legal studies'). It is also the case that such research will substantially overlap with areas of social science other than law

(eg. economics, sociology, political science, public policy etc) and that in terms of larger, more ambitious projects, the ideal may be interdisciplinary research involving not just 'law in context' type lawyers and legal research but also collaboration with other social scientists in other disciplines as appropriate.

The lawyer's contribution to such research is essentially in asking: what is the functioning/ effectiveness of both the law and its implementation, how do people behave in relation to the law, and what are the social consequences of the law in operation? It also embraces the examination of law related regulatory instruments as tools for environmental sustainability. This means not just command and control but also process-based approaches (eg. the use of environmental management systems in agriculture and the extent to which this requirement might be included in regulation), the roles of self and co-regulation, and equally important, the enormous potential of regulatory pluralism, invoking and harnessing both commercial and non-commercial third parties in informal and sometimes formal social control, eg. the impact of the Forest Stewardship Council in bringing pressure for sustainable forestry—here the role of law may be in facilitating, encouraging and underpinning private efforts rather than mandating behaviour change amongst landholders, but researchers have yet to engage with the implications of legal pluralism or its relationship to conventional forms of regulation.

In terms of LWRRDC's future research agenda, I believe all the above factors lead to three conclusions. First, there is a continuing role for traditional legal research (explication and interpretation) but this is a relatively modest and unambitious one given LWRRDC objectives in the social science area.

Second, there is a more important role for broader based, law in action/law in context type research. The most important contributions are likely to come from empirical work and some of this is likely to yield the greatest results when it is done in collaboration with one or more of the other social science disciplines. But such research cannot be done 'on the cheap', particularly given the fieldwork involved, and in terms of LWRRDC funding it may require what would be on the border of the moderate to large categories.

Finally, there are only a very few socio-legal scholars in Australia qualified to undertake this sort of work in the field of NRM and an important investment in the next generation would be to fund PhD scholarships in this area.

7. Public Policy and Institutional R&D for Natural Resource Management: Issues and Directions for LWRRDC

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Summary

This paper summarises some themes from the public policy and institutional research literatures, and seeks to match these to policy and institutional challenges in natural resource management in a manner useful to informing LWRRDC's future R&D plans.[16] The 'problem set' is described as that of natural resource management (NRM) within the broader policy field of ecologically sustainable development (ESD). The attributes of policy problems in this field are identified and these translated in policy challenges. A framework for assessing and exploring policy and institutional R&D—'adaptive policy, institutions and management' (APIM)—is constructed to guide the discussion. This emphasises longer term, iterative, persistent and yet flexible approaches to replace policy adhocery and amnesia.

The paper proposes that a policy and institutional 'language' is required, to enable communication of the connection between R&D and policy, between research funders, researchers, stakeholders and policy-makers. The paper contributes towards such a language, in the form of checklists and frameworks detailing (in order as they appear in the paper):

- core challenges for policy and institutions;
- requirements of adaptive approaches;
- a summary discussion of the loci of policy responsibilities in the Australian system;
- descriptions of different modes of policy and institutional research;
- a framework for analysing and prescribing policy and policy processes;
- a menu and selection criteria for policy instrument choice;
- attributes (design features) of institutions ;
- features encouraging adaptive capacity in ESD/ NRM institutions;
- questions for assessing the policy and institutional merit of R&D proposals; and
- key current trends in ESD/NRM from a policy perspective.

These present a greater degree of complexity than probably desired by many stakeholders and managers, and will require discussion amongst all affected parties to assess which are considered most pressing. Issues and modes for delivering policy and institutional R&D are discussed, and some illustrative research projects identified.

7.1 Introduction

In a brief paper such as this, it is impossible to do justice to the wide range of disciplines, methodologies and theoretical bases that can be brought to bear on policy and institutional issues across the variety of resource sectors and issues, contexts and places falling within LWRRDC's problem set.[17] To produce a balanced, digestible and useful outcome for the Corporation, this paper will address the following:

16. The author thanks Catherine Mobbs and Elim Papadakis for comments on the draft of this paper, but claims individual non-transferable rights to residual errors.

17. Also, few people are qualified to attempt to fully cover this ground. It should be noted that the author has an original background in the natural sciences, but developed an interest in policy through employment and then through research into the theoretical and policy aspects of sustainability. Lack of satisfaction with applying models and approaches from core policy-related disciplines to sustainability led to the development, over the last few years, of a general approach and a series of specific analytical and prescriptive frameworks for sustainability policy. These are reflected in this paper. The general approach might be seen as located halfway between many natural scientists, who too often see having an opinion on 'policy' as sufficient, and many social scientists, whose theoretical leanings make their work not particularly attractive to those seeking operational lessons and guidance in NRM; an attempt (whether successful or not) to make theory applicable to practice, and to test theory and methods by application to practical contexts.

- Define the 'problem' of 'policy and institutional failure' that is apparently perceived by LWRRDC, in a manner that opens this up for progress rather than vague complaint. This will involve commenting on the general state of resource and environmental policy and management in the post-ecologically sustainable development (ESD) era. (Part 2)
- Propose a general framework to characterise and summarise the policy and institutional demands that arise from ESD (adaptive management, institutions and policy). (Part 3)
- Provide a sketch of the field; that is, what disciplines and professions are relevant to policy and institutional research, and a summary of some approaches taken to R&D in this area. (Parts 4–7)
- Define 'policy' and 'institutions' in an operational manner for defining research directions and the linkages needed between LWRRDC and its clients (rather than a too rigorous and theoretically correct way, unconnected to substantive resource management issues). Note that this paper deals with *public policy*—the mechanisms and processes of the state—and not so much with policy as formulated and promoted by private interests or NGOs. (Parts 4–7)
- Description of some simple frameworks and checklists to form the basis of communication between LWRRDC and others. (Parts 3, 6, 7, 9)
- Map out some areas where potentially useful research (and perhaps 'development)' could be encouraged, and comment on how this might be organised and achieved.[18] (Part 9)
- Briefly refer to the possible role of 'meta-arrangements' addressing more broad and general problems and needs, and thus defining areas that it would be unreasonable to expect only LWRRDC to attend. (Part 8)

The detail of LWRRDC-supported research is not assessed in this paper, as this is dealt with elsewhere in the consultancy report: the aim here is to set a broad context for considering policy and institutional research.

The paper is based on the perception of the author that a crucial gap exists, this being; *the lack of a useable 'language' describing policy processes and institutional arrangements in the context of natural resource management*. This is evident in the vagueness of the increasingly heard complaints of policy or institutional 'failure', and the lack of specificity in much R&D as to what their policy and institutional implications are or indeed what these terms mean. The two terms are used in a very general sense—the analogy with biophysical R&D would be to claim that a program or project dealt with 'the environment' or 'natural resources' and not state what part of these was the target; water, salinity, biodiversity, pollution, or amenity (and accepting that these are too broad). The statement by Harris (1998: 34) can be both broadened and tightened, to apply the notion of precision to parts of the environment, to policy and institutional settings, and to the connections between them:

> The major contribution that the social sciences have made and can make in the future to environmental issues is to define more precisely what the terms environment and environmentalism have come to mean, and to understand the social impacts of environmental change in its various meanings, how they impinge upon the economic, social and political structures in place, and what changes are needed and warranted to deal effectively with emerging problems.

At present, policy and institutional issues are deemed by many to be an important aspect of achieving NRM consistent with ESD principles—if not the most important—but the articulation of what the problem is and thus what can be done about is less than clear. The major aim of this paper is to establish a basis for increased clarity and precision in this sense, and in so doing to inject some new ideas and possibilities into the discussion. Another aim is to set LWRRDC and the natural resource management issues with which it deals in the broader setting of ecologically sustainable development, and to focus some attention on the larger policy field and other relevant players.

To summarise the challenges, and the directions that might be taken, this paper frames the policy and institutional problem as one of achieving arrangements whereby purposeful, persistent approaches can be sustained in the longer term, with the information-richness, flexibility and capability to learn and adapt. A broadened view of the notion of 'adaptive management' is used to frame this, for two reasons; it is an approach that suits the nature of the problems, and it is an idea with evident appeal to a range of players in resource and environmental policy and management.

7.2 The policy and institutional 'problem set'

LWRRDC's mission statement is (LWRRDC R&D Plan 1996–2001):

> To provide national leadership in utilising R&D to improve the long-term productive capacity,

[18] The application of the term 'R&D' to policy is a problem, in that 'development' of policy or institutions is arguably not LWRRDC's role, whereas research into these areas may be. The term is used though, and later discussion deals with this tension.

> sustainable use, management and conservation of Australia's land, water and vegetation resources. The Corporation will establish directed, integrated and focused research and development programs where there is clear justification for additional public funding to expand or enhance the contribution of R&D to sustainable management of natural resources.)

This is a particular role within a broader institutional and political landscape, and a particular set of problems within a broader social goal and field of public policy problems; ecologically sustainable development (ESD). The nature of these are important to deal with if LWRRDC's role is to be appreciated within a proper context; the political landscape is noted later, and the nature of the policy field (ESD) is discussed now.

Traditionally, many issues of environment and resources were dealt with separately and in a fairly reactive fashion. Resource scarcity and allocation in particular sectors, end-of-pipe pollution control, and nature conservation mostly in reserves dominated early thinking and policy, with little integration as a coherent policy field and lacking a proactive style. From the 1960s, concern for the construction of a 'whole problem' approach was evident, given voice at the international level in Stockholm through the 1972 U.N. conference on the human environment and stated clearly as 'sustainability' for the first time in the 1980 World Conservation Strategy.[19] Drawing on previous U.N. processes on security, development, desertification, etc., the World Commission on Environment and Development articulated the modern idea of 'sustainable development' (WCED 1987), and this led to the 1992 U.N. Conference on Environment and Development and the ensuing Rio Declaration, Agenda 21 and related conventions. The agenda of sustainability is very broad—indeed one commentator described it—not too outrageously, really—as the universally agreed goal of human progress (Harrison 1992). It stresses that environmental and resource issues are globally important and urgent, stresses the long-term nature of the issues, and above all combines them inseparably with issues of economic and human development and human governance.

Australia articulated this agenda through the ecologically sustainable development (ESD) process beginning in 1990, leading to the National Strategy for ESD and a range of related, subsidiary national policies on biodiversity, greenhouse, wastes, rangelands, and so on.[20] The important point here is that a large array of policies across three levels of government, and increasingly laws as well, are underpinned by stated (if vague) ESD principles, and so the many groups, individuals and agencies concerned with implementation or maintenance of these policies *should* be recognisable as a distinct policy community and policy field, or at least be in the process of becoming one. ESD principles are (Commonwealth of Australia 1992):

> **Goal:** Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.
>
> **Core objectives:**
> 1. To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations.
> 2. To provide for equity within and between generations.
> 3. To protect biological diversity and maintain essential ecological processes and life-support systems.
>
> **Guiding principles:**
> 1. Decision making processes should effectively integrate both long and short-term economic, environmental, social and equity dimensions.
> 2. Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation [the precautionary principle].
> 3. The global dimension of environmental impacts of actions and policies should be recognised and considered.
> 4. The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised.
> 5. The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised.
> 6. Cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms.
> 7. Decisions and actions should provide for broad community involvement on issues which affect them.

Despite the perception by some that ESD is 'dead', these principles increasingly underpin policy and some law in Australia, and reflect global international policy settings to which Australia is a signatory and participant. ESD principles are reflected in the Commonwealth's *Environmental Protection and Biodiversity Conservation Bill 1998*, and the

[19] Discussion of the history of development of the sustainability idea can be found in Caldwell 1984, Martinez-Alier 1989, Dovers 1990, Common 1995.

[20] A detailed discussion of the ESD process, and analyses of its strengths and weaknesses, can be found in Hamilton and Throsby (in press); see also Diesendorf and Hamilton 1997; Harris 1998.

implementation of the National Strategy for ESD is being assessed by the Productivity Commission.

LWRRDC is concerned with land and water management, but it must be recognised this is only one part of a larger problem set. When ESD issues are considered as public policy problems, it becomes apparent that they display a number of attributes more commonly, and more often in combination, than many other policy fields (Dovers 1997a):

- broadened, deepened and highly variable spatial and temporal scales;
- the possibility of absolute ecological limits to human activity;
- irreversible impacts, and related policy urgency;
- complexity within and connectivity between problems;
- pervasive risk, uncertainty and ignorance;
- typically cumulative rather than discrete impacts;
- new moral dimensions (eg. other species, future generations);
- 'systemic' problem causes, embedded thoroughly in patterns of production, consumption, settlement and governance;
- lack of available, uncontested research methods, policy instruments and management approaches;
- lack of defined policy, management and property rights, roles and responsibilities;
  intense demands (and justification) for increased community participation in both policy formulation and actual management; and
- sheer novelty as a suite of policy problems.

This paints ESD problems as often different in 'kind' than those in other policy fields (eg. service delivery, social policy, economic policy), and some would argue different in 'degree' as well. This is important, as it suggests that we might need to recast policy processes, institutional arrangements and modes of analysis to properly address these new and different problems. Other policy problems are not 'easy', but existing arrangements and approaches have been developed by constant reference to longer-standing concerns, and so there is a *prima facie* case that new and different problems might require new and different mechanisms. Social science perspectives on environmental problems are, relative to many other policy fields, relatively few and recent (see Harris 1998). There is a wide variation in the attention paid to ESD problems, the methods used and the effectiveness of these across disciplines, sub-disciplines and interdisciplinary alliances of relevance to public policy and institutions.

The above attributes form the basis of defining problems more clearly in terms of precisely what it is about a specific policy issue that we need to attend. This is expanded on later, but for now we can draw on ESD principles and existing policies, and on these attributes, to state some general challenges arising; or, demands that sustainability places on public policy and institutions:

- to improve information capacities (gathering, manipulation, communication);
- to improve policy and management coordination and integration across sectors, portfolios and jurisdictions;
- to increase longevity and persistence in policy processes and initiatives;
- to enhance policy learning across space and time;
- to improve capacities and techniques for policy instrument choice and comparative policy analysis;
- to provide clearer policy and statutory mandates (more direction, less discretion)
  to improve institutional capacities; and
- to enhance and institutionalise community participation in policy and management.

In terms of policy and institutional research, these 'imperatives' can serve as an initial scoping tool for an organisation such as LWRRDC—whether a research project addresses these challenges is a useful starting question (see part 9 below). One must stress the commonality of policy problems the field, and note that this is important given the relatively recent and still institutionally weak and fragmented nature of ESD as a field of public policy and administration.

In terms of policy statements and general strategies, Australia has, on international comparison, achieved much in the six years post-ESD and post-UNCED. However, the level of policy activity has not been matched yet by full implementation or the sort of degree of positive change in the environment or in human use of it that is envisaged in the literature or even in official statements. The rather sombre assessments of global progress at the Rio +5 U.N. General Assembly session in 1997, or in Australia by the 1996 state of environment report (SEAC 1996) (see also Hamilton and Throsby, in press) evidence this falling short. However, Australia has in some ways led the world in new approaches to resource and environmental policy and management—statutory management arrangements, consultative inquiry mechanisms, community based programs, etc.—and these will be considered later. There are two aspects to this failure to achieve as much progress on ESD (and the many subsidiary problems) as many

expected or desired. The first is the degree to which these problems are very difficult, and thus the amount of time it will realistically take to address them. The problems (biodiversity conservation, climate change, water and land degradation, etc.) are indeed difficult, and in some cases have only been noticeable on political agendas for a short time—expectations of instant policy gratification are to some degree unwarranted. The development of new policies, policy processes and especially institutions does take time—many years, very often—and so expectations should be realistic. This emphasises the need for longer-term approaches to policy; a recurring theme in this paper.

The second aspect is the extent to which failure or disappointment with progress is less excusable, as a result of poor policy or inadequate implementation. It is unarguably the case that environmental and resource policy and management, and ESD generally, although occasionally high on political agendas, are not evident as strong concerns in public policy or institutional terms when compared to economic or much social policy; other things are considered more important.[21] Further, aside from this issue of priority, there is an increasing perception that resource and environmental policy and management have suffered from inadequate and incomplete implementation and poor persistence over time—policy adhocery and amnesia (Dovers 1995a). In many cases, the general policy position is appropriate, the scientific understanding sufficient (if imperfect), and the technical wherewithal adequate for much greater advances to be made, but these are not pursued, applied or implemented in a sustained or purposeful fashion. This is often termed a matter of policy or institutional 'failure', and this speaks very directly to the topic of this consultancy and LWRRDC's role. Even where things have been done well, often they are not persisted with, or the experience well analysed and more widely applied. Very generally, most stakeholders would agree, and even official policy says, that more needs to be done.[22]

In response to this situation, LWRRDC has, in the last few years, sought to support R&D generally described as 'socio-economic', through prioritising certain social, institutional or market issues in the general call for proposals. The view in the Corporation is that the quantity and quality of the offered projects has not been adequate (hence the reorientation of which this consultancy is part). This paper does not deal with the detail of previously or currently supported R&D dealing with—or claiming to deal with—policy and/or institutional issues (see Part I, Appendices and other commissioned papers herein). A brief comment on this research, however, is warranted. From the supported projects emerging from searches of ARRIP and other inquiries using the terms 'policy' or 'institution', I would make the following pints as to weaknesses in the current range of R&D:

- few projects are substantially targeted at or deal with policy processes and institutional arrangements, but, rather, claim some policy implication without explaining the basis of this connection in rigorous terms;
- clear connections between the relevant research problem, a policy issue and relevant loci of policy or decision-making power or responsibility are not often established;
- in the case of more substantive policy/institutional projects, there is not often a clear theoretical or methodological basis drawn from the a recognisable and relevant social science (this is not a prerequisite, but assumedly there is either a judgment that such an appropriate basis does not exist or the researchers have not assessed possible existing approaches);
- there is virtually no appearance of researchers with a background in traditional public policy, public administration or institutional/ organisational theory and design research; and
- of all possible policy instruments, most attention has been focused on market mechanisms and 'social response' approaches (participation, community-based programs, etc.) with little evidence (although some claims) that other instruments have been assessed.

7.3 'APIM': a general framework and direction

For the purpose here, what is needed is a general framework that can be used to interrogate and propose management, policy and institutional requirements, guide thinking on what might be expected of policy and institutional research on NRM, and inform the framing of more specific R&D questions. In short, it is assumed that what LWRRDC is interested in is not theoretical elegance or the development of methodologies for policy and institutional research as a whole, but approaches to

21. There is not space here to elaborate this argument, but see Toyne 1994, Walker 1992, Dovers 1995a, Dovers and Lindenmayer 1997, Dovers and Gullett, in press.

22. The judgment of *ad hocery* and amnesia here emerges from detailed study of policy over an extended period. Yet caution should be exercised in making such a judgment - impatience or desires for instant policy gratification can colour the view. As Davis (1993: 15) put it, 'apparent [policy] volatility can become, in retrospect, the stately march of consistent underlying change'.

such research with a sufficient theoretical, conceptual and/or methodological basis (existing or innovative) but especially with *prescriptive and proactive potential.* That is, research capable of informing and prescribing—or at least suggesting—better ways of doing things, and of recognising current–future needs and not simply reworking past–current events and imperatives.

The framework proposed here is that of 'adaptive policy, institutions and management' (APIM), this being a broadened version of the notion of adaptive management (see Holling 1978; Lee 1993; Gunderson *et al.* 1995; Dovers and Mobbs 1997). Adaptive management in its earlier forms entailed modelling exercises between researchers and managers in relatively bounded ecosystem management situations such as a particular catchment or forest. The aim was to pose management interventions in terms of scientific hypothesis that could be tested, thus combining the research methods of science and the practicalities and realities of management, in a significant departure from ad hoc and poorly monitored approaches too often evident. The approach has been expanded more recently to include social and institutional as well as ecological and managerial dimensions. Here, we can think more broadly than discrete management contexts, adding policy processes and institutional arrangements as needing also to be adaptive. This can be constructed so as to proffer, in a very general way, and answer to some of the demands on policy posed above—an informed, iterative, inclusive and flexible approach to ESD and to NRM. Core features of the approach would be:

- an equal respect for and combination of perspectives from the natural and social sciences and humanities;
- open recognition of uncertainty, complexity and long time scales;
- accepting policy and management interventions as *essentially experimental*, with the goal of improving environmental and human conditions but also of consistently testing and improving understanding and capabilities along the way;
- wider inclusion of stakeholders, in a purposeful and structured fashion; and
- design and maintenance of sophisticated mechanisms (institutions and processes) to allow feedback and communication between theory, policy and practice and across different situations.

If we made substantive progress on these, few stakeholders in NRM would be other than delighted (and those who were not would be loath to admit it). These features lead to viewing 'policy' not as a political and bureaucratic process taking inputs from researchers and other information sources and systems and applying these in decision-making, but rather *policy-as-informing-system* in itself. This demands a reasonably comprehensive 'model' of the policy process as an iterative system, not just the having of 'a policy' (see below). This will involve a degree of political and management humility, accepting that policy disappointment or failure is likely, and being open to learning from this in a systematic fashion. Clearly, though, APIM represents a departure from the way we often do things, and would be hard to 'do'. The following summarise the rather daunting requirements of truly adaptive approaches (Dovers and Mobbs 1997):

- *informational*—sophisticated, iterative and widely-owned and accessible systems of research, monitoring and communication;
- *intellectual*—integration across disciplines and professions, theory, methods and practice;
- *statutory*—a commitment to persistence and accountability more substantial than the vulnerable and mutable realm of 'policy initiatives';
- *ecological/substantive*—situations suitable to open-ended, experimental approaches, especially having the 'spare capacity' in natural and human systems so that managers, etc. could honestly entertain adjustments to be made either way as understanding improves;
- *participatory*—democratised, open and accessible processes, with participation structured so as to be clear and to persist over time;
- *political*—political, stakeholder and community will to engage in difficult, long-term processes (reduced role of lobbying, and no instant policy gratification);
- *institutional*—persistent yet flexible institutional arrangements to allow fulfilment of all other requirements.

Public policy will always 'muddle through' (Lindblom 1959, 1979), but adaptive forms of policy, institutions and management (APIM) invite a more purposeful muddling through, where adhocery and amnesia are replaced by persistence, information sensitivity, inclusion, purposefulness, flexibility, and policy and management learning. Addressing these requirements will be a heroic task and complete success is unlikely, but we can assess policy options, institutional arrangements and R&D prospects in terms of their ability to meets one or more of these requirements.

The idea of APIM echoes in many core ways recent and highly influential ideas in political and social theory suggesting 'new' ways of approaching policy and politics; iteratively, inclusively, and in a mutually informed manner. Such ideas and proposals are described (although less often detailed) by terms and theories of 'civil society' (Cox 1995; Rayner 1997), 'dialogic democracy' (Giddens 1994); 'discursive democracy' (Dryzek 1997) and 'communicative rationality' (Habermas 1990).[23] The astounding increase in community-based resource and environmental management initiatives, especially in Australia, although they arguably lack cohesive and strategic direction overall, suggests that theory lags behind practice in this area. While it would be regarded by many scholars of these schools of thought as unforgivable, it can be proposed that these complex, emerging ideas can, for the purposes of thinking about NRM and R&D here, indeed be summarised as 'doing' policy and politics in an iterative, inclusive and mutually informed manner. This sounds fine, but opens up a massive task to research, design and implement the general direction (as does APIM).

The following sections explore the terms 'policy' and 'institutions' and comment on what research into these can entail. The discussion of public policy is the longer, as this raises many institutional issues also. The idea of APIM is used to set limits for the ensuing discussion, and to locate in these large, diffuse fields those issues and directions of greater relevance to improving sustainable management of land, water and vegetation resources and achieving ESD goals.

7.4 Approaching 'policy'

In a recent Australian book, Considine (1994: 2) observed that *policy* "is a deceptively simple term which conceals some very complex activities". Three decades earlier, Cunningham (1963: 229) described it as "rather like an elephant—you recognise it when you see it but cannot easily define it". In everyday situations, and in much discussion of sustainable resource management besides, 'policy' is used loosely, and often in ambiguous and unhelpful ways (at least, unhelpful except to those who might profit from ambiguity). The public policy literature goes into more detail, but does not provide any incontestable definitions. For a starting position, Davis *et al.* (1993: 15) define public policy as "the interaction of values, interests and resources, guided through institutions and mediated through politics", adding the explanations that policy is never one decision or action, that many actors are involved (policy communities and networks), and that it is best viewed as a process over time (Considine 1994; Ham and Hill 1984). Too often, policy is discussed in simplistic terms, without precision as to what parts of the 'process' are relevant to the matter at hand. Part of this has to do with the complex machinery of government, the many quasi-government agencies and the many private and non-government bodies that interact with these in the landscape of public policy (see below). We might keep the definition of 'policy' intentionally loose for now, similar to Friend *et al.* (1975) who saw policy as a 'stance'. A policy is an *avowal of intent*, a recognition of a problem and a statement, in general terms, of what direction might be taken—begging the questions of what, how, when, etc. This will be revisited later.

Box 7.1 presents a picture of this policy landscape, necessary so that, when talking of 'policy' and who does it and how it is made, one can locate the loci of decision-making, responsibility and/or influence (Davis *et al.* 1993: 25). This is a simplified picture, and only a few examples are given; indeed a detailed mapping of the policy and institutional terrain affecting ESD/NRM would be a useful task (accepting that some standard texts do this, eg. Bates (1995)). Overall, the landscape of public policy is shaped within the Westminster tradition, and a system of representative, liberal parliamentary democracy in a federation.[24] For ESD and NRM, federalism is crucial, given the vesting of most practical resource management functions with the States and Territories, but with significant coercive Commonwealth powers established but rarely used (Bates 1995).

The basic loci and division of policy responsibility in a Westminster system should be emphasised, as this is too often blurred in many commentators' minds: Parliament; a first minister and Cabinet, who essentially govern; ministers, with whom much statutory responsibility often rests; ministers' offices, which often have enormous influence over policy and the process of its formulation; public service departments, which provide policy advice and implement policy programs and their heads, who may be the legally defined authority; statutory authorities, that (ideally) are responsible for ongoing functions (area management, data gathering, etc.) best kept at distance from immediate policy and political debates; and the judiciary, which will in many cases adjudicate on whether responsibilities have been discharged and proper process (where legally defined) observed.

[23] For balance, the historian Eric Hobsbawm (1995: 11) commented that, in the 1990s, "strange calls for an otherwise unidentified 'civil society', for 'community' were the voice of lost and drifting generations. They were heard in an age when such words, having lost their traditional meanings, became vapid phrases".

[24] For a standard treatment, see Bell and Head 1994.

Box 7.1 The Australian state; or, the landscape of public policy, institutions, and public administration in Australia

Type	General examples	ESD/NRM examples (where relevant)
Federal executive & legislature	Parliament, Parliamentary C'tees, etc., Cabinet, Govt. and Opposition, Governor-General	Relevant ministers, committees
Public service departments	Treasury, defence, health, social security	Portfolios including responsibility for environment, primary industry, resources, regional development, planning
Judicial & regulatory bodies	High, Federal and Family Courts, IRC, Human Rights and Equal Opportunity Commission, other regulatory agencies (eg. broadcasting authority)	Land or environment courts, planning tribunals, administrative appeal processes
Enforcement agencies	Armed forces, police, security and surveillance agencies, inspection bodies	Some, across a range of bodies (eg. EPAs, park services)
State & local government*	(generally, these approximate the types of federal arrangements here)*	(ditto)
Inter-Govt. mechanisms	COAG, premiers' conferences, ministerial councils	Murray–Darling Agreement, IGAE, ANZECC
Public trading enterprises	Telstra, Australia Post (there were traditionally more of these, eg. Qantas, C'wealth Bank)	
Statutory authorities	Reserve bank, ABC, universities	GBRMPA, MDBC, LWRRDC, EPAs
'Semi-state institutions', private bodies & NGOs	Political parties, lobby groups, business associations, media, churches, unions, think tanks	Conservation groups, industry associations, professional or scientific associations

* This concentrates on the national scale. A great diversity of arrangements exist within each State and Territory, and they often approximate the above in terms of purpose and general categories but not detail. Most relevant for ESD/NRM are judicial bodies (eg. land courts, planning tribunals), public trading authorities (especially with privatisation and corporatisation in areas such as water, power, etc.), relevant departments (eg. land, water, environment, etc.), and statutory authorities (various purposes, including catchment management, reserve management, water, etc).

(Adapted from Davis et al. 1993: 25.)

For any policy or management issues, there will often be multiple ministers, etc. involved, and generally a statutory framework setting out roles and responsibilities. *Policy and institutional research, and other research claiming to be able to inform policy, must be highly sensitive to the loci of policy, legal and decision-making responsibilities and power in the specific context in question.*

Modern policy research arose in years after World War 2, as social scientists attempted to or were called upon to contribute to the better achievement of emerging social goals by applying more rigour and expertise ('craft') to the 'art' of politics and government (eg. Lasswell 1951). The field is variously called policy analysis, policy sciences and public policy, with different intentions and directions evident. Over the years, policy research under these titles has expanded hugely, with a myriad of sub-sets and competing approaches.[25] To make sense of this field for the purpose here, we can consider, very briefly, four matters: who does policy research; what the intent of it is; what they do; and what 'enduring questions' persist in theory and practice that might be

[25] I could not and will not attempt to expand on this massive field here, but see, for example, Daneke 1989; Brooks and Gagnon 1990; Davis *et al.* 1993; Howlett and Ramesh 1995.

relevant to ESD and NRM. First, then, who does policy research? Brunner (1991: 65) gives one version, identifying 'distinguishable parts of the [policy] movement':[26]

- public affairs (philosophy)
- policy analysis (economics)
- management science (public and business administration)
- policy studies (political science)
- socio-economics (sociology)

This casts the net broadly in terms of disciplines, but there are other players as well; for example, lawyers (see Farrier, this volume), institutional theorists (see below), and public servants who may have no particular disciplinary definition but certainly 'do' policy research. 'Public policy' is itself a recognisable area of research, but with many disciplines involved. Further, there are numerous sub-disciplines and alliances that analyse or prescribe policy in some way; environmental politics, ecological economics, resource management, and so on. And natural scientists concerned with ESD and NRM are increasingly liable to examine policy problems and prescribe solutions (whether well or not). The key point is that there are many disciplines and groups involved in policy research. These organise themselves and communicate in various ways. In terms of groups with recognisable status and involvement in policy research in Australia, the Australian Institute of Public Administration and the Australian Political Science Association are central to the field (through various activities and their publications, the *Australian Journal of Public Administration* and the *Australian Journal of Political Science*). Also relevant are the National Environmental Law Association and the Australian Environment Institute (the latter publishes the *Australian Journal of Environmental Management*, and members of the former often publish through the *Environmental and Planning Law Journal*). While policy researchers have engaged with sustainability issues, most policy research deals with other issues, and much resource and environmental policy research is carried out and is published outside the standard policy-related social science literature. This has resulted in a degree of separation between much environmental policy research and other policy research. In part, many concerned with environmental issues in this sense are either driven by an interest in politics rather than policy, with an implicit commitment to environmental reform, or are focused on fairly specific management improvements rather than general questions in public policy.

Environmental policy research was portrayed by Walker (1992a: 253) thus:

> ... though there are no established methodologies either for policy analysis ex post facto or for evaluation of proposed policies, there does exist a grab-bag of useful perspectives and techniques, analytical and evaluative. The practice of environmental policy studies will undoubtedly, over time, lead to their refinement. Eventually, there may emerge approaches with broad acceptance and proven efficacy.

There is no reason to differ with this opinion six years on, although progress has been made. This underlines the importance of encouraging the development of tools and of a language of research in this area.

A further, important player in applied policy research is the 'consultant', either with or without a recognisable disciplinary background, operating as a commercial firm or (increasingly) drawn from public research and higher education bodies.

The intent of policy research varies greatly, depending on the aim, the methods, and the affiliation of the researcher. For a public body identifying research needs and encouraging attention to them, such as LWRRDC, this is a crucial issue. A simple split is between that which is *descriptive*, and that which is *analytical*, and across these the extent to which *prescription* is attempted. Hogwood and Gunn (1984: 29) identify two broad categories—policy studies and policy analysis—that overlap in the area of evaluation:

> **Policy studies:**
> – study of policy content
> – study of policy process
> – study of policy outputs
> – evaluation
> **Policy analysis:**
> – evaluation
> – information for policy-making
> – process advocacy
> – policy advocacy, with either the:
> analyst as political actor,
> political actor as analyst.

This raises two distinctions relevant to LWRRDC, given the obvious sensitivities of an agency without a policy role involving itself in R&D with potential policy and political ramifications. First is the difference between research that recommends actual policy options or instruments, and that recommending *processes*; the latter may be more appropriate. Second, and related, is the position of the researcher, and whether they will, through their research, be playing what may be seen as a 'political' role, driven by normative or value-based concerns.[27] Further, the

[26] For timely surveys of many of these disciplines, see Academy of the Social Sciences (1998).

distinctions made in the typology above allow identification of the intent of proposed research—to yield information, to analyse implementation and outcomes, or to examine process? One mechanism whereby potential conflicts in this regard might be minimised is to *frame research questions and projects around existing policy principles and goals*. ESD principles are too generally stated for this tactic, but goals in some subsidiary policies are not. The large quantity of ESD and NRM-related policy produced in recent years abounds with these, and in most cases they have been arrived at through some consultative and/or intergovernmental process (eg. strategies on ESD, biodiversity, wetlands, rangelands). Almost overwhelmingly, these goals have not been fulfilled, and so the role of R&D to assist in their achievement *should* be able to be viewed as more proper and acceptable than research apparently driven by some other goal or principle. Further, operational outcomes of such research *should* gain wider currency in terms of communication and implementation.

The general methodological stances employed in policy research are numerous and varied, and the full set cannot be described here (nor is the author qualified to do so). An introductory theoretical framing below is adapted from Howlett and Ramesh (1995: 19); see also Farrier, Ross and Lockwood, this volume):

Unit of analysis	Method of theory construction	
	Deductive	Inductive
Individual	Public choice	welfare economics
Group	Marxism	pluralism/corporatism
Institutions	Neo-institutionalism	Statism

Within these theoretical dispositions, many specific approaches exist. The split between deductive approaches (applying generalised or universal assumptions to specific cases) and inductive approaches (using specific cases to establish generalisable propositions) is an important one for a body such as LWRRDC. One argument might be that the latter would be more desirable, in a novel, rapidly evolving policy field with contested understanding and methods and problems arguably quite different from those elsewhere. For brevity, we can characterise some common approaches that might be applied to NRM issues, not to map the full terrain but simply to indicate the difference (some will find these characterisations too crude):

- *Political science approaches*. Approaches to analysing policy here focus on the interplay of political and policy actors, communities and networks. Approaches of this kind often manifest in the ESD/NRM area as 'environmental politics' or 'ecopolitics', and, while essential to explicating the political environment of policy and decision-making, too much work in this area is retrospective and contained within notable case study conflicts and thus often of little prescriptive/ proactive value. An example methodology with this weakness (from LWRRDC's perspective, I suggest) is the 'advocacy coalition framework' designed to allow more structured investigation of the role of policy actors in shifting coalitions (Sabatier 1988; Jenkins-Smith and Sabatier 1994).

- *Psychological/sociological approaches*. Absent in the schema from Howlett and Ramesh used above, this is a relevant set of policy-relevant approaches examining individual and group processes in policy context (see Ross, this volume).

- *Policy/program evaluation*. This is the 'hands on' and practical side of policy research; where discrete policies or policy programs are assessed for their efficacy, outputs, costs, etc. This may be carried out within government (in agencies or by an audit or similar office) or by external consultants. An accessible treatment in an Australian NRM context is given by Curtis *et al.* (1998). Although most often aimed at administrative efficiency and accountability, given that there are a sufficient number of programs of some similarity in style and goal, research in this area can be of systemic potential to a wider set of agencies and stakeholders.

- *Public choice approaches*. These are essentially economic approaches based on applying the idea of individuals as rational utility maximisers operating in self-interest, making choices within constraint sets. Methods in this area, and their limitations, are dealt with by Lockwood (this volume).

- *Legal policy research*. Legal research is nothing if not also and always policy and institutional research. This area is discussed by Farrier in this volume. One important distinction, from an APIM stance, is between 'legalistic' approaches to regulation, liability, administrative law, etc., and more 'institutional' approaches looking at the law's role in establishing and maintaining

[27] I accept that all research has a subjective or value dimension, but for the purpose here it is necessary to gloss over this a little, and merely highlight both the importance of perceptions of normative influence in research for a body such as LWRRDC, and of making explicit the normative stance underpinning research in this area.

institutions and processes and the codification of general principles (such a ESD principles).

- *Institutional analysis*. (see section 7.7).
- *Policy cycles and decision process approaches*. These approaches stem from early work by especially Lasswell (1951), who proposed a 'policy sciences' approach, and have been reworked in various ways over the years. They combine to some extent elements of political science and policy evaluation approaches. The basis of the approach is to view policy over different stages as a problem-solving exercise, with a matching policy cycle, illustrated below (Howlett and Ramesh 1995: 11):

Problem-solving phases	Policy cycle stages
– problem recognition	– agenda-setting
– proposal of solution	– policy formulation
– choice of solution	– decision-making
– putting solution into effect	– policy implementation
– monitoring results	– policy evaluation

This allows a structured approach to interrogating policy and recognises that 'policy has many parts' and has cycles and that these are important. The widely admitted problem with such 'models' of how policy is 'made' is that very often (even most often) it isn't made this way at all; but in, rather, an ad hoc and messy manner with little linear logic. Further, there is the difficulty that policy is rarely contained within one agency or clear process, but more often across many (Considine (1994) offers an accessible discussion). Decision process appraisal, evolving from the work of Lasswell (1971), pursues more tightly defined 'decisions' through various stages (Brunner 1996). Such approaches are more helpful in discrete management context where problems are not too diffuse and interconnected (as they are in ESD/NRM).

Across all these, there is the extent to which the approach examines a particular policy context, or is comparative. There are arguments for either, and mixtures of the two, depending on the situation. For ESD/NRM as construed in an adaptive manner, there are strong arguments for comparative policy (and institutional) analysis to underpin policy learning. If this is accepted, then a central issue is the basis of comparison; that is, whether this is to be on the basis of political or administrative similarity, shared substantial problems, or different application of policy instruments? For example, if we seek lessons from overseas policy experience, do we examine like political contexts, contrasting ones, or shared issues? If research is not comparative, this issue is still important in that it exposes the question of where else the lessons of policy analysis would relate to.

What emerges from thinking about the many possible styles of policy research is that all will be valid for different purposes, and probably more often they should be applied in concert than separately (for the sake of better analysis as well as to better develop them in a comparative manner). However, they may not be well suited to the sort of ESD/NRM issues that concern LWRRDC, for reasons stated earlier.

7.5 Enduring questions in policy analysis

Another way of looking at the prospects for policy research is to consider what might be termed 'enduring questions' in policy analysis; issues often given much attention, but which have not attracted clear consensus as to resolution or methodology, and have relevance to the 'problem' as stated in part 2 of this paper. The following are sharply summarised, more to indicate areas where work might be progressed rather than to explicate these questions in any substantive way:[28]

- *'Policy analysis as handmaiden?'* (Horowitz and Katz 1975). This concerns the relationship between policy research (as undertaken by supposedly independent researchers) and the state or its policy agencies. That is, the link between policy analysis and policy formulation (see the typology of Hogwood and Gunn above, and Garson (1986) and Torgerson (1986)). Too close an association with government constrains the breadth and perhaps innovative potential of inquiry, but maximises the likelihood of uptake of results, and *vice versa*. For LWRRDC, this is mostly an issue to be sensitive to, from the perspective of both researchers and policy agencies.
- *Policy, rational or non-rational?* There has been a longstanding tension between what can be crudely categorised as 'rational-comprehensive' and 'incremental' approaches to public policy (alternatively, synoptic and anti-synoptic traditions). The former constructs policy as a stepwise and well-defined process attended to in a 'scientific' manner producing a 'rational' policy outcome. Incrementalism says this is unrealistic—policy making (and thus analysis) is more complex and politically contingent than this—and proposes that we proceed in small, less

[28] Some researchers, from a particular disciplinary or methodological perspective, might disagree that particular 'enduring questions' are in fact contested, but the author would hold that at the least in all cases enough contesting approaches exist to justify inclusion. This iteration is from an unpublished, in preparation manuscript of the author.

rational steps.[29] Arguments both ways are possible, and are beside the point here. An attractive position is halfway—to recognise the messiness and politics of policy but not abandon the hope of more rigour and direction—a purposeful incrementalism. Incrementalism may be an accurate description of reality, but not necessarily of how things might or could happen, and rational models can be very useful as analytical tools (Davis *et al.* 1993; Dye 1983). It should be noted that many resource and environmental managers and policy-makers are being required to demonstrate adherence to quite detailed and strict procedural frameworks reeking of a rational approach, such as impact assessment processes, environmental management systems (ISO 14000 series), the risk management standard (AS/NZS 4360), life cycle assessment, or even iterations of ESD principles in statute law.

In opposition or at least corrective to both rational and incremental views is the explanation that decisions and policy are products of ubiquitous and unavoidable *power relationships*, most decisively portrayed at a fine resolution by Flyvbjerg (1998). However, while this view should be taken account of, it is difficult to see it informing the R&D plans of an agency such as LWRRDC.

- (Relatedly) *The utility of models*. Following this, there is a problem in that the literature abounds with descriptive, analytical and prescriptive 'models' of the policy process, and choosing between these is problematic, as each construction will guide the questions asked, methods used and information sought. Also, the applicability of many policy models to ESD/NRM problems may be questionable, given their evolution with reference to other policy problems (service delivery, social policy, etc.). Any model (whether quantitative or conceptual, simple or complex) has a theoretical, conceptual or philosophical basis. Clarity as to what particular construction of the policy process R&D workers in ESD/NRM subscribe to or are proposing should be encouraged—if the political and policy process is construed a particular way, this will influence assumptions, methods and finding. For example, a focus on individual choice may ignore institutions and non-economic behaviour, whereas an institutional analysis may do the reverse. Besides model choice, there is the issue of avoiding taking a model too seriously; as a singular representation of either the way things are or should be.

- *Politics, values and the state*. A core problem with policy research—and one particularly acute for a body such as LWRRDC—is the relationship with politics and the state. Rational studies which ignore politics are as unhelpful as purely political analysis focusing on the conflict of the moment and descending into a vicarious spectator sport. Indeed, much environmental 'policy' literature in Australia is in fact the study of politics, of limited prescriptive or operationally proactive content. Many scientists and stakeholders deride 'politics', viewing it as a venal expediency obstructing rational decision-making, but, as Davis *et al.* (1993: 257) warn, this is unrealistic as well as probably dangerous:[30]

  > Politics is the essential ingredient for producing workable policies, which are more publicly accountable and politically justifiable ... While some are uncomfortable with the notion that politics can enhance rational decision-making, preferring to see politics as expediency, it is integral to the process of securing defensible outcomes. We are unable to combine values, interests and resources in ways which are not political.

  For researchers, the challenge is to impose some order on analysis and prescription and proposed process, while factoring in the political context. The answer, for a body like LWRRDC, would be to demand sensitivity to particular and changing political contexts, and to pursue R&D capable of improving the penetration of policy debates with a wide variety of legitimate information sources and different voices (a matter of process and institutional design, and of communication). This enduring question includes the problematic area of political and community will and the common failure of poor or absent implementation after rhetorical or in principle policy statements. This, on the face of it, should be proceeded with as a question of communication and educative policy approaches, or left in the realm of political science-style inquiry probably not suited to R&D encouraged by LWRRDC. Alternatively, a focus on policy stressing the preconditions to policy and the tasks post-policy statement (see the model presented below) can be pursued less problematically, as this will to some extent demonstrate and encourage more sustained

[29] Lindblom (1959) penned the classic description—'the science of muddling through'—and in 1979 put it that we were 'still muddling, not yet through'. One wonders what the 1999 judgment should be.

[30] There is also the matter of viable alternatives; Winston Churchill is said to have judged our political system—Westminster parliamentary democracy—as the worst system in the world, except for all the others. Rule by technocrats is one alternative.

implementation. It also includes the issue of *values* in policy and policy research, emphasising that policy instruments and approaches are linked to underlying political theories and philosophies (eg. Gillroy and Wade 1992). This is an issue sharpened by the increasing focus on stakeholders, perceptions and participation in NRM. Again, the answer would seem to be a focus on the nature of processes and institutions enabling the mix of values and different forms of knowledge and information.

- *Problem definition*. Defining policy problems is core to avoiding applying 'pseudo-solutions' to 'pseudo-problems' (Dery 1984). It has been stated that the policy literature lacks useful typologies of policy problems that extend beyond nominal categories and simple classifications (Linder and Peters 1989). Too often, we confuse substantive problems (eg. dryland salinity, or remnant vegetation protection) with the policy problems these present. Two ways forward suggest themselves. First, rather than seeking to classify problem types, we can explore more generic problem features via the *specific attributes* of NRM policy problems with a view to clarifying the features of problems rendering them different or difficult, and then to consider what that means about policy options (see later in this paper, and the framework for scaling and framing sustainability problems in Dovers 1995b). Second, we can seek to ensure that R&D connects well with the detail of policy processes and institutional, legal and administrative arrangements, to ensure that research speaks sensibly to the loci of policy responsibilities.
- *Policy instrument choice*. Too often, instrument choice is a matter of convenience, expediency or disciplinary or ideological bias. Very often singular instruments are advocated, when typically a mixture will be needed. Further, rarely do we observe a full menu of instruments assessed via rigorous selection criteria. Across the policy literature, there is little consensus on how to choose the best instrument/mix of instruments, or even over what the menu is (eg. see Linder and Peters (1989) and Howlett (1991)).[31] Partly this is due to the difficulties of being prescriptive across so many areas of application. A challenge for NRM is to evolve the art and craft of instrument choice and analysis in a manner specific to NRM problems (which, we have claimed, are different and difficult). The aim is to choose instruments best suited to the particular situation, and on the basis of comparative analysis or experience.
- *Policy learning* (subsuming policy monitoring and evaluation). Learning from policy experience and accruing lessons in a positive and proactive way is "a concept that is advocated but not adequately conceptualised" (May 1992: 350), nor is it particularly evident in practice. Lee (1993: 185) stated that "deliberate learning is possible, though surely uncommon, in public policy". Policy (and institutional and management) learning would appear absolutely central to an adaptive approach to ESD/NRM. Importantly, learning needs to involve improved understanding and not simply mimicry, according to May (1992), who goes on to provide a simple typology: instrumental policy learning, involving the viability of more specific instruments or program design; social policy learning, entailing lessons about the social construction of policy problems, the scope of policy or about policy goals; and political learning, where advocates become more knowledgable about policy processes and how to advance their arguments. Bennett and Howlett (1992) emphasise *who learns*: government instrumentalities; policy actors, or broader policy communities? For LWRRDC, there is the issue of what might be learned and who needs to learn from R&D in their area, and the issue of whether processes and institutions exist to enable such learning to occur and accrue.

This very brief discussion raises a range of questions about policy research. The next part seeks to provide the basis of a 'language' of policy suitable for LWRRDC to articulate and communicate to researchers and other agencies a more detailed version of what LWRRDC takes 'policy' to mean.

7.6 A 'language' of policy

The need for a more explicit language of 'policy' expressed at the beginning of the paper suggests providing some detail of what comprises 'policy', in such way as to also allow a prescriptive and proactive focus as well as analytical potential, with relevance to some of these enduring questions and the idea of adaptive processes, and with some value as an antidote to adhocery and amnesia. Box 7.2 presents a more detailed view of ideal conditions for policy processes for ESD/NRM. This is not a 'model' to be taken too seriously, but a framework for analysis, and one to assist prescription (or at least suggestion). It is a guide to preconditions for good policy; things that should not be forgotten. Some of the elements may seem commonsense, but experience shows they do get left out.[32] Also, it is not the case that all preconditions will

[31] Environmental economics goes furthest in specifying instrument menus and criteria for choice, mostly concerning environmental protection, but has a habit of usually recommending economic instruments.

need to be met in each case; for example, a particular policy or program may rest on, say, discussion of social goals or environmental monitoring serving a range of policy programs. But it forces the question of whether these elements have been attended to, and whose responsibility it is or should be to do so. Some elements will be more or less important in different situations, and we can probably never be perfectly comprehensive, but an ideal is a useful goal. In many discussions of policy, the emphasis is too often on element 10 of the model (the policy statement, or 'avowal of intent'), with perhaps some reference to implementation, without sufficient attention to what must come before and after.

For LWRRDC's purposes, this is a broad basis of a 'language' of policy, enabling greater precision in locating the part or parts of a policy process or cycle an R&D project connects with (or not). So, rather than say that a research project has 'policy implications', it is possible to identify (or ask) which aspect of policy it is relevant to (problem definition, instrument choice, process or institutional design, compliance, monitoring and evaluation, etc?). It is also a mechanism whereby LWRRDC might map those aspects of public policy that would be most appropriate or effective for it to concern itself with, for reasons of political sensitivity, economy or strategic choice. Especially, there are 'parts' of the policy process where the task can be seen as building the option available to policy-makers, rather than advocating policy change (eg. elements 3–9, 12–17).

The framework may be considered too complex for LWRRDC's use, but abbreviation would lose useful detail. Moreover, element of the framework in Box 7.2 conceals another level of detail in many cases highly relevant to LWRRDC's interests in promoting operational, prescriptive and proactive research. The following notes some of these—essentially those elements most central from an APIM perspective—and in some cases explores them a little further:[33]

- *Elements 2–4 (monitoring).* There is little argument that, overall, we do not have adequate systems in place to monitor public opinion and understanding of NRM issues, nor do we have anything like an adequate system of information and monitoring of environmental conditions, resource status and in many cases human interactions with these (especially of non-traded resources and environmental assets). Despite the potential consolidation of existing information through new initiatives such a state-of-the-environment reporting, the NL&WRA,[34] remote sensing and environmental modelling, and community monitoring, serious long-term ecological research and monitoring is a major gap. This opens up a complex area of relevance to LWRRDC, where specificity is required in connecting R&D with information and communication needs in a policy sense.

- *Element 5 (causes).* Identifying and separating proximate (direct) and underlying (indirect, but more important) causes of environmental degradation. This is crucial if policy interventions are going to be truly corrective rather than merely address symptoms in an antidotal fashion. This is an especially difficult issue for two reasons: first, it is a complex matter and hard to do; and second, it expands the policy field to include underlying policy issues such as social justice, economic policy or taxation. An example analysis of underlying causes and policy implications in the forests sector is given in Dovers *et al.* (1998), and a discussion of the dynamics of change in an 'adaptive' vein is supplied by Gunderson *et al.* (1995).

- *Element 6 (uncertainty).* Dealing with decision-making in the face of uncertainty will be a constant, whatever efforts are put into R&D, and this remains a challenge for policy research. An initial challenge is to identify *different forms of uncertainty*. Uncertainty does not exist solely as a lack of objective scientific knowledge, but is socially constructed and politically negotiated, manifesting in many forms such as deemed irrelevance, taboo, intentional distortion, false commitment, etc. (Smithson 1989; Wynne 1992). Whether the uncertainty targeted by an R&D project is the only or most important type attending the policy problem needs to be ascertained.[35] This leads to a matter highlighted in part 9 below: choosing between the many, quite different methods and techniques available to support decisions and policy making in the face of uncertainty.

- *Element 12 (instrument choice).* This element covers a large part of current policy research and debate; which instruments are best? This question has been subject to a massive, inconclusive and often biased literature.

32. Perhaps the framework is best viewed as a checklist, and seen as useful for the same reasons a checklist is useful when preparing for a journey; things do get left out.

33. The ones explored further are those where the author and colleagues have or are currently developing more detailed extensions to the framework.

34. An analysis of the performance of SoE reporting in different jurisdictions and under different conditions and, in time, of the Audit is a potential research topic in itself.

35. A summary of these issues, and a framework for assessing uncertainty, are provided in Dovers and Handmer (1995) and Dovers *et al.* (1996).

Box 7.2 A framework for policy analysis and prescription for ecologically sustainable development and natural resource management

Problem framing:

1. Discussion and identification of relevant social goals
2. Identification and monitoring of topicality (public concern)
3. Monitoring of relevant natural and human systems and their interactions
4. Identification of problematic environmental change or degradation
5. Isolation of proximate and underlying causes of change or degradation
6. Assessment of risk, uncertainty and ignorance
7. Assessment of existing policy and institutional settings
8. Definition (framing and scaling) of policy problems

Policy framing:

9. Development of guiding policy principles
10. Construction of general policy statement (avowal of intent)
11. Definition of measurable policy goals

Implementation:

12. Selection of policy instruments/options
13. Planning of implementation
14. Provision of statutory, institutional and resourcing requirements
15. Establishment of enforcement/compliance mechanisms
16. Establishment of policy monitoring mechanisms

Monitoring and review:

17. Ongoing policy monitoring
18. Mandated evaluation and review
19. Extension, adaptation or cessation of policy and/or goals
20. Iterative description and explanation of process

Critical general elements, applicable at all stages of a process:

– policy coordination and integration (across and within policy fields)
– public participation and stakeholder involvement
– transparency, accountability and openness
– adequate communication mechanisms (multi-directional, democratically structured)

Source: modified from Dovers (1995a)

The essence is how to choose, from a wide instrument menu and on the basis of some consistent criteria, for each particular context or need. Box 7.3 extends standard policy and environmental economics treatments of this into more detail and relevance for ESD/NRM (from Dovers 1995a; see also Young *et al.* 1996). This provides an extension to the model/framework allowing detailed questions to be mounted in or about research dealing with the merits of different instruments. Although treating approaches such as community involvement as an 'instrument' to be applied is questionable, perhaps even offensive to some, including the entire field of possible approaches into this framework allows a more comprehensive view, and can force consistency in analysis and advocacy.

- *Element 14 (statutory and institutional requirements).* This reveals a very large and crucial set of questions, especially if an adaptive, persistent approach if desired, and demands another detailed 'language' connecting R&D and policy processes. This is dealt with in part 7 of this paper, and in Farrier's paper in this volume.

- *Element 15 (enforcement, compliance).* This is also dealt with by Farrier (this volume). The importance of detailing this element is borne out by the common claims of the 'failure' of regulatory policy approaches, when in fact enforcement may have been weak. This is not simply an argument between lawyers and economists, but is enormously important to consider closely for what it means for alternative policy instruments. Market mechanisms are now promoted as alternatives to 'failed' regulatory ones, but as yet *strong* market mechanisms have been uncommon (Eckersley 1995; Dovers and Gullett, in press). If it is the case that strong enforcement is the equivalent of strong market mechanisms, and that neither are likely, then this is an important proposition.
- *Elements 16–19 (monitoring and evaluation).* This is clearly important, and also not widely evident in practice. While there is often a 'review' forecast in policy statements, the ongoing processes necessary to fulfil this may not be put in place, or the responsibility for and content of it made clear. Particularly, maintaining monitoring and evaluation over the longer-term (in a political sense, say, five–ten years) is rare. External policy evaluations have a place (eg. by audit offices or consultants) alongside internal ones, but internal processes and mechanisms are always essential to maintain information flows and records to enable evaluation. For broader learning, attention must be across policy fields as well as on single programs and policies. Furthering detail in this regard is possible but not explored further here (see Curtis *et al.* 1998). An important point is that attention to policy monitoring will make later policy analysis and learning both possible and cheaper.
- *General element (participation).* Public participation and stakeholder involvement is a topical issue in resource management, and one receiving considerable attention, but the subject of little discernible clarity in a public policy sense of prescriptive/suggestive and proactive analysis. A minimal need here (in terms of a 'language') is a more detailed and sensitive typology of forms of community involvement, their attributes, policy intent and institutional and other requirements. This is discussed a little further in part 9 below. (NB: the other general elements require similar attention, but are not explored further here.)

Quite clearly, attention to different elements or aspects of the full 'process' of ESD/NRM policy demands input from different disciplines, professions, parts of community, skills and methods (as already established for public policy generally). Recognition and articulation of this is important if research directions are to be established, connection with appropriate researchers made, and assessment of proposals comprehensive. To emphasise this, and strictly in terms of research, the following disciplines and professions would have primary roles in R&D on the elements of the framework in Box 7.2 (the list is not exhaustive, and emphasises the social sciences and humanities):

1. Social goals—political science, philosophy, sociology, psychology, public policy, history.[36]

2. Exploring topicality—sociology, psychology, demography, statistics, some branches of economics, history.

3–5. Monitoring human and natural systems, problem identification—information sciences, demography, ecology and other natural sciences, public policy, law, economics, geography, public health, psychology.

6. Uncertainty—philosophy, information sciences, mathematics, ecology and other natural sciences, public policy, law, political science, psychology.

7. Assessing existing policy—political science, economics, public administration, public policy, law, history, planning, institutional and organisational theory.

8. Framing policy problems—public policy and administration, law, sociology.

9–10. Policy principles and statement—political science, law, public policy, public administration, communications.

11. Defining policy goals—public policy and administration, law, relevant natural sciences, economics.

12. Instrument selection—all disciplines mentioned above, plus communications, education, public relations, public health.

13–14. Implementation planning and requirements—public administration, law, institutional theory, public policy, accounting, geography, sociology, psychology, history, institutional and organisational theory.

15. Compliance/enforcement—law, economics, public policy and administration, psychology, education, communications.

16–19. Monitoring, evaluation—law, economics, accounting, public policy and administration.

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36. The argument for the inclusion of stronger historical perspectives in ESD/NRM research and policy is sketched in Dovers (1994).

Box 7.3(a) Policy instruments for ESD/NRM, and criteria for instrument choice

Instrument class	Main instruments and approaches
1. R&D, monitoring	Increase knowledge generally (basic research) or about a specific matter (applied research); establish a standard; develop technologies or practices; establish socio-economic implications; monitor environmental conditions or policy impact.
2. Communication and information flow	Directions: research findings to policy; policy imperatives to research; both to firms, agencies and individuals. Mechanisms: state-of-the-environment reporting; natural resource accounting; community-based monitoring; environmental auditing; strategic impact assessment; fora for consultation or policy debate.
3. Education and training	Public education (moral suasion); targeted education; formal education (schools, higher education); training (skills development); education regarding other instruments.
4. Consultative	Mediation; negotiation; dispute resolution; inclusive institutions and processes.
5. Agreements, conventions	Intergovernmental agreements/policies (international or within federations); memoranda of understanding; conventions and treaties.
6. Statutory	New statutes or regulations under existing law to: create institutions; establish statutory objects and agency responsibilities; set aside land for particular uses; land use planning; development control; enforce standards; prohibit practices.
7. Common law	Torts; nuisance; public trust.
8. Covenants	Conservation agreements tied to property title.
9. Assessment procedures	Review of effects; EIA; social impact assessment; cumulative impact assessment; risk assessment; life cycle assessment; statutory monitoring requirements.
10. Self-regulation	Codes of practice; codes of ethics; professional standards.
12. Community involvement	Participation in policy formulation; community-based monitoring; community implementation of programs; cooperative management; community management.
13. Market mechanisms	Input/output taxes/charges; use charges; subsidies; rebates; penalties; tradeable emission permits/use quotas; tradeable property/resource rights; performance bonds; deposit-refunds.
14. Institutional or organisational change	To enable other instruments or policy and management generally, especially over time.
15. Change other policies	Distorting subsidies, conflicting policies or statutory objects.
16. Reasoned inaction	(Where justified by due consideration.)

Box 7.3(b) Criteria for instrument choice:

1. Effectiveness criteria: information requirements; dependability (re- goals); corrective versus antidotal focus; flexibility (across contexts, time); gross cost; efficiency (relative to achieving goal); cross-sectoral influence.
2. Implementation criteria: equity impacts; political/social feasibility; legal/constitutional feasibility; institutional feasibility; monitoring requirements; enforcability/avoidability; communicability (re- those affected).

20. Description—public policy and administration, communications, education.

General elements—education, communications, public policy and administration, political science, sociology, psychology, law, planning.

In most cases, as with using the framework in a prescriptive or suggestive manner, the involvement of various groups of stakeholders would be crucial to research design and implementation. Again, this has the rudiments of a more specific basis for LWRRDC for clarifying the appropriateness of R&D teams to intended research tasks. The more important lesson, though, is that no elements of the public policy process should be viewed as the domain of one discipline (mono-disciplinary projects may still be valid, but the limitation can be recognised, or suitable linkages suggested). It needs to be recognised that many of the disciplines above do not focus substantively on NRM issues (although they may on the 'environment'). It will be more in the realm of sub-disciplines and interdisciplinary alliances (eg. ecological economics, green social theory, cultural risk studies, environmental psychology, etc.) that such a focus may be found, as well as in research agencies with little overall social science background but who are engaging with policy and institutional questions because of deemed lack of purchase of purely biophysical approaches or because of increasing research opportunities (for example, CSIRO, BRS). Some of these issues are dealt with in Ross and Lockwood (this volume).

7.7 Approaching 'institutions'

This part of the paper is shorter than that discussing policy, as many of the issues have been already discussed (it is the nature of the notion of 'institutions' that it impinges on everything else). The aim is to briefly discuss institutions, and again to seek to provide a 'language' suitable for defining and articulating future R&D directions.

Institutions are very topical at present. The terms 'institutional arrangements', 'institutional failure' and 'institutional change' are being used increasingly with respect to NRM, and generally in rather imprecise ways (including by this author at times). The attention to matters 'institutional' appears to stem from a perception that, despite much biophysical research and the presence of many, apparently viable technical answers to resource management problems, they are not being implemented, and thus the problems they address are not being resolved. So something other than technical is going wrong; hence 'institutional failure' (and also 'market failure', see Lockwood's paper, but noting that markets are, properly, institutions too). However, the term when used in this way seems to encapture laws, organisations and bureaucracies, policy processes, markets, financial systems, social arrangements, educational systems, and more. Thus, much commentary is not particularly focused. However, it is clearly the case that in all these lists are indeed the weak points obstructing or failing to deliver the improvements in sustainable land, water and vegetation management deemed otherwise possible.

As discussed regarding policy, and underlying causes to environmental degradation, this raises the difficult issue (for LWRRDC) of bounding the arena of interest in such a way that unacceptable encroachments onto other policy fields are avoided, or, if such incursions are deemed desirable, that they are carefully planned.

In a pure sense, an 'institution' is "an established order comprising rule-bound and standardised behaviour patterns" (Jary and Jary 1995). An institution may or may not have organisational or bureaucratic manifestations, and may owe its acceptance, predictability and support to custom or to law. This sets a very broad field; too broad for an agency such as LWRRDC, and we will define it differently later.

A number of major theoretical and methodological approaches can be applied to institutions. A legal–historical approach can be taken, describing political institutions and their evolution and change. This is fairly observational, although from it can emerge the basis of much other insight. For LWRRDC, it may indeed be valuable to encourage simple description, given apparent misunderstandings in the community and among researchers (in this sense, one might propose research and communication directed at furthering the notion of a resource and environmental 'civics'). A broad brush view of Australian institutions, without any strong theoretical overtones, is provided in Henningham (1995). A more analytical approach informed by political or sociological theory exposes perhaps more of the reasons for, and nature of institutional change. A rare book in this vein in Australia is Papadakis (1996), examining broader institutions such as political parties and the media. The theory of institutional design is surveyed in Goodin (1996), in a field where the nature and features of 'successful' institutions are sought for the purposes of future design. As a reaction to the abstractions, focus on individuals choice and lack of attention to decision-making in neoclassical economics (ie. public choice theory), a large and complex body of work has been developed under the various titles of neo-institutionalism, institutional economics and new institutionalism, seeking to improve explanations of economic behaviour through recognising the transactional and mediating role of

institutions (eg. North 1990). Finally, institutional analysis swerves close to sociology where human individuals and groups are the focus of attention (see Ross, this volume).

For LWRRDC's purposes, we need a more tractable definition of institutions, not at odds with the detail of different theoretical insights but able to be connected to resource management. Institutions are pervasive and crucially important but, unless clearly defined, a not very helpful framework. Theoretically, organisations are separated from institutions—essentially because organisations may manifest underlying institutions but are subject to sudden and even arbitrary reform—however, here I would propose to dissolve this boundary a little, with the proviso that organisations thus included have a degree of predictability and longevity. This will allow a better fit with common usage in resource management circles. A simple definition can be (drawing partly on Henningham 1995: 3):

> An institution is a persistent, at least partially predictable arrangement, law, process, custom or organisation serving to structure aspects of the political, social, cultural or economic transactions and relationships in a society. They allow organised and collective efforts toward common concerns and the achievement of goals. Although by definition persistent, institutions constantly evolve.

It is important, though, for use of the term to be clear about what kind of institution is being referred to; that is, it is insufficient for a research project to talk of 'investigating the institutional environment', without saying what this actually means. We may talk of informal social institutions at a local scale, institutions of the market of many kinds, legal institutions (common or statute law) with a great variety of purposes (courts, planning laws, etc.), persistent public agencies (departments, commissions, etc), informational/commercial institutions such as the media, cultural institutions across a wide range such as sport or arts, political institutions (parliaments, ministerial councils—see Box 7.1), and so on. As with 'policy', much improvement in the connection between R&D and policy and management outcomes might flow from the discipline demanded by greater precision.

From a public policy perspective, and from that of ESD/NRM, institutions can be three things: a filter of, or barrier to policy and management change in that they structure society in certain ways; are in themselves an agent of change in some cases; and are also a policy instrument (institutional reform). Two approaches exist: negatively, to assess institutional barriers to change (perverse market incentives, conflicting regulations, organisational inadequacies, etc.), or, positively, to design better institutions to enable or encourage change. The first approach relates to element 7 in Box 7.2, and instrument class 14 in Box 7.3, is a common focus in policy analysis, and impinges quickly on policy fields other than NRM (and see Farrier and Lockwood, this volume).

The second approach—designing and creating improved institutional arrangements *within* the NRM field—would seem to offer much scope for LWRRDC and its stakeholders. Institutions are, if nothing else, products of their history (Goodin 1996), and it is therefore likely that the existing institutional setting of NRM, despite recent changes, will in many ways owe more to past understanding and imperatives than to present needs or likely future demands. This suggests the validity of exploring institutional design, in theoretically and conceptually sound ways but with a close eye to the particulars of Australian NRM contexts. Also, we less often create new institutions than redesign and redirect existing ones, and must keep in mind the normal parameters of governance (a good reality check on institutional reform suggestions is whether it would be constitutionally possible, or whether an equivalent exists in some comparable policy field). This is not to say that critical questioning of the normal parameters of governance is not a useful thing to do, but that it needs to always be explicit that this is what is being done, and why.

To assess existing institutions and to suggest new arrangements, the research task, then, is to seek 'design rules' or guidelines. What makes for a 'good' institution, keeping in mind the adaptive approach advocated here? The literature on institutions is both large and inconclusive, at least in terms of principles for reform and design. One iteration of generally-stated 'design principles' for good institutions is (Goodin 1996):

- revisability; or being capable of change
- robustness; but not being liable to change too swiftly or unthinkingly
- recognition of and sensitivity to complexity in motivations of individuals and groups being publicly defensible
- variability; or being able to experiment with different structures in different places.

These are good enough as general rules. It is further proposed that an effective institution fits well into its operating environment. This is intuitively obvious, but somewhat problematic if the point of institutional reform is to positively change the operating environment, as is the case with furthering the goals of ESD and NRM. Another design point is that the 'software' of institutional arrangements (people, culture, community acceptance, information, etc.) is as important as the 'hardware' (organisations, laws,

facilities, etc.), and a failure to balance these may lead to institutional failure (Dryzek 1996). Thus, the imposition of an institutional arrangement will work only if it 'suits' the people, the politics and the place in a given context.

The following 'attributes' of institutions provide some basis for unpacking the notion a little more, and for connecting R&D with potential institutional improvement (from Dovers and Mobbs 1997):[37]

- extent or limits in geographical space (spatial scale)
- jurisdictional, political and administrative boundaries
- degree of permanence and longevity
- intended or actual roles (informational, cultural, legal, economic, etc.)
- sectoral or issue coverage/focus
- nature and source of aims and mandate (in custom, or statute or common law)
- degree of autonomy
- accountability (how, to whom)
- formality or informality of operation
- political nature and support (actual, required)
- exclusiveness/inclusiveness (membership, representativeness)
- degree of community awareness and acceptance
- degree of functional and organisational flexibility
- resourcing requirements (financial, human, material)
- information requirements (internal, external)
- reliance on and linkages with other institutions.

This provides a foundation for thinking more clearly about the strengths and weaknesses of present institutions and the desirable features of refashioned or new ones. (See also the consultancy reports undertaken on institutional, legislative, etc. aspects of coastal zone management for the Resource Assessment Commission (RAC 1993).) As with policy, this greater detail does not make the task easier—quite the reverse, as each attribute opens up a potentially complex area of debate and analysis and begs an array of skills and perspectives. But it opens the possibility of being more specific and useful when we propose investigating 'institutional failure' or of needing 'new institutional arrangements'. There is endless scope for sorting through the 'attributes' listed above across the countless institutional arrangements and substantial problems in natural resource management. This consultancy will offer some possibilities, but as with all future directions this area will require discussion amongst stakeholders to isolate those more specific ones felt to gain best purchase on achieving sustainable NRM.

To indicate the potential further, speculatively and at a coarse scale, we can consider more closely the attributes that adaptive institutions might possess. I would propose that some Australian resource management institutions and organisations have, in various ways, evidenced an ability to move forward in their particular areas in a way consistent, at least in part, with the imperatives on policy ('APIM') stated earlier. These include the: Murray–Darling Basin arrangements; Great Barrier Reef Marine Park Authority; Resource Assessment Commission; Land and Water Resources Research and Development Corporation; Victoria's Land Conservation Council; and parliamentary committees in some circumstances. These have certainly not 'fixed' their problems, but they are believable institutional attempts, and so should offer some guidance. There are other possible examples, perhaps less positive, but *all* experiences will have merit as cases to examine—perfect institutional success and complete institutional failure will never occur. Other, newer institutions and organisations may, in time, prove worthy of closer examination (eg. in Victoria the new Catchment Management Authorities, in NSW the Resource and Conservation Assessment Council, and in Tasmania the Public Land Use Commission), and we should maintain a watching brief. Also, many shorter term processes could yield lessons, although in a different way given their more limited nature (eg. the ESD process, RFAs, etc). Critical, consistent, comparative analysis of past and present experiences with institutions and policy processes is a significant gap in the theory and practice of resource and environmental policy and management in this country. Several features are evident across the examples named above—no one case displays them all—and these can be proposed as, if not design rules, then at least as general features of institutions that can support a more adaptive approach, and thus warrant further investigation:

- sufficient longevity and continuity (to experiment, adapt and learn);
- sufficient resources (human, financial, informational);
- a statutory base providing transparent and accountable processes, and a higher probability of persistence;
- integration of research and policy foci and/or roles;

[37] Again, institutions and organisations are being conflated to some extent.

- a degree of applied or grounded focus (region, sector, specific problem)
- cross-sectoral and cross-problem mandate, and thus;
- some ability for comparative analysis (concurrent and/or sequential);
- a clear, predictable and maintained participatory structure and approach to investigation;
- mandate and ability to experiment with approaches, methodologies and instruments, and to move across professional and disciplinary boundaries; and
- political context favouring establishment and continued operation.

Some of these are obvious enough, others less so. Taken together, they provide some basis for thinking about the shape of future institutional arrangements at a number of scales. Some aspects have had insufficient attention in the past, in an institutional and policy process design sense. These are: further exploration and testing of these sorts of features through comparative analysis of processes and institutions; comparative analysis of operation of policy instruments and methodologies under different conditions, and especially across natural resource management sectors; community participation (levels, kinds, purposes) and the institutional and other requirements for it; the role of statute law in enabling adaptive institutions and processes; and the implications of marketisation on policy and institutional capacities. This sort of sketch analysis could and should be furthered in Australia, and possibly extended through international examples.

7.8 The problem of missing meta-arrangements

Thus far, although referring to the broader field of ESD, this paper has dealt largely with LWRRDC's role. It is important to note, however, that there are deficiencies across the many sectors, institutions and jurisdictions relevant to ESD, and that LWRRDC should never be expected to attend to these. The brevity of the following discussion should not discount the crucial importance of this issue (the arguments are detailed in Dovers (1995a) and Dovers and Gullett (in press)).

ESD in Australia is, institutionally speaking, fragmented and weak. Although given high priority rhetorically, the consolidation of ESD in policy processes, information systems and institutions has been less than generally deemed necessary. So, the R&D issues for LWRRDC dealt with in this consultancy echo much more widely and strongly across the policy field in which it is only one player. While much research and policy development and analysis is occurring, it too often is scattered, specific and not widely communicated outside a particular sector or agency. LWRRDC is a case in point; while it provides a point of coordination and linkage, there are many other players and communication and coordination is a constant problem (eg. nationally, MDBC, GBRMPA, Environment Australia, ABARE, BRS, other RDCs, and so on). Should LWRRDC involve itself more in ESD/NRM policy R&D, there would be a clear case for saying that others should be doing so as well, or that a larger 'meta-arrangement' or mechanism is justified. The integrative nature of ESD is part of the problem, as we are still trying to figure how it can fit into a political and public administration system structured around sectors and traditional functions. The need for more coherent national institutional arrangements has been expressed from the early 1980s (World Conservation Strategy and National Conservation Strategy for Australia) through to and beyond UNCED. The ESD process recommended a number of mechanisms in this regard, but these were not pursued. The lack of whole-field and national coordination, communication and coherence is increasingly felt (stressing that national coherence does not mean federal power).[38] Publication of a thorough review of the ESD process and its implementation, including a study of institutionalisation, is imminent (Hamilton and Throsby 1998).

It is not the case that this is an unreasonable hope, as other policy fields do, to greater and lesser extents, enjoy institutional arrangements providing such coherence. By simple analogy with other, supposedly comparable, diffuse fields of public policy, we can point to some possibilities. Public health has the Australian Institute of Health and Welfare and the National Health and Medical Research Council; economic policy has the Productivity Commission and other institutions;[39] emergency management (a cognate policy field, I argue) has Emergency Management Australia and the Australian Institute of Emergency Management.

There is an arguable case that ESD/NRM does not enjoy the degree of institutional and informational parity with other policy imperatives (especially

38. It is understood that the primary industries portfolio is undertaking the task of preparing an NRM policy, but the process for this is not known.

39. The recently issued PC brief on reviewing ESD implementation says two things: first, there was not a more appropriate institution; and, second, the review is of implementation by Commonwealth *agencies*, not the Commonwealth itself, and so may not focus on the meta-arrangements required.

economic) that statements in international and national policy would suggest it deserves. This is not necessarily intentional, but rather an expectable result of its relatively recent appearance on the policy agenda, and the fact that institutions reflect the past rather than the present. Two questions, and therefore R&D possibilities, arise from this: why this is the case; and what might be done to improve matters.

7.9 Research directions

The preceding material has offered a sketch of the policy and institutional research field; others could be painted. In terms of general directions for research encouraged or supported by LWRRDC, some key points emerge, as well as some more specific possibilities. The key points revolve around the Corporation's need (in my view, at least) not to be concerned with theoretical and methodological development in policy and institutional research per se, although this should result as an important benefit, but rather with R&D that encourages actual or describes potential improvements in policy and institutional settings for NRM. The perspective sketched above—adaptive policy, institutions and management (APIM)—is one way of articulating this need, but others may propose variants or alternatives of possible value and this should be encouraged.

What has been discussed and argued thus far can be now brought together in three ways. First, a set of questions is proposed to assist assessing research propositions. Second, consideration is given to major policy trends worthy of attentions for their implications. Third, some illustrative research possibilities are summarised.

The key points can be phrased as questions to be asked of research propositions.

- What is the theoretical, conceptual and/or methodological basis of the research (whether existing, proven, proposed, innovative), and why is it suited to the policy and institutional problems in question?
- Is the implicit or explicit statement of the policy or institutional problem to be addressed precise with respect to the detail of policy processes and institutional arrangements; ie. what *particular parts* of these are important, and why?
- Does the policy or institutional problem constructed and addressed exist across a sufficiently wide number of contexts (sectors, jurisdictions, places), or is the policy instrument or institutional issue of sufficient 'systemic' potential, so that research outcomes will be of wider relevance?
- Are clear connections made between the R&D proposed, and the loci of decision or policy-making responsibility in the institutional, policy and statutory setting (eg. do the stakeholders identified include those who have responsibility for implementation or communication of the outcomes)? Further, does the definition of the *research* problem translate to a coherent *policy* problem?
- Is the research approach suitable and relevant to: the particular attributes of policy problems in ESD/NRM; and the peculiarities of the Australian context in terms of substantive issues and political and administrative arrangements?
- If the research involves comparative policy or institutional analysis, what is the basis of the comparison (political/administrative/legal similarities, similar biophysical problems, etc)? If not comparable, to which other context is it deemed applicable, and on what basis is this judged?
- To what extent is the research proactive/ prescriptive in the sense of enabling better policy and institutional performance in future; what likely ongoing needs will it propose or address, and, if retrospective, how will examination of past events or arrangements contribute to future demands?
- Does the research team include expertise appropriate to the policy and institutional tasks included in the research or, if not, is adequate connection made so that outcomes can be properly interpreted in a policy and institutional sense? (Note: 'appropriate expertise' does not necessarily mean a 'correct' disciplinary background, for example a natural scientist may evidence methodological coherence through past work or through answers to the preceding questions.)
- Especially, but not only, in the case of interdisciplinary R&D (hopefully the most common category), has there been a reconciliation of different scales of attention and analysis—ecological, geographical, political, administrative, cultural?

These questions permit a wide range of approaches, but serve to enable the greater precision in research objectives and intent that is needed. The checklists and other descriptions of 'policy' and 'institutions' above, and the proposed preconditions of APIM given earlier, add detail to these general questions. In particular, research must show connection with:

- *existing or reasonably imagined political, institutional, administrative and legal*

arrangements (ie. be within normal parameters of governance); a wide menu of possible policy approaches and instruments; and a practically defined policy or management problem of broad relevance.

This is a basis for extending the current 'template' used by LWRRDC to assess research possibilities, making it more operational at finer resolutions when considering policy and institutional research.

In proposing proactive approaches relevant to future needs, the problem emerges of predicting future trends and needs; an area this paper will not go into. This should be the subject of a broader debate, including a range of interests.[40] Rather, we can start by proposing that some major current trends or factors will continue to be important for some time yet, whether in an active sense, or in terms of sorting through the implications of what has already happened.

- First, we must assume that ESD/NRM issues continue to attract sufficient public and political concern to warrant ongoing attention, and that we continue to find the policy and institutional dimensions of these difficult to resolve (the experience of the past two decades suggests that the latter assumption is reasonably safe).
- Demands for community participation in ESD/NRM policy and management are likely to continue, and probably intensify. While considerable research has been undertaken in this area, it is not apparent that much overall strategic organisation of this has occurred. Also, the very rapid growth in community-based programs follows no apparent coherent design or intent, and provides an endless supply of case study opportunities. Care would be needed to design research and monitoring in this field in a strategic manner. In the sense of APIM, there are many questions now emerging and begging inquiry, especially in exploring different forms of participation for different purposes and contexts and the requirements for supporting these (see Dovers 1998). From a policy and institutional perspective, two broad approaches exist: from the 'top down', as an issue of policy instrument choice (what type of participation for what purposes), or from the bottom up, as a question of the creation of social institutions driven by community need but assisted and supported by government (through statutory underpinning or resources, etc). Another approach is descriptive and analytical, and combines these two, in seeking to describe and interpret, as lessons, those arrangements currently in place.
- Information technology will doubtless be increasingly applied to NRM problems, with a range of implications potentially both positive and negative (eg. Healy and Ascher 1995). Potential research areas include the potential biases and access closures involved in reliance on computer-based systems in informing NRM and related policy (eg. Wong 1997), archiving and data stream continuity problems, the role of IT in human communication, and integration of social, environmental and economic data in complex spatial and temporal frameworks and modelling and how this relates to human decision making situations.
- Policy and decision-making and community planning will always have to be made under conditions of often radical uncertainty, and the development, comparison and testing of techniques and approaches in this regard remains a major frontier (eg. ASTEC 1996). Comparative analysis would seem to offer the most, as there is a wealth of possible techniques available (see Dovers *et al.* 1996) but too often only one technique (adjusted BCA, risk assessment, negotiation, application of the precautionary principle, etc) is proposed or tested at a time. Further exploration of the kinds and degrees of risk and uncertainty affecting NRM, and attitudes towards this, is warranted, as well as examination of methodological options. It is pertinent to ask whether scientific uncertainty (missing knowledge) is the most important form of uncertainty, or whether other forms—presumed irrelevance, taboo, distortion, confusion, etc—are in fact more crucial in obstructing sustainable resource management.[41]
- The reform and rearrangement of public sector institutions and activities informed by market principles and property rights approaches—marketisation—is a major structuring trend across all areas of public policy. Marketisation flows from a neo-liberal political stance, and manifests as outsourcing, downsizing, corporatisation, privatisation, pricing public goods, and so on, and has been most clearly evident in the English-speaking world (including Australia) (Castles 1990; Bell 1997; Orchard 1998). Marketisation applies both in the sense of the wider application of economic instruments, and also the implications of marketised institutions in NRM

[40] The sort of discussion a Commission for the Future could have capably enabled, but that is another 'informed, inclusive, adaptive' national organisation given too short a life.

[41] Smithson's (1989) linguistically and philosophically based taxonomy of ignorance is recommended, but there are many others (see Dovers and Handmer 1995).

and the fate of non-core or non-market functions such as cross-catchment or sector integration, community involvement or environmental monitoring. This connection between instrumental and institutional aspects of marketisation is important both conceptually and practically (Dovers and Gullett , in press). Even if the trend of marketisation over the last fifteen years does not continue, there has been sufficient institutional and policy change of long-term import to demand close attention to this in future. The forthcoming report of the CSIRO/LWRRDC workshop 'Integrating economics and social science' makes particular research recommendations regarding the water sector.[42] These, along with directions emerging from the LWRRDC-supported work in marketised water management systems, provide directions. Importantly, though, such work could be extended through comparison with other marketised sectors—fisheries and electricity are obvious choices—and through more attention to the NRM impacts of institutional change *within* relevant parts of the public sector. If the marketisation trend continues, attention to deficiencies or strengths of existing regulatory frameworks now may usefully inform future statutory and institutional design, especially in terms of clarifying and codifying community service and environmental obligations.[43]

- At a broader scale, trade liberalisation and globalisation, like marketisation in the domestic sense, even if not continuing has already wrought sufficient change to demand attention in the medium-term. Forecasting the impacts of changing trade flows (including possible non-trade barriers) on both private and public NRM capacities in major production sectors is an area of potential research.

- There is likely to be increasing interest in the role of statute law in NRM, not in the strict 'regulatory' sense, but particularly in structuring ongoing capacities and processes to enable APIM (it is likely, as Iles (1996) proposes, that an adaptive approach would demand markedly different environmental laws). (See Farrier's paper, this volume.) Further, one can predict that the implications of codifying ESD principles as statutory object in some law will be increasingly noticed, and begs analysis of how these have been stated in law and interpreted by courts and policy-makers.

- New or re-fashioned institutional arrangements and policy processes will continue to be experimented with, at a variety scales, in all likelihood (on past evidence) in the absence of structured learning from past or current experience (adhocery and amnesia). In learning from what has already been done, special attention to variation in implementation and style across jurisdictions and sectors is crucial. Research in this area will need to be clear about what is being investigated; simplistic searches for easily transferable 'blueprints' of processes and institutions for application elsewhere should be avoided, and advocacy of such blueprints viewed with scepticism. Most processes and institutions are the product of a unique context in time and place, and cannot be simply transposed. Rather, a more sensitive and finer scale mode of inquiry will be needed, looking at the detail of attributes, features or methods used. Another process or institution may seem irrelevant to that being contemplated or designed, but certain things it did might be much more relevant—a particular instrument, a way of creating communication channels, a mode of participation, codification of principles and creation of process in statute law, etc. Most cases can yield useable lessons both positive and negative, and the challenge is to build up a stock of these from across our collective experience, and apply these in various combinations to answer future needs. The discussion above of APIM, policy and institutions provides some detail on this. Comparative analysis of policy processes and institutions could be mounted at a number of scales, and range from modest, tightly targeted projects to much more comprehensive ones. Analysis might focus within Australia, or elsewhere, or both.

- As a subset of the preceding area, comparative policy instrument analysis is one area where skills could be better developed, and lessons accrued from existing experiences. This can and should cut *across* as well as *within* instrument classes, and would benefit from application of a consistent set of criteria for assessment (both pre- and post-implementation) across research projects. The menu of instruments and criteria in Box 7.3, explored across instances of application, provides a basis for exploring this.

- Finally, the continued negotiation of (and probably increase in) local government roles in ESD/NRM can be expected to continue. This involves a balance between appropriate

42. Incidentally, the title of the report suggests that economics is not a social science, which it is, but perhaps the features and prominent position of economics demand such a separation?

43. This is an issue emerging with respect to competition policy, see Cater (1997) and House of Representative Standing Committee on Financial Institutions and Public Administration (1997).

devolution of responsibility, and the casting off of state responsibilities with insufficient resources to meet these responsibilities.

Strategies for R&D

The above open up a large scope for research, and although a few more specific suggestion are made below, it is important that the range of more-specific possibilities considered by LWRRDC be informed by the Corporation's board, stakeholders in the field, researchers active in the area already, and newer entrants to this research field possible attracted by LWRRDC's future emphasis (if it indeed decides on such an emphasis). There is overlap across the above, and research projects could address more than one with careful design, or with firm encouragement from LWRRDC. For example, social institutional questions may be investigated with particular reference to community participation *and* the use of information technologies, or research into the impacts of marketisation could look at implications for public engagement (citizens or consumers?) *and* the continuity of data streams in processes and institutions.

Strategic choices will need to be made, choosing a mix of R&D aiming to further develop methods in a broader NRM sense, to explicate more specific contexts (applied research), and to describe and communicate the policy and institutional landscape (further developing a 'language' and furthering resource and environmental 'civics'). All three are necessary, and are not necessarily mutually exclusive in any one project. The perception of stakeholders across a range of regions, sectors and substantive issues will be critical to isolating those potential projects with the most wide applicability (common instruments, institutional challenges, information needs, methodological weaknesses, etc). Important also is choosing between R&D aimed at informing sustainable management in a practical or exact fashion, and that likely to be informing in an heuristic or general fashion. LWRRDC's mission would suggest favouring the former, but the usefulness of the latter should not be discounted in appropriate circumstances. For example, a contestable non-market valuation may not precisely inform policy choice, but may have an influence of perceptions in the policy debate by assigning importance to an otherwise overlooked asset. Similarly, ideas rather than numbers can be highly influential when well-argued and promulgated at the right time.

This suggests a multiple approach to achieving policy-related R&D objectives on the part of LWRRDC. A few summary points below expose some of the issues here as they arise from the discussion so far:

- *Mode of supporting R&D.* Accepting that the total investment in this area will not be large, the organisational issues associated with delivery are important. For the policy and institutional area, it would seem that creation of a separate mechanism for 'non-biophysical' research has as many dangers as inserting policy-related research within existing, commissioned program areas. Separating policy and biophysical research reinforces an unfortunately common split, while inserting policy concerns into specific programs misses the opportunities of more generally focused research. A strategic mix is optimal. Clearly defined and articulated criteria for policy-related research in a separate portfolio can be linked to and inform the encouragement of increased policy relevance of research within programs. Both would need to apply an improved and specific policy and institutional 'language'; the former seeking R&D exploring more generic methods and applications (across a number of sectors, programs and problems), and the latter seeking to match this with encouraging better linkage with policy and institutional loci of responsibility in more specific areas. A balance between general call and commissioned research is needed. The more open potential of general calls for research is valuable, although more detailed instruction from the Corporation might be advisable—not in terms of *what* research topics, but regarding rather the *style* of approaches and policy connections desired (as argued for in this paper). Leveraging maximum returns from R&D investment may be achieved through investing smaller sums in exploratory research—proposing new methodologies or reviewing areas—as a precursor to larger investments should such prove encouraging. This reflects existing LWRRDC practice, but in a different field. Some social science may be relatively cheap in this regard (eg. consolidating reviews), whereas in other cases is will not be (eg. substantial institutional analysis, or that involving fieldwork). Thought should be given to the process of grant applications and assessment, with possibilities for additional negotiation mechanisms between application and acceptance allowing recasting of research proposals (both largely social science and largely biophysical science-based) to improve the 'policy purchase', or to include extra disciplinary skills in cases where the research indicates potential policy lessons but where these do not seem likely to be maximised in a proposal as it stands. Such negotiation may include the possible provision of modest extra resources to enable inclusion of other disciplinary inputs to a project. Partnerships with ESD/NRM research agencies in other sectors

are attractive, but in a policy sense this should be pursued where common policy problem or institutional attributes of generic applicability can be explored rather than more applied connections within one program or sector. Joint projects and partnerships, as already supported by LWRRDC, tend to be targeted quite specifically, with fewer partnerships developed at more generic, cross-sectoral or problem level.

- *Developing connections and widening the researcher 'catchment'*. Some major disciplines have only tentative and early connection with ESD as a field of concern, and often far less with substantive NRM issues. If LWRRDC moves more into policy and institutional research, then expanding the catchment of available research expertise is an attractive option; that is, to explore ways of attracting the attention of more researchers in, say, public policy or public administration than are engaged already. This may be done, initially at least, through connections with established professional and academic bodies in these fields. This also invites consideration of science-policy linkages and improving the relevance of biophysical research in the main natural sciences, through encouraging attention to policy questions in scientific research (eg. the Ecological Society of Australia now often has policy-related plenary sessions in its annual conferences, and such events represent an opportunity for dialogue and increased mutual understanding). At the broadest level, the three Academies (Science, Social Sciences, Humanities) may be useful points of contact and communication.
- *Growing the population of researchers*. It is apparent that the ESD/NRM field is not well served in terms of human resources—mostly due to its relatively recent emergence. This is particularly the case in relation to policy and institutional areas, and may warrant attention. Building connections with main disciplines would attend to this to some extent (and note that the Academy of Social Sciences (1998) warns of a declining strength in younger social science researchers across many social sciences). Funding research scholarships, as LWRRDC does already, is another way, with three advantages: building the human capital in NRM research; cost-effectiveness (compared with other options); and the ability for detailed and often innovate research requiring three-four years of intensive effort. More, and more targeted, scholarships might be entertained.
- *Linkages with cognate policy fields*. While this paper has argued that many approaches from other policy fields may have limited purchase on substantive NRM problems, this is of course not a rule. There may be benefit in considering processes and mechanisms whereby linkages with cognate policy fields can be developed, for both practical and methodological purposes. Cognate fields means areas where similar issues or problems may be encountered (time scales, information processing issues, community involvement, cross-jurisdictional problems, etc.). Two areas come to mind: public health (already some linkages exist through environmental health), and especially emergency management (see linkages proposed in Dovers 1998).
- *Communicating outcomes and developing a literature*. The available literature on NRM is scattered, fragmented and too often 'grey'—academically, professionally, and for stakeholders. LWRRDC's record in making research outcomes available is admirable, but it remains the case that much research is only communicated to a small set of researchers and some immediately concerned managers and stakeholders. It seems that some LWRRDC projects have not communicated findings much beyond a workshop and conference paper or so. This is of concern for implementation, for methodological development and for the creation of an ongoing academic and applied body of knowledge in the long term. Encouraging better communication from individual projects is one option (not an easy one), and widely communicating what research is being done is another (ARRIP serves a useful purpose in this sense). But thought may be given to mechanisms whereby research outcomes are 'mainstreamed'. Linkages with main disciplines and professions may be explored in this sense (conference symposia on NRM issues, or special issues of journal or bulletins, etc). This does, though, beg the question of the meta-arrangements across the ESD field.

  In terms of communicating R&D outcomes to the broader community of stakeholders, quite different considerations arise that are beyond the scope of this paper. It should be kept in mind, though, that policy-related research will require perhaps quite different thinking as to the media and channels through which research outcomes can be put before the non-affiliated or less directly involved stakeholders in NRM.
- *Initiating attention to the lack of meta-arrangements*. LWRRDC may wish to consider taking a role in initiating a dialogue on the need for meta-arrangements for policy and institutional

research and (perhaps) development across the broader ESD field, as discussed above. However, clearly this is the responsibility of many other agencies as well.

Research possibilities

On the basis of the preceding, the following briefly proposes a small number of research undertakings consistent with the notion of APIM and related discussions in this paper. These are not meant at this stage to be in any way a complete menu in terms of coverage, but rather illustrative of the type of R&D possible. LWRRDC should be able to identify a range of other agencies as appropriate partners in some of these projects.

- Comparative institutional analysis of catchment management arrangements, as already promoted as an R&D priority, informed by the detail of institutions given above. While reviews of catchment management arrangements have been done in recent years, the aim here would be to compare across state jurisdictions with a view to assessing the potential of different regimes (and, importantly, *aspects thereof*) to meet the requirements of APIM or a similar approach.
- Other comparative analyses of NRM policy processes and institutional arrangements might be invited or encouraged. The coverage and scale of these needs careful thought, and input from stakeholders. Broad-brush overviews across the ESD/NRM field are possible and potentially informing, as are more focused projects examining, say, local government administrative structures (a highly variable area), State administrative and portfolio arrangements, or the (actual or potential) role of statute law in creating and maintaining adaptive institutions and processes. (Note: research focused on institutions should be viewed as inevitably interdisciplinary, and this regarded as an attractive feature.)
- Regarding the point above, the experience with and efficacy of 'super-departments' in the resource and environmental area would be worthy of examination, given the fact that, across Australian jurisdictions, nearly every possible portfolio and departmental combination of agriculture, conservation, natural resources, land management and environment has been tried. What configurations have been tried, what problems have been encountered, are particular arrangements successful, etc? Attached to this can be the question of the efficacy of different experiences of the department–statutory authority division in public administration.
- Examining the role of IT-based or orientated methods in informing community-based resource management arrangements, particularly in terms of stakeholder understanding of, and access to the technology (and its assumptions and function), and relationship to other, more traditional information and communication processes.
- A review of possible 'meta-arrangements' to encourage more cohesion and coordination across the ESD/NRM field, in terms of information, communication, methodological development, and comparative policy and management analysis. This would involve a review of existing arrangements (including, perhaps, examination of arrangements in other policy fields and in comparable countries),[44] survey of proposals for reforms and initiatives in this area, and development of broad options.
- Investigate capacities, methods and arrangements for enhancing policy monitoring and learning, especially across sectors, jurisdictions and problems.
- Development of a typology of forms of community participation in NRM (and possibly other areas in the ESD field). This could result from a review and survey of past and current policy programs and management arrangements, with a strong analytical element aimed at producing a conceptually coherent typology of participation, and the development of a more sophisticated understanding of the requirements for maintained and resilient participation under different conditions.
- A straightforward descriptive project mapping out, in accessible terms, the policy processes and institutional arrangements relevant to NRM. The aim of this would be to communicate the 'policy landscape' to stakeholders, to managers, and to researchers wishing to connect more closely with policy. At present, a clear picture of this is difficult to obtain without reference to a wide and often not easily accessible literature. A particular challenge would be to mount such an undertaking in such a way that regular updates are possible, perhaps through electronic means (given the rapid change in arrangements, anything more than a year or two old is often inaccurate.
- Related to the above point, research is possible on where different NRM stakeholders get their information on policy and related matters—

44. On comparison, it may be that, rather than look to the politically comparable English-speaking world, insights could be sought from continental Europe in view of its increasingly close intergovernmental arrangements.

research publications, fact sheets, books, the rural press, other media, NGOs or government, newsletters? Of these, are there sources more trusted than others, and what information is needed or found wanting?

- Comparative policy instrument and institutional analysis of market mechanisms and/or marketised institutional arrangements across sectors related to ESD/NRM (eg. water, fisheries, electricity), ideally with extension to other policy fields (health, service delivery, etc). Connections between NRM aspects of marketisation and other areas are not well developed.[45] An underlying theme for exploration here is the issue of basic assumptions underpinning policy styles, especially the connection and/or tension between the logic of market-orientated policy approaches and a 'social response' model favouring community involvement (both being strongly apparent in ESD/NRM at present). A working hypothesis might be that social response and market approaches are not representative of different policy or political 'logics', but in fact are both manifestations of the neo-liberal political ideology which has shaped public policy so profoundly in the English-speaking world in the last two decades, albeit in conflict.[46]
- (Tentative and less defined). A broader comparative instrument analysis project, more in a review mode, to develop more detailed criteria for instrument choice as they apply under different conditions (political, sectoral, with respect to substantive problems, information environments, etc.). The aim here would be to better inform instrument choice in specific NRM contexts, but in a manner consistent across the field.

The above are only a sample of research possibilities, provided more to illustrate the kind of research that would be consistent with the discussion in this paper. For a larger menu, or a specific agenda based on prioritisation, it would be necessary for the general emphasis of this paper ('APIM') to be widely discussed and, if endorsed, for research directions and projects to be similarly canvassed.

45. A significant organisation in this regard is the Centre for Public Sector Research, University of NSW.

46. Questions regarding reliance on a social response model are surveyed in Woodhill (1996); marketisation is surveyed in Orchard (1998) and Dovers and Gullett (in press).

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Commentary on policy and institutional R&D paper

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The broad objectives of Stephen Dovers' paper are to focus on: adaptive policy, institutions and management; longer term, iterative, persistent and yet flexible approaches to replace policy adhocery and amnesia; and create a policy and institutional 'language' (eg. define the problem of 'policy and institutional failure'). This discussion is organised under five headings: accessibility and language; resistance to change; participation in decision making; policy; and the political process and the question of cynicism or trust.

Accessibility and language

If, and I think this is one of his aims, Dovers is endeavouring to simplify and render more accessible a vast amount of policy-related research, then this is a valuable exercise, particularly with respect to providing directions for LWRRDC. It is difficult to create a widely-accepted 'language'; very few have succeeded in doing this, but the idea of drawing together some of the key approaches for policy research is extremely useful as is the idea of providing checklists. Dovers and other consultants are either implicitly or explicitly addressing the question of accessibility of social science research and theorising. Much research is inaccessible because of: the style in which it is presented; the division of labour and self-referential character of academic and policy debates; and the lack of people who have the interest or capacity to bridge the gaps between (unnecessarily) complex theory and (translating this theory into) concepts that are useful to practitioners.

A further point on the question of language: you do, of course, occasionally get some very influential accounts which shape policy and/or public debate for long periods: Rachel Carson's *Silent Spring* (1962); Meadows *et al*., *The Limits to Growth* (1972); The World Commission on Environment and Development *Our Common Future* (1990); Ulrich Beck's *Risk Society* (1992).

As both Helen Ross and Stephen Dovers point out, it is characteristic of social scientists to subject any new language to challenge. There is also huge diversity as traditional approaches are challenged and not replaced by dominant alternative set of ideas. This suggests, however, the difficulty of making appropriate generalisations about approaches, methodologies, motivations and research endeavours. In considering the notion of 'policy and institutional failure' we are confronted by the enduring difficulty that these terms may be open to a range of interpretations. Such terms have been described as 'essentially contested concepts' (Gallie 1962; Connolly 1983).

One of the important developments of the past decade has been growing awareness of the problems associated with defining core concepts and hence boundaries of particular disciplines (see Papadakis 1998). This theme is also touched on by Helen Ross. Dovers points out that there is 'lack of available, uncontested research methods, policy instruments and management approaches'. However, this may suggest futility of efforts to find a common language. Rather, one may encourage plurality of approaches suggested by Ross. As Dovers points out, few people are qualified to cover comprehensively the question of policy and institutional issues across the variety of resource sectors and issues, contexts and places falling within LWRRDC's problem set. This is not really a problem, as the field in issue terms is too vast, as long as this is recognised. Although Dovers cites the complaint by Walker that there are 'no established methodologies', I would argue (along with Ross) that there exists a plurality of methods. Similarly, the range of relevant social and political science approaches is also highly diverse, something that Ross justifiably appears to welcome in her paper.

Resistance to change?

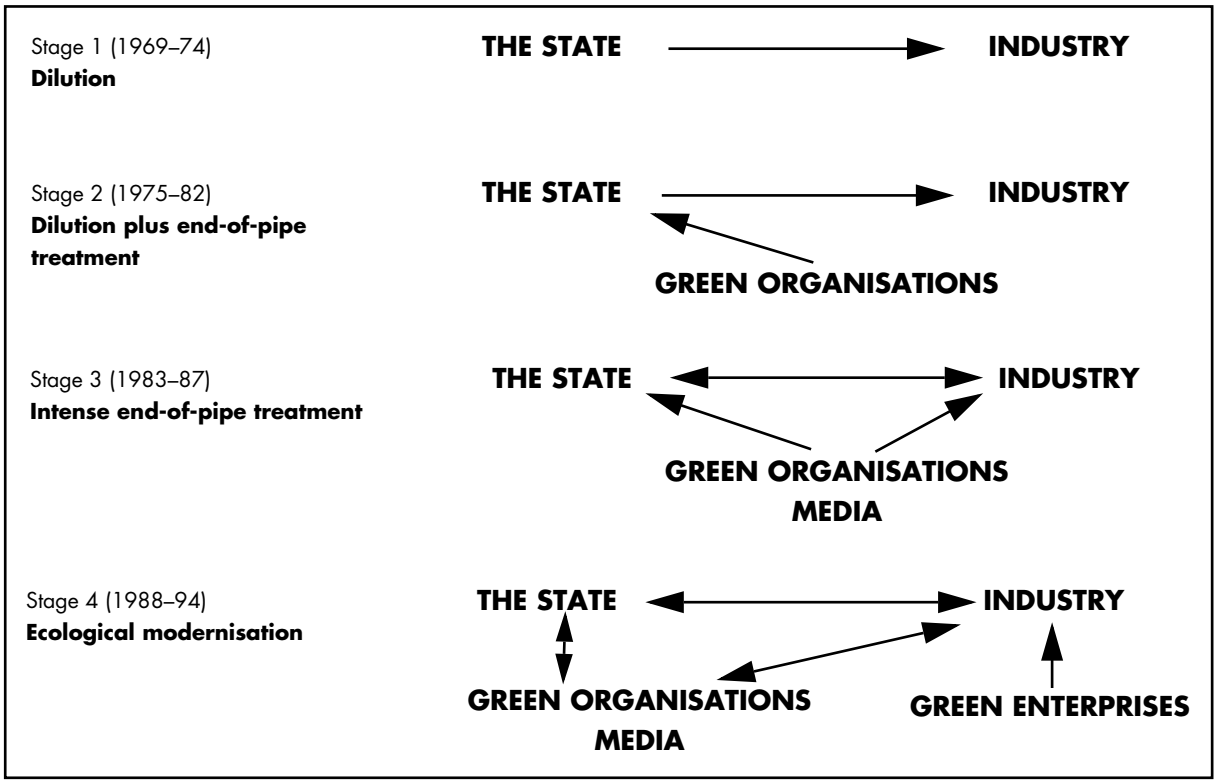
The pillars of Dovers' approach are purposefulness and persistence in long-term approaches, as well as adaptation. These proposals are welcome for many reasons including some of those outlined in his paper. As Dovers also argues, his proposed approach may suit "the nature of the problems", with "evident appeal to a range of players in resource and environmental policy and management". However, the question arises: why do they not feature regularly in policy and institution-building? In other words, we need to focus more on the *impediments* to successful long-term, iterative policy implementation and institution-building. As Dovers points out, "traditionally, many issues of environment and resource were dealt with separately and in a fairly reactive fashion". There are also several other considerations. These are covered in depth in Papadakis (1996). The table below, from this work, summarises some of these perspectives. The focus on innovation is perhaps most important in at least three respects: in ensuring that one way or another this planet remains habitable; in overcoming some of the inertia that is an inevitable part of institutional stability; and in enabling us to develop new perspectives.

The progression in ways of thinking about the capacity of institutions to tackle environmental problems can be summarised as in Figure 7.1 which describes the changes in 'paradigm and actor configuration' in a country like Germany. Martin Jänicke and Helmut Weidner analyse what they see as a four-stage process.

The responsiveness by government to new challenges

	Obstacles	Possibilities
1	Responsiveness mainly to crises	Responsiveness based on principles for long-term action (focus on consequences and on stewardship)
2	Inertia (tradition)	Adaptation (innovation)
3	Binary codes	Options and alternatives
4	Path dependence/evolution/circles of history	Design/new concepts
5	Excessive analysis (focus on what is and on behaviour)	Design and vision (focus on potential)
6	Self-referential systems/circularity of political communication/ the relative autonomy of politics/agenda-setting by elites	Dialogue between systems (trust, goodwill, competence)/ social communication/expert communities/social movements/ public opinion
7	Public opinion (top of the head) (possibilities for manipulation)	Public opinion (considered judgments) (possibilities for communication)

Figure 7.1 Changes of paradigm and actor configuration in Germany (from Jänicke and Weidner 1997).



The first stage 'dilutes the problem'. For instance, with air and water quality seen as the main problems, 'dilution of pollution was seen as the appropriate solution,' rendering it less visible, as in the use of high chimneys to disperse emissions (Jänicke and Weidner 1997:146). In stage two, nongovernment or green organisations lobbied the state or policy-makers, with the goal of preventing certain projects. They also insisted that governments introduce 'end-of-pipe treatments', and technologies to clean up the mess left by industry, power stations and cars. This approach was intensified in the 1980s with pressure by nongovernment organisations and green political organisations on industry as well as government. Green groups managed to mobilise the media in their favour. The same happened in Australia (see Papadakis 1996). The final phase is described as 'ecological modernisation'. Green political organisations became part of governing coalitions in the German states. They are now even part of a governing coalition at the federal level—a world first it would seem. In Germany, the spur to this final phase occurred after the Chernobyl nuclear disaster, and major pollution problems on the Rhine River. As Jänicke and Weidner (1997) point out, this is much more a period of dialogue between social actors, of regular contact between industry and nongovernment organisations, and numerous industry initiatives to improve the environmental suitability of its products. There is of course nothing inevitable about these stages, and as Dovers and others have pointed out, we may have slowed down considerably the progress associated with pathbreaking initiatives like ESD in Australia.

Dovers makes a good point that, contrary to perceptions by some that ESD is 'dead', the principles underpin policy in many domains. When the new Environment Protection and Biodiversity Conservation Bill 1998 was presented and read to the Senate it aimed to enshrine in legislation the promotion of ESD (s.1), outlining the principles of ESD (s.136), and requiring their consideration by the minister when dealing, for instance, with enforcement of conservation orders (s.465) (Papadakis 1999). Also, Dovers is correct to point to the fact that a great deal has occurred in the six years post-ESD and post-UNCED, though there is a long way to go in achieving targets in all kinds of major areas including greenhouse emissions, biodiversity, and sustainable consumption and production. As Dovers points out, achieving institutional change is difficult and takes time.

In that respect the work by Putnam (1993), which traces the institutional successes and failures of contemporary Italian government in the North and South of Italy to the formation of city states between 700 and 900 years ago is of interest. There is another aspect of Putnam's work that is of interest, particularly to the question raised by Dovers about

more inclusive and participatory forms of policy making ["wider inclusion of stakeholders, in a purposeful and structured fashion"]. I am referring here to the pivotal role of voluntary associations. During the twelfth century the focus of voluntary associations was on defence against aggressors; economic cooperation; and the enactment of laws. Now the notion of civic communities is pertinent to initiatives like Landcare as well as efforts to reclaim the urban environment (see Roddewig 1978).

As Dovers points out, concern about the environment appears to feature less prominently on the political agenda than economic or social policy issues. However, there is another way of looking at things. For instance, the notion of sustainable development represents an attempt to recast environmental concerns, and link them to economic and social considerations. There is another issue here as well—namely, the need to focus on precisely what are the obstacles preventing the environment from featuring high on the agenda and, perhaps more importantly, why the environment is seen as separate from economic and social concerns.

Dovers advances the 'APIM' framework. Much of this is prescriptive and clearly worth while. But, what are the obstacles? Dovers recognises that "APIM represents a departure from the way we often do things, and would be hard to 'do'". Again, it would be worth investigating why it represents such a radical departure. Moreover, he lists some of the daunting requirements that underpin his framework, for instance, participation in decision-making.

Participation in decision-making?

Take the focus on "democratised, open and accessible processes, with participation structured so as to be clear and to persist over time". For Noelle-Neumann (1984) and for other writers, one of the most perceptive observers of the process of public opinion was Alexis de Tocqueville, who focused, among other things, on the dangers of conformity arising out of the democratic French Revolution: "Dreading isolation more than error, they professed to share the sentiments of the majority" (Tocqueville, 1955: 155, cited by Noelle-Neumann 1984: 38). Moreover, as Ginsberg (1986: ix) notes: "In de Tocqueville's view, governmental responsiveness to opinion encouraged citizens to believe that the state was simply a servant to whom vast powers could safely be granted. As a result, be warned, it was the government that ruled *by* opinion that would ultimately rule absolutely". Or take the critique by Pierre Bourdieu (1979) of the concept of public opinion, and of three problematic assumptions:

- the notion that all individuals are capable of holding an opinion on a range of policy issues;
- the implication that the views of every respondent carry equal weight, in other words, have equal value; and
- because the polls used structured questions, the implication that there is a consensus about the nature of the problem that needs to be addressed.

One postmodernist critic, Limor Peer, argues that 'non-opinions' constitute a major problem for democratic institutions since "the democratic principle of self rule rests on the assumptions that all people have opinions, that they have the same value, and that they should be expressed and acted upon" (1992: 231). She also cites well-known experiments on the validity of survey research. In an experiment conducted in the 1970s people were asked whether the *Public Affairs Act 1975* should be repealed. Most respondents hadn't heard of the Act but about 33% did offer a response to this question. The researchers later revealed that this Act never existed. Their experiment showed, however, that up to a third of respondents to a survey have offered an opinion on a fictitious issue. In other words, people were asked a question about an issue that was fictitious and were still prepared to give a response (Bishop *et al*. 1980). The concern about non-opinions also arises from influential studies on the limitations of popular participation in decision-making that focus on the long-term instability of individual policy preferences over most issues (Converse 1964) and on the inability of the electorate "to judge the rationality of government actions" (Campbell *et al*. 1960: 543; see also Dye and Zeigler 1970).

However, criticisms of the inadequacy of survey research in capturing the *potential* state of opinions and the situation in which they are formed are useful, but do not negate the immense potential for formation of opinion on environmental issues and on policies to deal with them. Whatever our approach to implementing environmental policy, public opinion is likely to remain a crucial mechanism in the process. The identification of problems associated with the formation of public opinion can be used as a basis for highlighting the dangers of opinion polling in order better to understand the possibilities for heeding the judgment of citizens (see Yankelovich 1991 and the discussion of the relevance of his work to environmental issues in Papadakis 1996).

Dovers also cites the important work by writers like Giddens, Habermas and others on civil society. The important exercise will be, as he implies, to translate these new ways of understanding social change into specific frameworks for understanding and influencing shifts in policy and institutional practices.

Policy

Dovers's definition derived from work by Glyn Davis and his collaborators is certainly very valuable, as is the broad framework for state action presented in Box 7.1 of his paper. Similarly, I endorse his suggestion that we map out the terrain affecting ESD/NRM. In a recent collaborative venture with researchers covering institutions in about ten countries and the European Union, the following template was devised to address the question of 'Implementing Sustainable Development in High-Consumption Societies' (in the light of the UNCED process). The template (see Box 7.4) was developed by Lafferty and Meadowcroft (1999) to inform a forthcoming study.

Dovers refers to the importance of sensitivity to the 'loci of policy'. This is a pivotal consideration. What are the relationships between different agencies? More importantly, what is the logic underpinning the action of different actors (see Luhmann 1989, 1990)? Without understanding this, it is difficult to envision a constructive dialogue over environment and natural resource management issues. I would be more cautious about the suggestion by Dovers that we "frame research questions and projects around existing policy principles and goals" (see the earlier discussion of contested concepts). This potentially limits scope for asking new questions. Dovers suggests that ESD etc. "have been arrived at through some consultative and/or intergovernmental process". It is unclear how far this constitutes a sound basis for accepting principles, goals etc. There would still appear to be scope for contestation over the goals.

There is scope, and I think this arises in the paper by Ross, for 'monitoring' and trying to apply, and adapt new theories as they emerge to environmental and natural resource management issues. The focus on other countries could be extremely useful, even if we need to take into account the different institutional histories and patterns and contexts. There is a very useful section on enduring questions in policy analysis. The point about the dangers of too close an association with government is well-made.

It is difficult to arrive at a halfway position between 'rational–comprehensive' and 'incremental' approaches to policy, but 'purposeful incrementalism' sounds good. Does this imply long-term objectives with short-term benchmarks? Also, it is uncertain that managers can or do adhere to quite detailed and strict procedural frameworks. This requires further investigation, especially given the goals of an organisation like LWRRDC.

It is, as Dovers does, important to note that any model has a theoretical, conceptual or philosophical basis (even if not explicitly stated). This may also may undermine some of the claims about positivism. Even a descriptive, positivistic account makes (perhaps hidden) assumptions about what is worth studying (see also the paper by Ross, this volume).

The political process and the question of cynicism or trust

Dovers draws attention to the relationship between politics and the state. The dangers of cynical attitudes towards the state and politics are numerous. Recent research from the U.S. shows that there is a lack of correspondence between performance by the state and attitudes towards it (see Nye 1997: 10). Another consideration is that performance itself is difficult to evaluate, and findings are contradictory, with evidence of progress (Bok 1997: 61) and failure (Lawrence 1997: 131). Much of the evidence points to the importance of perceptions (subjective opinion) rather than a straightforward response to objective performance (Nye and Zelikow 1997: 256–7). Perceptions of what? The received wisdom and recent research points to several key factors that create distrust of governmental institutions, namely: perceptions of inefficiency and wastefulness; spending money on the wrong things, concessions to special interests; and politicians' lack of integrity (Blendon *et al*. 1997: 210; Lipset and Schneider 1983).

The other issue is that of the pivotal role of politics (Papadakis 1998). For Crick (1993: 21), politics is "the activity by which differing interests within a given unit of rule are conciliated by giving them a share in power in proportion to their importance to the welfare and survival of the whole community" . He devotes the largest portion of his work to defending politics against the alternative approaches. For instance, Crick takes issue with 'anti-political' socialists who treat everything 'as a matter of principle' and shun all compromises, which he regards as essential to political rule. In fact, one could develop an argument as to why compromise or 'pragmatism' itself reflects a principle. Crick therefore appears to take issue with approaches that undermine conciliation, rather than with principles per se. There is, however, another dimension to Crick's argument, one derived directly from Aristotle's idea that politics is 'the master-science'. This was not a claim that politics could 'explain' all the other sciences, but that "it was the one [science] that gave the others some reasonably acceptable mutual priority in their claims on the scarce resources of any known community" (Crick 1993: 164). The claim rests on an assumption that "the fundamental problem of society is that demands are infinite and resources are always limited" (Crick 1993: 164). In sum, decisions over the allocation of resources are 'ultimately political' and require the skill of conciliation between different interests in order to resolve them.

Box 7.4 Government response to UNCED (general case study):

(i) basic understanding and response:
How has the policy response been understood and what is it believed to entail?
How has the policy response been related to established normative principles and governmental and administrative priorities?
What are the dominant perceptions of how a policy is to be realised in the particular context—that is, ecological, economic, social, political, and cultural circumstances?
Has a strategy document been prepared? What are its key features? What is its status?

(ii) pattern of institutional engagement:
How has the commitment to the policy been institutionalised?
Has the commitment been formalised in legislative enactments?
To what extent have existing institutions actively taken up this theme?
Have new bodies or organisations been established?
What relationship exists between new mechanisms and established political structures?
What resources (political, financial, bureaucratic) have been devoted to implementing the policy?

(iii) measurement and monitoring:
What attitude has government taken on the issue of measuring and monitoring progress toward policy implementation?
Have initiatives been taken to devise sets of indicators to evaluate the 'sustainability' of existing practices and to monitor the impact of policy innovation on movement towards a sustainable development trajectory?
How are measures of environmental conditions, economic activity, and quality-of-life to be constituted and inter-related? Will indicators be aggregated or disaggregated? Expressed as physical or financial terms?

(iv) relationship between national and international responses and obligations:
How are national actions understood to relate to international objectives?
To what extent has government addressed issues the UNCED process defines as the specific responsibility of the North?
What has been the attitude towards relating national objectives to the behaviour of other parties (eg. 'lead from the front', 'wait for consensus', 'free-ride', etc.)?
What about development assistance? technology transfer? and other cooperative goals?

(v) relationship between central government and other actors (governmental and non-governmental)
How does central government understand its own initiatives in relation to participation by other layers of government and non-governmental actors in the process of engaging with the policy area?
How are policy-related linkages with other tiers of government being structured?
What approach is taken toward the mobilisation of 'major stakeholders' and popular participation? Are 'top-down' or 'bottom-up' approaches being favoured? Are the two dimensions being integrated?

(vi) sectoral responses (sub-cases):
Describe major initiatives and policies, institutional responsibilities, targets and objectives for each of the sectoral themes (eg. climate change, biodiversity etc.)

(vi) explanations for the observed performance in implementing policies:
Factors which contribute towards understanding the character and extent of the implementation effort:
the nature of commitment by political authorities to policy objectives
- orientation of public attitudes towards policy issues
- formulation of (clear and consistent) policy goals by policy implementers
- choice and mix of steering strategies designed to secure ends
- attitudes of significant organised interests
- background geo-political factors (geographic extent and population)
- structural/economic factors: relative sectoral significance (resource/industry/service balance); trading patterns; cyclical economic activity
- political system factors
- regulatory style, policy culture, etc.

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Part III Ways Forward

This part of the report synthesises main themes of the preceding material and suggests options for LWRRDC further investment in social and institutional R&D. It recommends that LWRRDC increase its support of social and institutional R&D, and presents options for targeting and organising this.

Given the potential size of this field, the aim is to offer directions that steer a path between strategic investments and interventions but still do justice to the breadth of possibilities. The intent is to offer a mix of near-term achievable initiatives, and some longer term processes, along with indications of where LWRRDC might operate essentially on its own initiative and alone, and where the input of other agencies and interests is not only desirable but clearly warranted. Some clear directions are recommended, but a variety of other options presented as well. What follows does not attempt to summarise all the issues and possibilities surveyed in the four commissioned papers in Part II, or in the background material covered in Part I—the commissioned papers, in particular, stand as original contributions in their own right and cannot be adequately reflected in summary. It is recommended that they be read by those wishing to comprehend this R&D field, and indeed that they be treated as partial introductions to large and complex literatures and areas of thought and practice.

It is important that the options presented here (and others that may be identified) are discussed fully by LWRRDC, its stakeholders and clients before commitment or investment. Given that the Corporation's investment in this field can only be partial and thus carefully strategic, understanding and ownership of the directions taken should be as full as possible.

8. Synthesis and Recommendations

8.1 Synthesis of the four papers

The four papers commissioned for this consultancy discuss R&D from the perspectives of social research, economics, law, and policy and institutional aspects. Central themes and points common to the papers, and which are generally confirmed by the literature and people consulted, are now summarised.

There is no doubt that the social and institutional (S&I) field is critically important to the achievement of sustainable NRM. It is widely accepted that the most crucial barriers to sustainable NRM are not scientific or technical, but rather social, institutional, political, economic and cultural. Without more attention to S&I issues, Australia will not be examining the *underlying* causes of unsustainable patterns of resource use. Few agencies are more suited to targeting these issues than LWRRDC. While less social science than natural science research has been undertaken on NRM issues, there is a enormous potential for both tried and innovative approaches and methodologies to be brought to bear.

However, the size of the field should not be underestimated—essentially, the terms of reference for this consultancy, and thus the scope of any program, spans the entirety of the social sciences and humanities as they might interact with resource and environmental policy and management. Clearly, a full engagement with this field could dwarf LWRRDC's

existing portfolio of R&D programs, and still be inadequate. Moreover, within the S&I field, there are most usually multiple methods and approaches that could be brought to bear on a particular problem, even from within one social science discipline. This can be seen as a problem, in that it forces choices across a wide range of possible ways of doing R&D, but also an opportunity for 'methodological pluralism' and learning from multiple perspectives. This will require careful program design, and conscious experimentation with different methodologies.

Moving further into the realm of S&I R&D will involve some degree of departure from the traditional approach which sees the process as the generation of 'answers' and the communication of these to decision and policy-makers ('positivism'). This will need to be seasoned by and blended with an appreciation of the value content of policy and social questions, the validity of different understandings and approaches, the need to engage in qualitative inquiry, and the rarity of unequivocal best options emerging from even the most thorough R&D.

Related to this, should it pursue S&I research more, LWRRDC will find itself with the danger of being associated with policy or value advocacy, a function which does not sit too well with the Corporation's mandate. This need not be a problem, if the clear aim of R&D is to: enrich the menu of options available to policy-makers rather than recommend particular instruments; analyse barriers to the effective implementation of existing policy goals; clearly align with the interests of bona fide stakeholder groups; and/or ensure that R&D has a sound basis in problem framing and methodology.

A guiding framework for LWRRDC's intervention in this area is the notion of *adaptive policy, institutional and management arrangements for sustainable NRM*, so that the building of longer term skills, capacities, options and arrangements in an informed and iterative fashion is seen as more important that the quick attempted resolution of near-term concerns. Not that the latter is unimportant, but R&D as a strategy is more suited to the former. Also, any R&D program should be adaptive in its own right, with careful planning over time to ensure integration and synergy across separate projects, an emphasis on building linkages both within and outside of NRM to enhance learning, and attention to communication of R&D outcomes.

LWRRDC has invested already in this area, and given the short time since S&I issues have been prioritised, the results are encouraging. However, there has not been much in the way of guidance or strategy so far, with the choice of R&D projects being largely determined by supply. Some areas, such as law, public administration and conflict resolution have received very little attention. A logic or guiding framework is clearly needed.

Given the size of the field and the shortage of resources, there are obvious and very strict limits to what can be expected. A strategic approach is thus required, encouraging a mixture of R&D directions delivered through a variety of mechanisms. The aim of such a strategic approach would be to intervene where there is a chance of greater policy or management 'leverage' for a given investment, or where the issues are generic or systemic to NRM in a number of categories. However, LWRRDC is only one agency involved in research and development on ESD/NRM. The S&I field opens up considerable opportunities for partnership and coordinated approaches, with individuals and groups both within and outside the NRM field. Indeed, although LWRRDC is particularly well placed and qualified to enter this area, a very clear responsibility lies on other agencies to also support an expanded focus.

Reviews initiated by LWRRDC of its own programs, and many other sources, have recognised that much NRM research remains focused on biophysical aspects of natural resource management when the nature of the issues to be addressed are well beyond the capacity of the technical or scientific solutions that this research formulates (see Part 1). Attending to the social and institutional dimensions of NRM problems involves the crucial shift of focus toward the *underlying* (indirect) rather than proximate causes of land, water and vegetation degradation—moving toward a more corrective than antidotal approach to the issues, and treating causes more than (or at least as well as) symptoms. However, given that LWRRDC cannot encompass all the areas of need, its engagement has to be carefully and strategically designed and focused. The task for the remainder of this part of the report is to discuss and identify options for this strategic intervention.

Before proceeding, the alternatives to further investment should be considered also. Given the size of the field, and the clear case that LWRRDC can only ever attend to part of it, excuses are available to leave things much as they are. There are already researchers active in this field operating in universities and elsewhere, often largely independent of external funding sources. Where external funding for S&I research does exist, it is often in the form of tightly defined consultancy work for specific agencies and their immediate policy agenda. Further, within government departments there are policy units who might see S&I research as their domain, and the required range of options put before decision-makers already through their efforts. LWRRDC has had some success already in supporting a relatively small amount of S&I R&D through general calls. If

LWRRDC does not support S&I R&D in a more substantive fashion (and if other agencies continue to give it a low priority), this R&D activity will continue at somewhere near the current level. (Although it may in fact diminish as research institutions face a range of external resourcing pressures.)

The problem for LWRRDC and its stakeholders with existing patterns of research is that they do not necessarily serve the goals of the Corporation. As pointed out in Part 2 of this report, much existing research does not have a strong purchase on resource and environment issues and, further, much deals with dimensions of NRM not particularly close to the pragmatic concerns of LWRRDC stakeholders (eg. environmental *politics* rather than policy analysis). As to the activities of government policy units with R&D responsibilities, there are five arguments that what is currently done at that level will not be sufficient. First, the difficulties encountered in resolving NRM problems to date suggest that existing capacities are not adequate. Second, government-based policy research and development in general does not engage stakeholders and the research community in the way in which many people would deem (correctly in our view) as absolutely necessary. Third, existing skills and expertise within agencies need to be supplemented with the expertise of people from a broader range of backgrounds so that the S&I dimensions of NRM can be taken on fully. Fourth, tightened budgets in recent years have seen less time and resources available for longer term policy research and development. Fifth, the very nature of government departments (and, for that matter, statutory authorities) may constrain the consideration of innovative approaches and methods (ie. ones potentially at odds with the policy preference of the moment), yet it is precisely such approaches that many stakeholders view as necessary to explore.

Consideration of the 'no' alternative thus strengthens the case for increased LWRRDC involvement in S&I research. Continuation of existing patterns of R&D, apart from being insufficient overall, will not address many issues with which the Corporation is most deeply concerned. So, the value of increased LWRRDC involvement in this area is that this R&D activity will increase, but more especially that more work will be done with closer relevance to issues of concern to LWRRDC and its stakeholders.

If LWRRDC does proceed, some resistance from stakeholders to increased investment may be encountered. In a recent assessment of the National Dryland Salinity Program (Hayes, 1997: 22), survey respondents when asked about preferred research interventions were least supportive of sociological research, and legal regulation of land use. In this consultancy, many people consulted were concerned that critical engagement with policy research would undermine LWRRDC's role in the government research community. To put across an S&I research agenda effectively will require a communication strategy and opportunities for stakeholder input as the portfolio evolves. This does not only apply externally, but within the Corporation as well, as it is internally that much of the effort will need to be made.

A central task in communicating the 'logic' of a portfolio of S&I R&D will be the articulation of the objective and principles underlying it.

8.2 Objectives and principles of an S&I program

Any enlarged investment by LWRRDC in this area needs to be based on a clear view of objectives and underlying principles. Curtis *et al* .(1998) discussed the need for an articulated 'program logic'. Such a 'logic' will ensure not only that directions and intent are understood, but also that any review of the program will be more useful. The following sketches and explains a draft set of guiding principles for a program or theme of expanded S&I research and development activity by LWRRDC which articulates such a logic. The wording and intent should be discussed fully by the Board and others before finalisation and adoption. These are broad, and can be detailed and pursued through an extended 'Template of Questions' (see below). Also, these principles should be pursued subject to existing objectives and criteria guiding R&D investment (eg. regarding national significance).

Guiding principle 1. The overall objective of a LWRRDC program in 'Social and Institutional R&D for NRM' should be to: explore more effective policy, institutional and management arrangements for sustainable resource management, through social science and especially interdisciplinary research on policy, institutional, social, economic and legal issues, and encouraging the incorporation of such perspectives into non-social science R&D where appropriate. In so doing, LWRRDC should emphasise the evolution of policy, institutional and management arrangements that are adaptive, informed, learning and participatory.

Guiding principle 2. Advocacy of particular instruments, policies, laws, etc. should not be an aim of any LWRRDC-sponsored activity, except where a bona fide policy agency or broad stakeholder group is an explicit partner and endorses such an aim, or where stated, existing public policy goals can be pursued through such a focus (noting the challenge presented by missing or too vaguely stated public policy goals). To improve policy and management, R&D should

aim to *enrich the information base and menu of policy, institutional, organisation, legal, etc. options available* to policy-makers and others. The actual implementation of findings of S&I research is the responsibility of others (especially governments), and may take longer than is the case with more applied scientific and technical R&D. This aim would favour, in a general sense, comparative R&D mounting constructively critical analysis across existing approaches, or that which explores more than one future option.

Guiding principle 3. Through increased social and institutional R&D, LWRRDC should aim to *build skills and capacities* in social science perspectives on NRM amongst both R&D providers and policy-makers. This can be achieved by: expanding the catchment of R&D providers working on ESD/NRM issues; introducing appropriate social science perspectives into predominantly biophysical R&D activity; training or assisting the next generation of social scientist (or multi-skilled) researchers in NRM; and/or communicating as widely as possible the outcomes of social and institutional R&D. As well as making biophysical research more cognisant of social science perspectives, LWRRDC can also aim to improve the understanding, in the social sciences, of NRM issues and natural science positions on these.

Guiding principle 4. LWRRDC should also seek to *expand its pool of available R&D providers and partners* from outside the NRM field, both in terms of organisations and individuals. This should include linkages with cognate policy fields where these have experience with or a common interest in approaches, issues or instruments relevant to NRM (eg. health, emergency management, education, regional development and employment, regarding issues such as structural adjustment or community involvement).

Guiding principle 5. LWRRDC should support R&D with a *demonstrable theoretical and/or methodological basis* in the social sciences or, alternatively, innovative work where the inadequacy of such established social science perspectives can be shown. While the development of social science theory and methods per se should not be a goal of LWRRDC-sponsored work, R&D that addresses such questions, while at the same time addressing NRM issues, should be favoured. Support for R&D should be contingent on the research questions being explicitly translated into recognisable and significant policy and/or management problems. Finally, R&D framed by short-term issues or political episodes should be avoided, and support focused rather on issues that can be shown to be likely to be of ongoing importance.

Guiding principle 6. In making a relatively small investment in such a large and diffuse field of R&D, there must be clear recognition of the fact that virtually any R&D task could be validly undertaken in a number of different ways. Where at all possible, R&D should be sponsored through mechanisms allowing the expression of *different theoretical and/or methodological approaches*, and the explicit choice between these on the part of LWRRDC. Over time, it should be the case that LWRRDC-sponsored research on a particular theme or topic would not be done by R&D providers who use or consider only one available approach.

Guiding principle 7. Given the scattered and often inaccessible nature of both the academic–technical and the more popular literatures dealing with social and institutional aspects of NRM, LWRRDC should through its own activities seek to *improve communication and access to information* of R&D outcomes in this area, in concert with other relevant bodies (see 8, below).

Guiding principle 8. Increased activity by LWRRDC should be accompanied by efforts (entailing actual R&D or not) to establish new or further develop existing *arrangements and linkages to increase the coherence of the ESD/NRM field*, both in terms of R&D, and policy and institutional understanding and learning. While the Corporation's mission and performance places it as an important player in this regard, the bulk of the responsibility for establishing and resourcing new arrangements would fall elsewhere.

Guiding principle 9. Before sponsoring interdisciplinary R&D or pursuing new approaches, *sound common conceptual understanding* needs to be evident. Detailed interdisciplinary work or cooperation on applying new approaches will be far more effective when the parties involved (different researchers, stakeholders, agencies) have evolved a common view of the purpose, constraints and issues involved in a project.

To operationalise these objectives in LWRRDC's ongoing functions, the following extends the existing 'Template of Questions' aimed at ensuring the incorporation of the program logic at all appropriate stages. The envisaged application of this extended template is explained in the discussion of organisational issues below.

LWRRDC utilises a 'Template of Questions' to guide program design and development, to ensure consistency and relevance across programs and activities (see Appendix E). Question (2) of the Template—regarding 'failures' to manage the resource sustainably—is particularly relevant, but a consideration of the perspectives put in the commissioned papers (sections 4-7) would suggest that this is a highly complex matter prone to, notably,

'market failure' and 'institutional failure', but also 'technical failure' in as much as this relates to information availability or uptake. Further, Question 3 of the template (interventions) is relevant as this raises the issue of institutional adequacy, policy instrument choice, market reform, communication strategies, and so on.

In extending its role in S&I research and development, LWRRDC should adapt the template to seek such consistency and relevance in new areas. Rather than rewrite a familiar and (apparently) effective tool, it is suggested that the template be extended, in the form of supplementary questions. It is envisaged that such supplements to the template would be used at the program level as the template already is, but also as an interrogative and scoping device at the project appraisal level. In the latter case, it would apply equally to more 'pure' S&I research as an assessment tool, and also to biophysical research which claimed or evidenced potential policy or institutional relevance. For biophysical research, the aims of applying the supplemented template would be, first, to test the basis and validity of claims of policy connection, and to establish cases where potential exists for such linkages to be encouraged or enabled. The template should be applied as it is currently, with the supplementary questions used only when appropriate. It would be applied for different reasons by LWRRDC itself, by any reference panel or ad hoc committee set up (as discussed elsewhere), or by referees. Organisationally, the main points of application would be Program Management Committees and Program Coordinators, but elsewhere as well (see Recommendations).

A draft list of supplementary questions follows (in italics), with brief explanations, fashioned so as to expose the basis of R&D proposals or themes, and to establish the connection (if any) with loci of responsibility. Not all will be relevant in each case—they are prompts, not a strict procedure. These questions still allow and, in fact encourage, a wide spectrum of R&D, but seek to clarify issues of appropriateness and intent.

An extended LWRRDC 'Template of Questions' for informing program design and project assessment to address social–institutional issues

1. *Has a biophysical problem (eg. a form of land degradation) been reframed as a research problem in a manner as to also reflect a valid and significant policy problem?* Moving from primarily biophysical research, with mainly technical and managerial applications, to S&I research will necessarily involve a recasting of the ways problems have been (or could be) stated. Natural scientists ask questions that differ from those of administrators, or social scientists. Is there scope for attention to the research problem from other perspectives or different disciplines at an early phase of the project so as to forecast and avoid findings with insufficient connection to policy considerations?
2. *What is the theoretical, conceptual and/or methodological basis of the research (whether existing, proven, proposed, innovative), and why is it considered suited to the social, economic, policy and institutional problems in question?* S&I research can call upon many different theories, ways of viewing the world, paradigms, methodologies and styles of inquiry, all of them valid in some contexts. The initial choices made in framing an R&D activity will direct ensuing research in particular ways, and thus exclude some perspectives, information and findings.
3. *Is the implicit or explicit statement of the policy or institutional problem to be addressed sufficiently precise with respect to the detail of policy processes, legislative frameworks and/or institutional/administrative arrangements; ie. what* ***particular parts*** *of these are relevant/ important, why, and how does the R&D connect with them?* If R&D is to be policy-relevant, then it is inadequate in a project description or design to simply state that this is so. The loci of power and responsibility need to be identified, and the connection between those and the R&D demonstrated (eg. do the stakeholders identified include those who have responsibility for implementation or communication of the outcomes)? This means that there will always need to be a descriptive element in proposals themselves, or referred to (see (8) below).
4. *How will the R&D contribute to: improving the selection, design or application of policy instruments; assisting the creation of more effective institutions; changing individual, group or institutional behaviours in ways consistent with NRM objectives; and/or improving understanding of societal processes that influence these?* This builds on the previous question, addressing specific data and methodological issues and choices in S&I research. In addressing this principle, cognisance is demanded of the detail of each of the above (eg. the many forms of, say, regulatory or market instruments, or the richness of institutional forms).
5. *Is there evidence that a wide menu of policy instruments and approaches has been considered, and is there justification for the choice of instrument/s to be dealt with in the R&D*

proposed, and for those not? Many alternative policy approaches and instruments exist (statutory, educational, institutional, economic, negotiative, etc.), all of which are valid to consider and may be effective under different conditions (see Section 7). R&D relating to policy instrument analysis or choice should not conceal or leave implicit the researcher's assumptions or preferences regarding different instruments.

6. *Does the work have the ability to address on-ground management issues or the policy, social, legal, economic and institutional settings of these, across a wide number of contexts (sectors, jurisdictions, places), or is the policy instrument or institutional issue of sufficient 'systemic' potential, so that research outcomes will be of wider relevance?* With S&I research, the nature of LWRRDC's 'national significance' criteria requires additional attention. As well as the wide occurrence of the biophysical process or problem and on-ground management issues, there is the question of how common to different jurisdictions are the policy and institutional issues.

7. *Is the research approach suitable and relevant to: the particular attributes of policy problems in ESD/NRM (eg. spatial and temporal scale, connectivity between problems, uncertainty, etc.); and to the peculiarities of the Australian context in terms of substantive issues and political and administrative arrangements?* When applying social science approaches to ESD/NRM contexts, even if these are well-tried in other policy fields (eg. health, service delivery, economic policy), the question of how well the assumptions or methods will transfer arises. Note that testing such transferability is a valid R&D aim, as long as that is explicit. Comparison across jurisdictions requires demonstrable understanding of the differing statutory and administrative settings within the Australian federal system.

8. *If the research involves comparative policy or institutional analysis, what is the basis of the comparison (political/administrative/legal similarity or intentional contrast, similar biophysical problems, shared or contrasting experience with specific instruments or approaches, etc)? If not comparative, but claimed to be of wider relevance, to which other contexts is it deemed applicable, and on what basis is this judged?* R&D analysing and comparing experiences or prospects across different jurisdictions, sectors and problems is to be encouraged, but the choice of comparative topics needs to be made with care. Again, this demands a descriptive element to proposals and to R&D, whether as part of the project or drawn from earlier or existing work.

9. *Is there a demonstrated need for descriptive R&D, an identified audience for this, and a means of communicating it?* Given that, very often, part of the problem is a lack of common understanding of existing policy, institutional and legal settings affecting NRM, descriptive as opposed to analytical R&D will have a role, but description of such settings should have a clear purpose, and communication of the description should have a defined audience and a strategy for this communication in place.

10. *To what extent is the research **proactive and/or prescriptive** in the sense of enabling better policy and institutional performance in future; what likely ongoing needs will it propose or address, and, if retrospective, how will examination of past events or arrangements contribute to future demands?* LWRRDC's mission is to further the goal of sustainable resource management, and thus R&D must have a potential to improve management, policy, statutory frameworks, etc. toward this end. Thus, R&D will need to identify and address current and future imperatives in NRM, and tell us something about how we can do things better.

11. *Does the research team include expertise appropriate to the policy and institutional tasks included in the research or, if not, is adequate connection made so that outcomes can be properly interpreted in a social and institutional sense?* S&I research demands that LWRRDC interacts with and draws on a markedly expanded and different community of R&D providers than in the past, and it is important that care is taken that these providers possess abilities appropriate to the tasks. (Note: 'appropriate expertise' does not necessarily mean a 'correct' disciplinary background, for example a natural scientist may evidence methodological coherence through past work, through proposed consultation, or through answers to the preceding questions.)

12. *Does the R&D sit within the domain of existing or reasonably imagined social, economic, political, institutional, administrative and legal arrangements (ie. within normal parameters of governance) and, if not, what is the justification for such a departure?* Some S&I research might explore institutional, economic, social, legal and even constitutional options quite different to current ones. This may be warranted, but given the far lower chances of adoption if this is done, would need to be well justified. The option of redesign or improvement of existing structures and processes should be considered.

Taken together, the guiding principles and the extended template provide the basis and essence of a program logic for LWRRDC in this area. The Corporation will possibly need to reshape these into a form suitable for its purposes.

8.3 Organisational options for S&I research

The issue of how LWRRDC might best organise an increased effort in S&I research is not straightforward. The ESD/NRM agenda clearly calls for an integrated understanding and analysis of both physical and social processes and structures. One key question for LWRRDC and cognate research organisations with responsibilities for multi-sectoral NRM issues is how to design an organisational structure which does not embed bias against particular forms of knowledge, or preclude important perspectives and information. In particular, there is the potential, if an R&D field is broken down into non-interacting parts, to unhappily reflect the very fragmented and uncoordinated character of the NRM field, which is so much a part of the problem. This section makes some general observations about this issue before later recommending an organisational option for LWRRDC.

As noted in Section 3, LWRRDC and cognate organisations such as MDBC, RIRDC, and the CRC for Tropical Savannas necessarily adopt different pathways to manage research. In broad terms, however, the typical organisational structure involves the establishment of thematic priorities and sub-themes which provide a focus for a number of individual studies and are coordinated by a research manager, usually with the assistance of some form of advisory body.

For example, LWRRDC's thematic priorities involve a high level split of the NRM environment into land, water and vegetation issues and, within these themes, a further sub-set which reflects major 'problems', generally also expressed in biophysical or substantive problem terms (eg. salinity, groundwater, remnant vegetation). High level thematic priorities in the RIRDC approach involve a two-way split between industry concerns and cross-sectoral concerns. Sub-themes in the latter case reflect major 'issues' for the rural sector—global competitiveness, resilient agricultural systems, and human capital, communications and information systems. The emerging CRC approach illustrates a system where individual projects can contribute to four high level themes—North Australia landscape, landscape processes, ecosystem management and human capability development—and to regional case studies. The proposed MDBC approach complements three high level themes—riverine, dryland, and irrigation—with an additional high level theme termed basin partnerships.

In broad terms, social and institutional perspectives can exercise influence in NRM research through (i) the integration model where social and institutional perspectives are reflected in the management framework for each theme and sub-theme; and (ii) the thematic or program model where S&I perspectives are themselves expressed as a priority theme. The workshop held for this consultancy termed these the 'process' and 'program' options, respectively.

With the exception of LWRRDC, which has so far focused more on the process model, the research organisation approaches listed above generally have elements of both models (if only in theory at this point). It is not within the scope of this project to analyse the efficacy or otherwise of different research models. The important points are that: all these organisations have either recently restructured or are contemplating restructuring their research approach in part to address problematic issues surrounding integrative research and delivery/adoption; research managers still report difficulties in dealing with issues which are not seen as primarily technical; and it is difficult at this stage to obtain evidence of the extent, effectiveness and utility of incorporating S&I perspectives in NRM through either model.

There are advantages and disadvantages with both. The process model seeks to ensure consideration of S&I issues across as many activities as possible, especially with respect to biophysically-orientated R&D, and this is to be applauded. But it may not offer opportunities to make significant investments or allow critical mass in social science research on NRM issues—that is, it may simply comprise many, small interventions of marginal impact. It would be difficult to ensure integration across the range of S&I research and development when it is spread across other, disparate programs. Furthermore, there may be a lack of visibility and credibility with a portfolio of R&D made up of scattered components. On the other hand, a discrete program would provide such profile, an important consideration in terms of signifying commitment and attracting the attention of R&D providers and stakeholders. It would also promote the initiation of more significant investments in social science research. However, a 'straight' S&I program may not be the best vehicle through which to achieve integration of S&I perspectives into other programs.

While proponents of the either/or model can be found, it is our view, informed by the majority of those we consulted and relevant literature, that, for LWRRDC, there is room and the need for both an improved process to incorporate S&I perspectives in thematic NRM research, and a program dedicated to the

provision of the particular focus and vision that the social sciences bring. A proposed model is outlined in the Recommendations, combining elements of both.

An issue associated with organisation is the mixture of applied versus more fundamental or theoretical R&D, such as between more pure social science undertaken within a discrete program and the interventions in other programs aimed at enhancing adoption chances. It will be important to negotiate the balance between the two, and to ensure that the nature of policy interventions that could be recommended is understood. Like other LWRRDC programs, a S&I program/process will span a range of research styles. In a study addressing the nature of institutional challenges for ecosystem management in the United States, Cortner *et al.* (1996:24-25) outline arguments for a mixture of social science research along a continuum addressing immediate managerial problems to long term, theoretical and philosophical questions:

> Research solely defined by the short term needs and concerns of managers is biased, by its very nature, toward the status quo; in the extreme it entrenches the power of existing institutions. With this focus it becomes too easy to ignore the theoretical questions underlying the reasons why problems emerge or solutions fail to remedy problems. Questioning and evaluating institutions in this macro sense is, however, at the core of citizenship and the democratic process … [At the same time however] We need a good track record of applied research … Support for [long term theoretical studies] more likely depends on the ability of social scientists to first demonstrate—more convincingly than they have in the past—their ability to effectively address short term applied problems.

There are methodological issues arising here. In finding a balance and mixture along the applied–theoretical continuum, there will be encountered the tendency—evident in biophysical but even more so in S&I research—to base studies on small or single samples and/or cases. This makes transferability a problem, and policy-makers and managers will find it easy to ignore the outcomes as too specific. Case studies (of sectors or places, policy processes or institutions, or particular groups within society) have advantages in grounding R&D and enabling the engagement of stakeholders at a regional or local scale, but may or may not produce more generally applicable findings. The alternative is thematic studies, with the themes being policy problems or instruments, societal phenomena, ecosystem processes, and so on. Thematic approaches may be more generic, but may not link as well with stakeholders and may not be as amenable to grounding. As with most things, a mixture of both is advisable, but carefully matched and with clear justification of the choices made. This issue is dealt with in the principles and questions in the preceding section.

The issue of resource requirements for S&I research is also complex. Too often, social science research is viewed as requiring fewer resources than natural science research, but the case is not so clear. Some desktop or scoping work can be quite cheap, yet be extremely useful, but much social science research is highly time and labour intensive. Many researchers in this area would agree that a major obstacle to an expanded scope for S&I research has been a lack of adequate resources. It is imperative that there is always an explicit recognition of the return for a smaller as against a larger investment in S&I research; *in other words, you get what you pay for*. In some cases, small investments will be appropriate, in others they will not. This recognition will help avoid the pitfall of expecting too much of research and the resulting disappointment, and of wasting time waiting for outcomes that will be inadequate to the intended purpose. The onus for this is just as much on researchers as on R&D funders, not to claim a comprehensiveness that is not going to be fulfilled.

To illustrate, the following brief examples of options show generalised cases where the choice of investment scale will define the sort of work and thus result that can be expected. They also serve to show the kind of cases where smaller, review or scoping R&D could precede and inform more substantive efforts.

- With legal R&D, small investments over short periods can be reasonably expected to yield useful results in the form of explication of the legislative framework and to some degree the exposure of significant issues (see Section 6). Significantly larger investments would be required to interpret this law in an informing manner for managers, stakeholders or practitioners, or to explore the operation of the law in context and in interaction with other institutions. (This also depends upon the breadth of statute law under consideration; that is, whether the topic involves swathes of different law across jurisdictions versus a smaller number of Acts.)
- Detailed comparative institutional analysis can demand significant effort, but have the potential to inform fine resolution design and reform. Less detailed or more broad analysis can be done with modest investments and more quickly, providing overviews and identification of significant issues but not detailed insight. Larger investments might be preceded by a scoping study which reviews the literature, identifies important themes, and describes the institutional forms or particular institutions deserving of closer attention.

- In social research, indicative surveys (whether written or interview) to identify issues or for triangulation purposes can precede and scope later, more detailed investigations of, for example, landholder perceptions of policy instruments or stakeholder decision processes.
- In economic research, the application of existing models can be done more quickly and cheaply as a means of identifying issues, with more detailed and specifically targeted model building and application as the next step.

The important variable is how much we already know about the problem; exploratory expeditions are suited to new suites of questions. Alternatively, in the case of a range of well-known but poorly connected situations, connective R&D may be modest in scale, profiting from previous, more specific knowledge. In any such case, there is, of course, a continuum of investment magnitude and speed, with the extremes (quick and dirty; slow, laborious and horribly detailed) to be avoided. Nonetheless, the idea of smaller studies preceding and designing larger studies does suit an adaptive approach. Note that the larger study may or may not be done by the same person or group as the smaller, earlier one.

The final issue for organising a program is that of encouraging interdisciplinary S&I research (and multi- and transdisciplinary research where appropriate), an aim endorsed very widely but as yet far from achieved (see Parts I and II). Very clearly, LWRRDC should place high priority on interdisciplinarity. Modest interdisciplinary alliances in the context of a bounded problem or a modest scale review or exploratory study can be undertaken well enough, but larger interdisciplinary projects are fraught with difficulty. There are not well developed incentives for interdisciplinary R&D, either in public funding agencies or within academia (an R&D program elevating interdisciplinarity would be one such incentive). We have few well-documented case studies of successful or unsuccessful interdisciplinary research programs; indeed, some examination and analysis of previous experiences would be a valuable R&D exercise in itself (perhaps most amenable to a well planned workshop to consider documented studies of past endeavours). With S&I research, all too often the place of the social science perspective is to come in at the end and try to make sense of a task such as identifying the 'policy implications' of some scientific work, only to discover that the work was not done in such a way as to be useful for that task. It is also the case that social science projects may ignore the relevance of natural science perspectives, such as taking account of recent changes in understanding of natural system behaviour. This suggests, in either case, that a minimal requirement is to open up R&D programs and projects *early on* to a wide consideration of what perspectives different discipline might be able to offer.

Importantly, in encouraging interdisciplinary research, it should not be assumed that interdisciplinary projects will always be better or more appropriate. Interdisciplinarity is not an end in itself, leastways not for LWRRDC (although it may be for some researchers). The disciplinary mix needs to be appropriate to the task. One criterion is whether the basis of the collaboration and the likelihood of success has been demonstrated clearly. A further check is to seek cogent articulation of the reason(s) why an interdisciplinary approach is to be taken; have existing mono-disciplinary approaches been tried and found wanting, and is the point of the R&D theory building, model development or problem solving?

There is the further problem that interdisciplinary endeavours may go too quickly toward detailed modelling or case study analysis, without first sorting out the purpose and agreed nomenclature and principles. An early step thus should be attention to developing agreed conceptual models, or to identifying existing ones, wherein the collaboration can proceed. Finally, it might occur that an R&D provider will, in all good faith, bring in another discipline through a single person who may or may not properly represent that discipline's range or central tenets. In organising its involvement in further S&I research, LWRRDC should seek cognisance of such issues (the recommended program below does this). Attention might be paid to currently evolving interdisciplinary alliances or fields, with a view to elucidating the problems and opportunities being encountered. Ecological economics, environmental history and adaptive management are three such fields of relevance to ESD/NRM. Eventually, some helpful ground rules and procedures might be developed as an important by-product of a LWRRDC S&I program, should there be sufficient feedback and documentation mechanisms.

The inevitably interdisciplinary nature of S&I research in natural resource management will necessitate the development of new linkages and partnerships on the part of LWRRDC.

8.4 Linkages with other organisations and potential for new alliances

S&I research will require a reliance on partnership arrangements, such as already favoured and pursued by LWRRDC, but perhaps in different configurations and potentially with new partners. It can be argued, moreover, that the generic nature of many S&I issues

will mean that both the need and justification for partnerships will be in fact greater. This will be required so that investments and goals can be shared in a mutually beneficial way, but also for the simple reason that LWRRDC should not be expected to shoulder more of the responsibility for encouraging R&D in this area than is appropriate. Other parts of the primary industries portfolio, the environment portfolio, and others such as industry and science, and specific agencies such as the Murray–Darling Basin Commission, Australian Bureau of Statistics, Australian Fisheries Management Authority, Great Barrier Reef Marine Park Authority and other RDCs, all have potential interests in the sorts of R&D explored in this report. In cognate policy fields, there are agencies with significant experience with methodologies and instruments of great relevance to NRM, such as the Australian Institute of Health and Welfare, National Health and Medical Research Council, Australian Bureau of Statistics, Australian Emergency Management Institute, and Aboriginal and Torres Strait Islander Commission. For reasons of time and resource constraints, this report does not deal with State-level matters, but clearly partnerships with State organisations and agencies can also be explored. Neither does this consider the issue of constructing partnerships in detail, as this is an area where LWRRDC is already active.

As well as public agencies, LWRRDC should seek to extend its contacts with academic or professional bodies with relevance to S&I research, whether in the NRM field or not, In or near the NRM field, such bodies include the Environment Institute of Australia and the National Environmental Law Association. In more mainstream social science, the Australian Political Science Association and the Australian Institute of Public Administration are organisations through which potential new R&D providers, advisers, referees, etc. can be reached. Developing links in this way can be very cost effective; small investment , for example to sponsor a symposium at a conference, brings NRM issues to the attention of hundreds or more members of a society or association. At a broader level, the Academy of the Social Sciences in Australia (and possibly the other Academies of Science and the Humanities as well) may offer another opportunity for communication. (The ASSA jointly sponsored a 1997 symposium analysing the ESD process, for example.) The Australian Research Council is another potential partner in some areas. As an example, LWRRDC's involvement in the first Australia and New Zealand Society for Ecological Economics served to help focus attention in that evolving field onto land and water issues.

Further, it may be that new R&D partnerships could be fostered with private firms. While this option has not been considered in detail during this consultancy, one example is law firms, who often support law students to gain further qualifications. LWRRDC could, in this area, offer practical contexts and problems that require addressing from a legal perspective.

It must be recognised that making contacts with new knowledge-based communities will take time. The initial communication lines and choice of fora takes time, as does the process of diffusion within that community and the eventual preparation of quality R&D ideas. This is evidenced by recent LWRRDC experience. Dissatisfaction with the quality and quantity of S&I research proposals in the past few years can be interpreted in this way, with the 1999–2000 general call being the first where LWRRDC has been more satisfied with the response. This report recommends that the Corporation's strategy in S&I research involve a mixture of near-term projects and medium-term processes.

If LWRRDC moves further into social and institutional R&D, this will involve a move into areas outside the Corporation's own expertise and that of many of its clients and stakeholders. To competently decide on research directions and to assess proposals will demand the development or accessing of additional disciplinary expertise, to blend with existing disciplinary, sectoral and practical perspectives already represented within LWRRDC, its Board and pool of referees. Particularly in the case of interdisciplinary S&I research, appropriate expertise is in short supply, and thus reliance on an individual as Program Coordinator may be unwise, at least as a sole means. The use of ad hoc committees or reference groups might be considered, as well as the active recruiting of a body of appropriate referees. Identifying such people would be a result of engaging with the sorts of organisations referred to above.

Entry into unfamiliar fields should encourage LWRRDC to think about forms of activity suited to quickly scoping or surveying R&D possibilities or policy and management options in a cost-effective manner. As suggested elsewhere in this section, sponsored conference symposia or journal special issues are means of profiling particular areas. A further mechanism is to use highly focused meetings supported by specifically prepared material. (It is apparent that many stakeholders are suffering 'workshop overload', but this may be due to the repetition of inconclusive discussions rather than the number of events.) After identifying an issue of importance, but in an areas where large investment in R&D is not yet, or may not ever be, warranted, a small number of commissioned papers could be prepared

by, say, 3-4 people with experience in one aspect of the issue, and these form the basis of a focused workshop. Very often, there are people capable of putting forward well-argued positions from existing information and experience; the challenge is to flush this out and consolidate it. Distribution of the amended papers along with summary of discussion and any clear outcomes of this would serve as a relatively cost and time-effective means of profiling and scoping an emerging issue, some suggested ways of addressing it and the reaction to these of a range of stakeholders. This would, for example, be an effective means of furthering the recommended focus on 'meta-arrangements' in the NRM field discussed below.

8.5 Meta-arrangements for ESD and NRM

Beyond the issue of what LWRRDC does with whom on specific projects and programs, there is the question of 'meta-arrangements' across the broader NRM field. The issue relates to policy and management as much as it does to R&D and research institutions. A core barrier to improving sustainable management is that NRM is not, in fact, a field with great coherence.

In 'Sustaining the agricultural resource base' (PMSEC 1995:16) it was argued that a national agenda for R&D in this area is needed which "coordinates all industry R&D corporations to a common sustainability goal". ASTEC (1993) noted the following problems for social science research: the higher education sector is the main performer of such research (so ongoing funding constraints here have an especially marked impact on this research); there is no identifiable location for policy about social sciences research (ie. no equivalent, for the social sciences, of CSIRO, ASTEC or the U.K. Economic and Social Research Council); researchers may not regard contributing to policy-making as their role; research is often intuitive, qualitative, argument-based and thus difficult to predict when the results will be available for policy-makers; and that government is poorly informed about the capacity of social sciences and has not identified its overall requirements for such research. Many of these issues are confirmed as relevant by many contributors to the recent review by the Academy of the Social Sciences in Australia (1998).

The point was made in the commissioned papers (see Section 7.8), by people consulted during this task and at the project workshop, that NRM is a fractured and fragmented policy and management field with insufficient coordination and information sharing. The point is even more apposite with regard to the broader ESD field within which NRM is located. This is a generally accepted problem, although individuals may disagree over the severity of the problem. This is relevant to LWRRDC both in terms of its role and mission (as one agency within this field), but also as a social and institutional issue amenable to some forms of R&D. LWRRDC has a role to play in this regard if it decides to engage more fully in S&I issues, but the bulk of the task should fall elsewhere in the Commonwealth sphere.

Most particularly, linkages and mechanisms to enhance shared information and perspectives (and thus policy and management learning) are required across sectors, policy problem areas, jurisdictions and over time. LWRRDC-sponsored R&D can attend to this to an extent, and especially through exploring partnership or jointly sponsored R&D with agencies in other sectors. But there is a larger challenge of the establishment of arrangements allowing broader and more persistent integration across NRM. Given that LWRRDC has, of all RDCs, an unusually cross-sectoral mission already, and that it has some intentions in the social and institutional area, it should consider this problem. While the creation of such arrangements (in whatever of the many possible forms they could take) is not the Corporation's role and is doubtless some way off, LWRRDC is well placed to at least initiate discussions and sponsor preliminary ideas. The cautionary note is that achieving coordination across different agencies may be quite difficult.

There are many possible avenues through which this could be pursued (see Recommendations, below). In the first instance the discussion should concentrate on the Commonwealth level, with consideration of State-local levels later, should that prove constructive. At the very least, such a perspective might inform LWRRDC's approach to both the National NRM Policy Paper and forthcoming discussions regarding 'Coordinating Commonwealth Involvement in Natural Resources Projects'.

8.6 Communication

A further and important dimension of the 'meta-arrangements' issue is that of communication of R&D outcomes to as broad as possible an audience. This relates closely to the issue of implementation and adoption that LWRRDC already pursues within programs and projects. But here, the particular emphasis is on the creation of an ongoing, evolving and common body of shared information across the various sectors, stakeholder communities, academic and professional groupings, policy networks and regions concerned with NRM and related issues. In the longer term, creating such a body of common

knowledge and experience will underpin many cases of improved implementation and adoption. Too often, we do not learn because it is not known what there is to learn. In S&I research and development, we are dealing with a very wide and diffuse field of knowledge, methods and applications, where issues such as policy instrument performance or institutional design are more often of generic relevance than mainly applicable within single sectors. Especially in the case of experience accrued over a meaningful time span with different policy approaches, access to a recognisable literature (whether academic, professional or lay) will be critical.

It is apparent that the outcomes of some LWRRDC-sponsored R&D projects are communicated only to immediately concerned stakeholders and through relatively grey literature, or a journal article or so at the most. LWRRDC already does an impressive job of formally publishing much R&D (eg. through its Occasional Paper series), but these are not forms of information with high visibility outside a relatively closed NRM community. Reliance on project-specific media contacts and press releases, etc. can go only so far. To reach new R&D providers, to establish a body of work accessible to emerging researchers and practitioners, and to reach non-engaged stakeholders, other means of enabling improved communication can be considered. It should never be seen as the Corporation's role to engage much in publishing or promotion of outcomes, but rather thought should be given, *in concert with other appropriate bodies*, to these issues.

This is a medium-term issue, and one which will require further discussion. For the purpose here, we can recognise two tasks: promoting the development of a more recognisable research/professional literature dealing with the S&I dimensions of NRM; and communicating outcomes to stakeholders not in a position to receive existing information regarding LWRRDC-sponsored research. For both, it is recommended that LWRRDC explore the utilisation of existing media and fora, especially where an *information market* already exists and can be harnessed in the interests of the Corporation's mission. In all cases, the investment would be modest, but the potential reach significant. The following options should be regarded as tentative and illustrative suggestions, as this issue was not a core task of the consultancy and has only been explored as it emerged as a question late in the piece:

- For the first audience, there is still a lack of core professional and academic journals in NRM (especially in Australia), and most more core social science journals cover NRM in only a haphazard fashion dependent on material as it is proffered (and, further, are often reluctant to publish applied material or that based largely in the Australian context). Several possibilities might be considered here. One is that of special issues of particular journals, offering periodic accounts of the 'state of the art' in particular aspects of NRM. These reach an already significant readership. For example, the *Australian Journal of Environmental Management*, which in recent years has published a significant amount of S&I material in NRM, organises special issues and has just established the mechanism of sponsored 'supplements' on specific issues. Other journals may be explored in this light. Established professional or academic conferences are another mechanism, and LWRRDC has used this option already. Of interest is the option of utilising the opportunity offered by regular conferences organised by groups not usually focused on S&I dimensions of resource management, but with the potential to make a contribution in this area. This may include scientific bodies which do not normally consider social science dimensions—an example is the Ecological Society of Australia, which since 1994 have regularly featured a 'policy relevant' plenary session at its annual conferences. Conversely, traditional social science associations, such as those identified earlier, may be a useful mechanism to alert social scientists not engaged with NRM issues to the possibilities of R&D in areas of relevance to LWRRDC. This would serve to address, over time, a core problem identified in this report—a relatively small catchment of S&I researchers working in areas relevant to LWRRDC.

- For the second audience—lay stakeholders—there are clear limits to what a body such as LWRRDC can, or indeed should, do. However, increased and more 'institutionalised' use of the rural press, in particular the major state-based rural newspapers (eg. *The Land*, *Country Life*) might be considered. Very often, good copy is well-received, the circulation of some of these papers is very high, and they are an enormously important source of information on policy, innovation and new developments. Rather than the time-consuming practice of specific press releases, it might be possible to establish a regular, say, once a month or once a year, feature profiling new and widely applicable R&D results.

- For both purposes, it should be recognised that (rumours of a paper-free, electronic age aside) most people read books, and that a surprising amount read non-fiction. Also, the edited volume is a standard and accepted publishing medium for many of the social sciences. The commercial book

trade thus represents a major information pathway in Australian society, and one which might be harnessed using its own market imperative to better communicate R&D outcomes. Books, too, enter the local and regional library collection more easily than other forms of written media, and are accessible through easily accessible commercial outlets. Australian publishers are increasingly interested (but still discriminating about) research findings on important contemporary issues rendered readable for a broader audience. Even in the case of potentially marginal (in a financial sense) volumes, a relatively small publishing subsidy is often used, enabling a body of work to be made available in a quantity and quality otherwise unthinkable. It may be that, given a R&D project—or even better a set of projects of similar tone—of sufficiently wide applicability, the most effective means of wide communication would be to encourage commercial publication. This would not be often done, but an ongoing arrangement with a particular publisher might see an emerging stream of perhaps one volume every two or so years, communicating the most interesting R&D outcomes with which LWRRDC is associated.

There are other options that could be explored. In addition to the rural print media, rural radio has potential for ongoing arrangements. As well as the traditional literature, options such as publication of LWRRDC occasional papers and/or fact sheets on the Web (as well as in hard copy, always) would improve knowledge of R&D outcomes.

Many of these issues are not unique to Australia, such as with the lack of history of building coherence across the social sciences through, for example, data infrastructure. In Canada, attention is being paid to research and data infrastructure capacities, within the framework of the Canadian Government's Canada Foundation for Innovation, by the Social Sciences and Humanities Research Council of Canada (SSHRC). In Britain, the Economic and Social Research Council is active in these areas.[47]

This discussion has been about communicating the outcomes of LWRRDC-sponsored R&D within the research community, and to the broader community. While not dealt with directly here, the issue of more two-way communication is crucial; involving feedback from stakeholders, managers, etc. into the research process. This is especially important in terms of ensuring that social scientists orientate themselves to the particularities and practicalities of NRM in Australia. LWRRDC's structure, and processes such as stakeholder workshops, achieve this to a good extent, and the improved communication that would follow from the above measures would doubtless increase the level of feedback. It should be noted that the point of a good deal of the research discussed in this report—and the sorts of processes and institutions that might follow—is aimed at enabling such communication. Also, it will be the case that the communication skills, pathways utilised and recipients targeted by researchers will be different with S&I research. It should be noted that this may demand changed communication strategies.

[47] See SSHRC (1998), Expanding research capacity in the humanities and social sciences: discussion paper, at www.sshrc.ca/english/policydocs/discussion.

8.7 Recommendations

The following sets out the consultants' recommendations to LWRRDC, drawn from the preceding material. Several of the possibilities surveyed up to this point are not in the recommendations but well may be considered superior by some people—difficult judgments have been unavoidable when dealing with what will inevitably be a small investment in a potentially massive area.

Recommendation 1: Overall. It is recommended that LWRRDC increase its investment in social and institutional R&D, and guide this investment strategically through the mechanisms suggested below. This increased investment is justified by the clear importance of social and institutional barriers to (and, therefore, opportunities for) sustainable resource management, the support of this by those consulted in the course of this consultancy, the relevant literature, the unique position of LWRRDC to play this role in the NRM field, and its existing interests, investments and knowledge of S&I dimensions of NRM. This investment should be guided by the goal of building longer-term adaptive capacities over and above the nearer-term resolution of particular issues. This will suggest R&D aiming to enrich the information base and the menu of policy and management options and analytical capabilities. Partnerships and coordination will be even more important in this area than in the operation of LWRRDC's existing programs.

Recommendation 2: Program design. It is recommended that LWRRDC establish a designated program of R&D in the 'social and institutional' area, but that this operate unlike other programs through having two separate but related functions. Thus, the program would operate less in a linear or hierarchical fashion, but rather in a 'network' manner. The program would operate as a means of commissioning a select range of 'pure' social science or S&I (and preferably interdisciplinary) R&D

projects, but would also function across existing programs. The latter would occur through a screening of mainly biophysical research proposals (both internally generated and from general calls) to identify ones with potential to inform policy and management more effectively given the incorporation of social, policy, institutional, economic and/or legal perspectives and expertise, particularly at the project design stage and in the later interpretation of results. Typically, this would involve the addition of an appropriate social scientist (more than one if needed) to the project team, perhaps for only two–three weeks full-time equivalent over the life of a moderate-size R&D project. A mechanism and contingency fund would be needed to allow negotiation with the applicants and resourcing of the additional input of expertise.

In terms of size of investment, it is recommended that, initially at least, the Corporation should invest in a social and institutional program at a level comparable to the larger of its existing programs (recognising that this would still mean the great bulk of R&D investment will still go toward largely biophysical projects). The program should be established for five years, as for other programs, but with an interim review at two years to re-assess priorities and resourcing. Commissioned S&I research within the program proper would account for about 60% of this, with 25% designated for enabling the incorporation of S&I perspectives and expertise into other programs. The latter is envisaged to involve constructive intervention and enlargement of, say, three–five projects from other programs per year. The remaining 15% would be available for resourcing other recommendations below. Smaller, exploratory projects or broader, scoping projects would be most appropriate in the first year or two of the program, with fewer larger investments. This will result in 'runs on the board', but more importantly allow larger investments to be targeted more effectively after the review at two years. In this way, the program can be somewhat 'adaptive' in its own right. The general call for R&D proposals is assumed to continue to encourage innovative proposals whether or not they be social–institutional. This program design is illustrated conceptually and organisationally in Figure 8.1. Whether a program coordinator with similar roles and responsibilities as those for existing programs is needed, or whether a combination of internal staff and external expertise would suffice needs consideration (see (3) below).

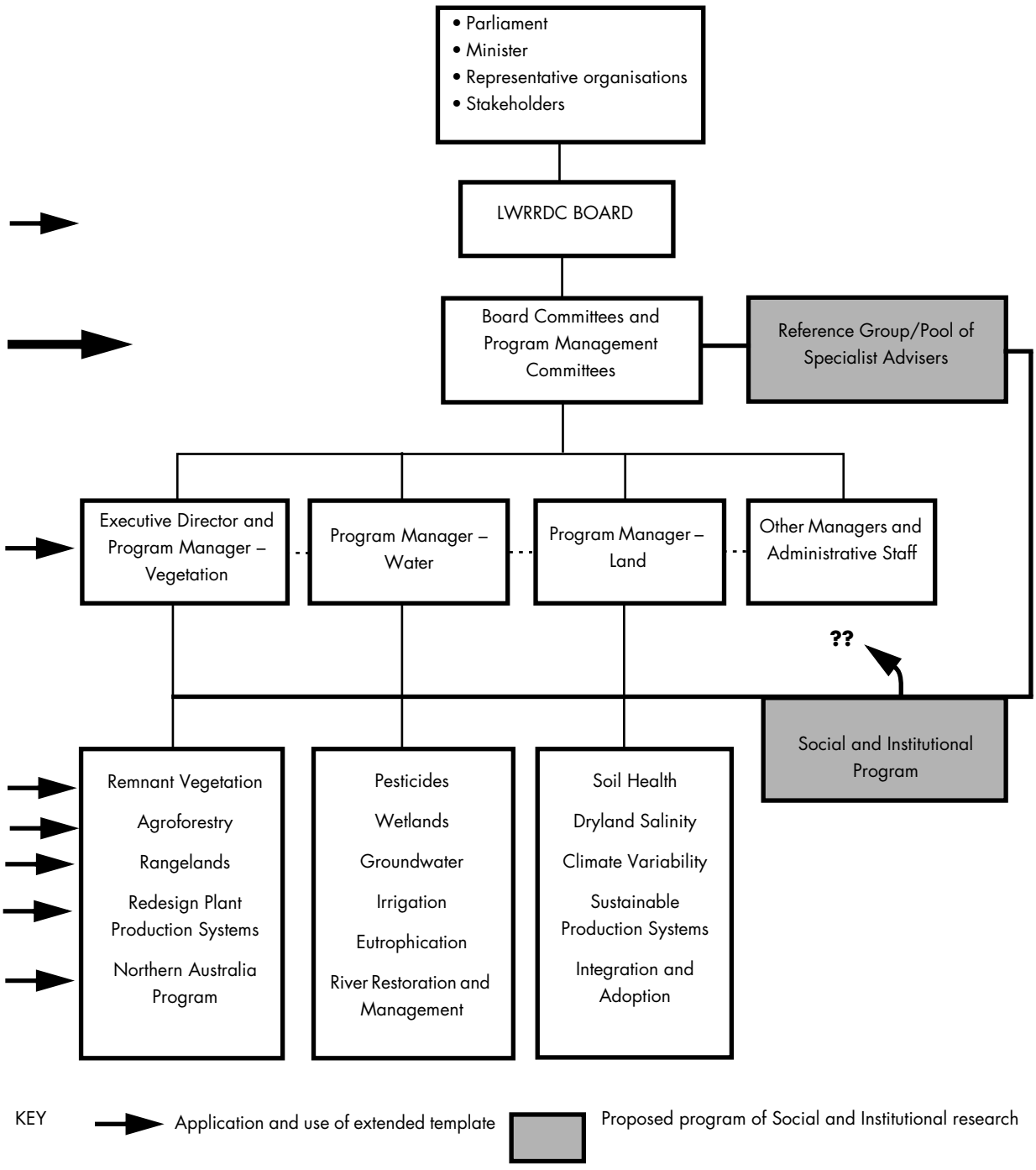
Figure 8.1 conceptualises the recommended 'program' within the organisational structure of LWRRDC, indicating how it fits within the existing arrangement and the information flows and linkages envisaged. The key points where the extended Template of Questions, guiding principles and aims of the S&I programs would be applied to seek incorporation into other programs are at 'Program Management Committee' and 'Program Coordinator' levels.

Partnerships, joint funding and cooperative design, and coordinated program implementation will be doubly important in this area, both in terms of discrete projects but also the development of more generic linkages across the NRM field (see (6) below).

In time, it may be appropriate to merge the existing Implementation and Adoption program (and the Rangelands program, possibly) into this new program of social and institutional R&D.

Recommendation 3: Project design and research proposal assessment. In operating the above program, three mechanisms are recommended to enhance the Corporation's expertise and judgment in this area. *First*, an extended 'Template of Questions' should be used to assess the potential of R&D proposals in both streams of the recommended program. This will enable a finer resolution of interrogation of the potential worth of S&I research or the possible S&I dimensions of other research. Figure 8.1 shows the locations within the LWRRDC structure and process where the extended template (and all that informs it from this report and elsewhere) would principally apply. *Second*, a summary of LWRRDC's favoured research themes and the essence of the extended template should be communicated to potential R&D providers to encourage these being attended to in proposals. *Third*, LWRRDC should seek to involve people who can offer the additional expertise required to properly design and implement the program and, more importantly, assess R&D proposals. As an alternative to, or as well as, an additional program coordinator, the option of retaining a small reference group to work with LWRRDC staff should be considered, at least for the first year or two of the program while a stock of referees is established in these new areas and LWRRDC's own familiarity is developed. This would entail retaining (part-time, perhaps on advice-based contracts) a group of four or five people representing a range of social sciences (ie. law, economics, public policy and administration, sociology–psychology), as a source of advice on both commissioned S&I research and on incorporation of S&I perspectives in other programs. Given that many tasks could be performed at distance, the cost could be held fairly low. This would operate in some ways as a small shadow of the LWRRDC Board, but expertise-based rather than chosen to represent sectors or interests (clearly, members would refrain from bidding for funds while thus engaged).

Figure 8.1 Organisational structure for a 'Social and Institutional R&D Program'



An alternative to the reference group model, or in addition to it, would be an expanded pool of expertise or register of specialist advisers could be identified, offering a much wider range of skills and expertise to be drawn upon as the need arises.

As presently constructed, the LWRRDC Board (with appropriate input via the mechanisms above) seem to have a valuable mix of perspectives at least on the application aspects of S&I R&D. Related to this, though, it is noted that biodiversity issues are not well-represented on the LWRRDC Board, and that, as a major cross-cutting problem, this issue should arguably be better represented. Also, consideration of NRM issues on Indigenous lands or concerning Indigenous peoples needs *specific* representation.

Recommendation 4: Research themes. This report in Part 2 suggests a range of research themes and projects fitting the interpretation of the consultancy

topic field. This recommendation distils a smaller number of these onto a short menu. It is important that these are passed through the filter of the LWRRDC Board and, to whatever extent is possible, stakeholder opinion, so that the fullest understanding possible is achieved of where these new initiatives sit within LWRRDC's operations. To further assist such understanding, the first theme proposes a research agenda on the requirements of an adaptive policy and institutional framework for delivering ESD/NRM objectives at the regional level, and the associated requirements for social, institutional and biophysical R&D. The remaining research themes are selected from Sections 4-7, primarily to provide the Corporation with a short list of relatively modest projects achievable in the nearer term and capable of feeding into the proposed program to both refine and enlarge the scope of R&D possibilities. (Larger investments should be the subject of further consideration and an opening up of the discussion involving other agencies and researchers.) With the exception of the first theme, the following are stated in summary fashion, suitable for re-stating as either terms of reference for commissioned research, or as priorities for general call research. It is important to understand that, for all of these, different approaches are possible, and mechanisms that encourage a range of approaches to be put forward should be favoured. The following separates a number of interrelated themes, and a different emphasis with some would enable merging or coordination of themes. For example, R&D on integration of social, environmental and economic concerns is important in its own right, but is included here in the first theme.

i) *Requirements of an adaptive policy and institutional framework for the delivery of ESD/NRM objectives at the regional level*. The literature reviewed, those consulted during this task and the workshop deliberations clearly indicate that the development of integrated policy, science and management approaches for delivery of sustainable NRM remains a central issue. Also, there is increasing emphasis on delivery at the regional level (whether catchment, bioregional, agro-ecological regions, etc), and while this emphasis may be sensible given the nature of NRM objectives, core difficulties have not been resolved. These include failure to develop linkages between and within disparate R&D and policy processes, the lack of attention to social and institutional structures and processes, and the related issue of still very unclear policy and institutional settings for regional NRM activities in Australia. LWRRDC has foreseen the pressing R&D needs in this area with investments in a number of integrated studies (eg. the Rangelands and Integration and Adoption Programs, and this consultancy). LWRRDC is well placed to consolidate and, if necessary, redefine existing efforts, as well as prepare for future investments, through a three-pronged strategy. This is an area where partners should be found, as the issues are common to a number of institutional arrangements and policy processes, such as catchment management, comprehensive regional forest assessments, regional economic development bodies, Natural Heritage Trust, the coasts and marine policy areas, among others. All these operate at scales between the State and local, and all are addressing the problems of this 'scale'—participatory approaches, science-policy linkages, and the integration of environmental, economic and social aspects.

The *first stage* would involve a study to develop a conceptual model and set of practical guidelines detailing the requirements of an adaptive policy and institutional framework for delivering, monitoring and reviewing the achievement of ESD/NRM objectives at the regional scale. The use of the term 'conceptual model' should not be interpreted as meaning something abstract; the aim is intensely practical. Too many disparate processes are in train in different sectors, with little shared perspective or understanding of common underlying problems, approaches or methods. A conceptual model would cover: justification and reasons for regional foci; consideration of (measurable where possible) policy objectives, criteria and indicators; requirements for assessment and trade-off techniques for economic, social and environmental elements of the policy framework; related DSS requirements to assist the implementation of identified techniques; and institutional requirements for regional delivery such as those involving government, industry and non-government stakeholder engagement and structural adjustment processes. The study should involve a range of stakeholders and academics. The *second stage* would use the conceptual model and guidelines in a gap analysis of LWRRDC's existing regional/ catchment projects to identify where additional work could be supported to ensure a greater and more immediate impacts of the projects. The *third stage* would involve application of the model and guidelines within LWRRDC's existing processes for seeking and evaluating R&D proposals, with the aim of more effectively targeting investments . Initially, the model and guidelines would complement use of the extended 'template of questions'. It would help provide the focus needed and grounding for delivering existing thematic programs/projects and any new S&I research projects in an integrated approach focused on changing and improving NRM practices. Eventually, the model, guidelines and template of questions should be refined and combined as an integrated evaluation tool. Overall, this would involve a moderate investment with the potential for high returns in future, including the significant

contribution of bringing together the fragmented body of experience and literature in a manner usable by decision makers and stakeholders.

ii) *Comparative analyses of alternative policy instruments under varying conditions*. NRM debates often revolve around the merits or otherwise of different policy instruments and options (eg. community-based approaches, statutory, market mechanisms, moral suasion). We have far too little detailed description and analysis of experience with different instruments operating under different conditions, and too much advocacy for specific instruments as being appropriate across the board. Clearly, different mixes of instruments will be more effective at different times and for different purposes. The aim would be to isolate key attributes of instruments and problem settings that make effectiveness either more or less likely. This would involve examination of current circumstances, but also back-casting to assess why instruments used in the past 'failed' (if they did)—for example, if a regulation, was it, or could it have been enforced; if a market mechanism, was it too low or too high, or were there other prices outweighing the message. It would be important for a broad menu of instruments to be considered. It would be advisable to embark on a scoping study, possibly leading to a larger project, with the first stage aiming for preliminary hypotheses and identification of cases suited to more extensive analysis. This theme links to (v) below through the exploration of community perceptions and understanding of different instruments and management regimes.

iii) Social research on respective *implications in changes of tenure* —private property rights, water rights and land rights and native title—for people's environmental behaviour. What opportunities might arise from such changes? How much do Australia's particular private property and leasehold arrangements encourage or deter environmentally responsible land management (there would be a strong historical dimension to such study). Especially, what new approaches to environmental management might emerge from native title, such as regional agreements, co-management, and other forms of partnership? (This is but of one many research themes needing attention regarding Indigenous lands.)

iv) *Identification of different forms of and structures for community involvement in ESD/NRM, and analyses of appropriateness and effectiveness for different purposes under varying conditions*. This is analogous to the instrument choice suggestion above, in that it proposes that there are many forms and purposes of community involvement, and that these will be effective only if certain conditions are met. Knowing more about these conditions would be invaluable for program designers, communicators and for stakeholders. This would involve both theoretical and grounded research and, again, a review and scoping study could precede a larger project.

v) *Analysis of the applications of information technology techniques and tools in NRM*, including electronic communications, decision-support systems and geographic information systems. In particular, how can users and developers collaborate to produce more relevant and useable software, and how the nature and use of IT techniques and differential access to them form or displace other techniques and affect power relationships in NRM?

v) *Description and analyses of the historical development of particular management and policy regimes that have played an important model role, followed by research into perceptions and understandings of these regimes in the present*. 'Model' processes, whether continued or abandoned, deserve close attention and fine-scale dissection to ascertain whether transfer of the whole or part is possible, and where and when it would be. Candidates for examination could include the South Australian soil conservation and vegetation program, or the late-80s to early-90s Victorian regional water planning process. Of particular interest is to identify where certain instruments or arrangements have been found acceptable or not (eg. when is regulation acceptable as opposed to education, pricing or compensation with respect to, say, remnant vegetation conservation or water allocation), and why.

vi) *Law-in-context research on how decision-makers exercise discretion under legislation* as to whether to permit, prohibit or control resource use activities. Where is the necessary information accessed from (applicants, other sources, fresh investigation or existing information bases, etc); how is uncertainty dealt with (especially the application of the precautionary principle); and what techniques are used (eg. BCA, non-market valuation, risk assessment, etc). Such research could focus on a particular piece of legislation, a set of statutes within one jurisdiction, or across jurisdictions (the decision as to which would need careful justification).

vii) *Researching and proposing possible 'meta-arrangements' to increase coordination and comparison across the ESD/NRM field*. Whatever the mechanisms considered , the aim would be to enhance policy and management learning across sectors, problems and jurisdictions. For something like this, it may be that the most appropriate means would be to use a targeted workshop based around small number of commissioned papers (2–3), with discussion and any recommendations written up and distributed, as

initial mechanism. (This would be a cost-effective and quick means of consolidating knowledge and perspectives on other such issues.) An explicit goal of any meta-arrangement would be to improve policy monitoring and learning over time, both as a strong need in itself, but also from LWRRDC's perspective to contribute to the longer-term assessment of the uptake and impact of S&I research.

viii) *Cross-sectoral and institutional analyses of the social and environmental impact of market-orientated institutional and policy reform* in natural resource management. This would not just consider market-based policy instruments, but (more importantly) the NRM implications of institutional changes of the last two decades based on the goal of 'marketising' public sector bodies (eg. corporatisation, contracting out, etc.). This would build on existing LWRRDC-sponsored work in the water sector, but seek to integrate insights from other relevant sectors within NRM (energy, fisheries, land management, agriculture) and from other policy fields (eg. health, service delivery).

ix) *Explication of NRM legislative, policy and administrative arrangements.* There is a clear need for more widely available and accessible descriptions of statutory, administrative and policy settings in ESD/NRM. This is a very basic service, but one suited to LWRRDC's mandate if that is to include S&I dimensions more. (At a general level, such a function was once addressed by the Australian Environment Council's 'Guide to environmental legislative and administrative arrangements in Australia'.) It may be that this would need to be preceded by research on information needs and sources of NRM stakeholders (see item (xii)).

x) *Comparative analyses of policy and institutional settings across time and jurisdictions* is an area of great need. The aim is to isolate elements, strategies or mechanisms within particular experiences with potential for more generic application. This could be framed in a number of ways, either broad or specific. The 1999–2000 general call priority regarding catchment management arrangements is worth pursuing and is an example of a specific focus. Institutional arrangements (or lack of them) underpinning regional NRM initiatives is another. A more broadly focused project/s could span a number of sectors and/or institutional forms or problems and, apart from yielding lessons in its own right, would be useful to scope further, more detailed examinations.

xi) It is clear that further research on the implications for NRM of *structural adjustment* is justified, on the basis of both the importance of structural adjustment but also the perception of many stakeholders that this is a crucial issue for R&D. Given the importance of this area to other agencies, LWRRDC activities would need to be carefully negotiated with other interested bodies, or ones that are not interested but should be.

xii) *Surveys of stakeholder information needs and sources of information on S&I aspects* of NRM of different stakeholders would be a valuable input into both future R&D (eg. explication of NRM legislative, policy and administrative arrangements) and communications strategies. Where do, for example, landholders get information on policy, etc., and what are their information needs? How can changing stakeholder perceptions, knowledge and expectations be monitored?

xiii) Continued attention to *nonmarket valuation techniques* is justified. Research directions here include: methodological stated preference work to further close the gap between stated and revealed value expressions; methodological stated preference research to extend the work of Bennett and others, attempting to locate the particular issue of interest within the wider policy agenda; and the development of integrated value methodologies that can address both economic and non-economic value expressions.

xiv) Examination of *decision processes*, such as to: develop decision process models that can be used to better understand individuals' decision behaviour in NRM contexts; and systematic appraisal of the key factors that drive stakeholders decisions and thus identification of policy levers most suited to affecting these (such work would involve collaboration at least between psychologists and economists).

xv) *Exploration of the extent, nature and effectiveness of social influence* in learning processes and the alteration of environmental cognitions, among Landcare and TCM groups. If social processes are effective, how can these be supported cost effectively, and information or new insights seeded into the learning networks? Can new media, such as information technologies, play a role for some people, and if so how? Such research assesses then expands on the potential 'adoption' role of group-based processes, and would consolidate the existing research on group processes.

xvi) *Smaller scale literature reviews and/or surveys of practice* as a style of R&D project are an attractive means of: involving new researchers; covering more ground for a given program size; getting returns on investment more quickly; tracking emerging or leading-edge methodologies or developments; and scoping these areas to assess further R&D potential. Potential topics, amongst literatures and/or methodologies of relevance to NRM, would include multi-criteria analysis (especially about procedures for scoring alternatives and weighting criteria), environmental risk assessment, strategic risk

assessment, conflict resolution, or social impact assessment. Another worth while possibility is the tracking of current policy processes (eg. elements of the RFA process) with a view that lessons accrued in these are noticed, and that the materials needed to be accessed for later, more detailed analyses are recorded and communicated (very often, locating the sources demanded by analysis of policies and processes even only a few years past end up requiring the combined skills of a forensic detective and painstaking historian). In some cases, such reviews could be a low-cost mechanism whereby reputable social science researchers with a less established connection with NRM issues can bring their expertise in some field to bear on matters relevant to LWRRDC, thus enriching the NRM area at the same time as familiarising them with that field in preparation for more substantial later work. To address this, terms of reference would include the requirement to sketch further R&D investment needs and scope themes, cases, etc. for more substantial studies.

(Note 1: The above research themes/projects are a selection of what is possible, and should not be taken as a complete menu, and actual selection will depend on LWRRDC's consideration of these and, eventually, the attraction of competent R&D proposals. Not all potential linkages between themes have been identified.
Note 2: Some of the above would be suitable areas for PhD projects—see Recommendation 5.
Note 3: Across all the above, smaller, pilot or scoping/ review versions could be done as per (xvi) above.)

Recommendation 5: Investing in future researchers and practitioners. It is recommended that LWRRDC expand its postgraduate student scholarship program, specifically in areas dealt with in this report. While particular research projects should not be prescribed, research themes can be stated as priority areas for support. (NB: through involving supervisors and research institutions, this recommendation dovetails with (6) below, and through the suitability of PhD research programs to labour- and time-intensive social science research, this will serve to pursue recommendation (4) as well.) A 50% increase in this area would be appropriate. The investment for this could come from that assigned to commissioned projects, or from other areas, as LWRRDC sees fit.

Recommendation 6: Building links and expanding the catchment of R&D providers. The establishment of the proposed program should be accompanied by an explicit effort to expand LWRRDC's links with R&D providers and their organisations in areas relevant to S&I research. The suggested reference group is one means of doing this, both in itself and through advice on appropriate initiatives. Other mechanisms include the development of an enlarged pool of specialist advisers and referees with social science expertise, and use of core social science journals, professional and academic bodies, and conferences to draw attention to NRM issues and the R&D possibilities.

Recommendation 7: Communicating R&D outcomes. Consideration should be given to means of encouraging the evolution of a more coherent *formal and lay* 'literatures' documenting developments and experiences in the S&I dimensions of NRM (this is a medium-term rather than immediate strategy). The former would be aimed at improving the academic, professional and managerialist body of shared knowledge and experience; the latter at addressing the issue of stakeholder access to innovative social and institutional ideas and developments in NRM, and the development of an improved 'environmental civics'.

Recommendation 8: Building a coherent policy field. It is recommended that LWRRDC consider initiating a discussion of mechanisms whereby coherence, coordination and integration across the ESD/NRM policy field could be significantly enhanced. Such options may entail institutional changes or the creation of information and communication links, and may be small or large. This could involve commissioning R&D in this area (a modest project) and using this as a basis, or simply organising some discussion forum, or arranging a forum where existing work on this issue could be brought together and considered. This should include consideration of arrangements in other policy fields. Initially, this might involve relevant Commonwealth agencies along with relevant researchers (particularly from the S&I area), and later perhaps extend to State and local level.

Recommendation 9: Administrative changes. As the recommended program evolves, LWRRDC will need to be open to changing certain administrative practices and procedures if existing arrangements are demonstrated not to suit the different forms of research occurring in the S&I area. Expanding the pool of referees has already been mentioned. The data identifying past and current R&D projects may need to be rethought, so that social scientists and potential users can search for relevant projects in more appropriate ways (see Part 1). Also, application forms for R&D proposals at present seem to be based on administrative imperatives and a history of natural science-orientated research, and less suited to social science proposals.

Recommendation 10: Where to from here? It should be that LWRRDC can make a near-term decision on the basis of this report as to the form, scale and general direction of the recommended S&I program, and perhaps as to the nature of some early investments in R&D of a pilot, review or scoping nature. The finer detail of the program content and structure will take further consideration, and the input of a wider group of stakeholders. Larger R&D investments within a new

program would require similar discussion to ensure that the research directions recommended here are endorsed more widely. (NB: It is assumed that investments presently being considered or proposed under other programs or through general calls will be handled as they would be normally.)

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Appendix A Terms of Reference

The Terms of Reference for this project were to:

- Assess recent reviews of LWRRDC programs and other literature and advise the Board on the significance of social, economic, legal, institutional and policy factors influencing decisions in natural resource management in Australia.
- Provide advice on what form of intervention into socio-economic, legal, institutional and policy impediments is likely to be most successful, and what are the costs, anticipated benefits and risks.
- Based on the above, advise the Board on whether there is a role, and if so what kind of role, for LWRRDC investing in such R&D. How could such R&D be linked effectively to organisations able to implement the changes required?
- Provide advice to the Board on how best it can consider policy and institutional arrangements including options of establishing a separate program in this area and/or incorporating relevant research into existing program frameworks. Advice should include recommendations of the scale and nature of investment (such as budgets and time lines).

Appendix B

Table 1 LWRRDC reviews and reports of research and development in natural resource management

Review and background	Relevant themes (significance or evidence of social and institutional factors in R&D failure relevant to NRM)	(a) Priorities or recommendations (b) R&D needs
Dryland Salinity R&D: a National Review. LWRRDC and others, 1992. Reviewed salinity R&D to identify future directions and to facilitate coordinated R&D.	Concluded that (i) current R&D lacked strategic focus; (ii) agencies seem to be operating under assumption that 'enough is known about salinity processes' and favour management responses while fundamental questions in most locations indicate that assumption not justified; (iii) only 2% of 126 projects are socio-economic; sociology of salinity and economic tools have been neglected perhaps because agencies: associate such work with extension and not R&D; did not see any need for it; did not recognise that the major determinant of success in landholder adoption of control technologies is where technologies lead to improved profitability; and (iv) lack of monitoring and evaluation makes it difficult to assess any R&D impacts (p8; 3.2; 3.3; 4.6).	(b) ICM approaches (focus on development of computer models to estimate impacts of changes, p4.5); economic analyses and models to help decision-makers choose between alternative approaches taking into account full costs and benefits; social impact and extension research including evaluating different extension models, role of personal/group values, risk attitudes, time preference, how to facilitate learning by farmer groups (p4.7); policy review—little has been done—but suggests it would be premature to define needed policy changes until fundamental technical and socio-economic research has resulted in clearer definition of preferred control strategies; policy research—to develop appropriate government policies to deal with market failure implicit in dryland salinity. (Some confusion is evident here given above recommendation—the rationale is that this could proceed to some extent in advance or parallel with other R&D, p4.7).
Procedures for economic assessment of management options for dryland salinity: report on a workshop. A. Webb and R. Price, 1994. Report of a workshop on economic assessment designed to inform the then newly established NDSP.	Perceived lack of rigour and scope in assessment of dryland salinity costs partly due to deficiencies in existing methods. Also due to biophysical data unavailable for input to economic analyses, and fact that policy makers have not insisted on rigorous economic assessment as an input to NRM decision-making (p9).	(b) salinity costs, especially off-site costs, who bears them; social, economic and environmental constraints to adoption; assessment of non-market aspects and also market impacts; integrated biophysical and economic models.
National Whole Catchment Management: a review and analysis of processes. G Syme et al, 1993. Review to examine WCM at the national level, to ensure that the newly established NDSP would be integrated with environmental management at catchment level	WCM is considered the most effective means to coordinate initiatives such as dryland salinity and Landcare, but has been mainly used to promote awareness. Has been dominated by 'social response' model (shape public attitudes through persuasion not prescription). Has had limited application as a means for complex management of natural resources (p9). Has been constrained by resistance by government agencies to an integrated approach, and lack of resources to develop and implement WCM strategies (p7).	Specific research needs are not identified; general comments made about the need for all forms of research on WCM (p54).

Table 1 LWRRDC reviews and reports of research and development in natural resource management

Review and background	Relevant themes (significance or evidence of social and institutional factors in R&D failure relevant to NRM)	(a) Priorities or recommendations (b) R&D needs
An assessment of the National Dryland Salinity R, D & E Program. G. Hayes, 1997. 1996 (mid-term) review of Phase 1 of the NDSP which was established in 1993 following the LWRRDC et al 1992 review of Dryland Salinity R&D. This review is process focused and conducted against LWRRDC's 'template of questions'.	Little or no progress in R&D implementation on the ground. Recognition that still too early to judge whether techniques and tools will be applied widely (p26; 81). However basic assumption that provision of 'integrated techniques' (focussed on biophysical issues) would be sufficient now seems doubtful (p71). Managers have no market signals or incentives to change practices which generate externalities. Market failure has been difficult to deal with due to no clear property rights to groundwater and recharge and costs of establishing such rights may be greater than societal benefit. Has been little institutional analyses of either dryland salinity or ICM approach but range of evidence indicates that institutional failures are significant (p3,10, and especially 51-56 which identifies 8 areas of such failure). Most previous research on costs of dryland salinity has focussed on farm level costs (ie largely private). None identify costs to nation and almost none have explored social or environmental costs (p38).	(a) Need to change the operating environment such that managers have incentives to change land use, and such that implementing agencies improve coordination and ability to utilise and deliver R&D findings. Ultimately requires political decisions on changes to policies and policy mechanisms. Research in following areas can inform such decisions (i) definition of a 'socially desirable' rate of salinisation, expressed as a target, as this is needed as basis to define types of interventions, (ii) alternative policy mechanisms to create incentives (for managers to avoid uses that result in exceeding targets), (iii) alternative policy mechanisms to improve delivery & achieve ICM (65). (b) broadly in the disciplinary areas of public choice, sociology, institutional economics, and resource economics (p72); specifically: efficiency of land use regulations in combination with incentives (role of regulatory framework); feasibility of economic instruments; attitudes to land retirement; institutional and social aspects of ICM process; national costs of dryland salinity (including costs to environment); implementation links with structural adjustment; extension (including to other catchments) and communication.
Role of social research in managing dryland salinity. I. Reeve and G. Hayes, (undated). Discussion paper by sociologists in the 1997 Review of NDSP. Based on interviews with ten social researchers involved in LWRRDC salinity projects. Focus on role that social research can/ should play.	Constraints against greater contribution of social research to dryland salinity problems: different research cultures; often concerned with behaviour so not politically neutral; some problems readily analysed but analyses can't directly influence any changes to fundamental issues of property rights (unless politically focussed but this is resisted by agencies).	(a) LWRRDC needs to recognise political aspects of dryland salinity if they want to gain from full potential of critical social research. But could not claim neutrality. If they choose not to fund R&D deemed 'political', social research is still useful to: assess possibilities within existing legislative/policy frameworks; clarify LWRRDC's conceptual schema for relationship between research and impacts; ensure biophysical R&D understands social context. (b) why powers in existing framework are ineffective or fail to be exercised; alternatives for institutional reform drawing on OS experience; alternative problem framing; implications of pace of social and economic changes on processes of adoption and abandonment of salinity practices. Report also suggests that social research is not needed into Landcare groups role in reform process—that it would be more useful to target such research at other groups with a legislative role eg TCM committees in NSW.

Table 1 LWRRDC reviews and reports of research and development in natural resource management

Review and background	Relevant themes (significance or evidence of social and institutional factors in R&D failure relevant to NRM)	(a) Priorities or recommendations (b) R&D needs
Assessment of knowledge gaps (re hydro-geological aspects) impeding implementation of dryland salinity management. D. Woolley, 1997. Discussion paper by hydrologist in the 1997 Review of NDSP.	Selected findings: concludes generally sufficient technical knowledge of hydrogeological processes to enable remedial strategy preparation, but lack of adoption of proposed procedures (between 1-5% adoption may be the norm). Possible that procedures are not economically and/or socially acceptable. Has been a great emphasis on development of computer models of focus catchment processes and to assess different management strategies but these are very costly and may not transfer to other catchments. Also models are very complex and not readily understood or useable. Tension between necessary complexity and practical needs of managers. Are simpler DSS frameworks possible?	(b) analyse reasons why uptake of R&D recommendations is so low. Report also notes that monitoring of catchment processes is ad hoc, and suggests that LWRRDC should require funding recipients to implement and continue long term monitoring programs. No discussion of 'how'.
R&D for sustainable use and management of Australia's rangelands. S.R. Morton and P. Price (eds), 1994. Proceedings of a national workshop to help identify priorities for LWRRDC investment in rangelands R&D. This approach was considered necessary as there was no agreed national policy/plan for future rangelands management that indicated such priorities. (Note that a National Strategy for Rangelands Management was released in 1997 but is still vague on priorities and research needs!)	Selected findings: linkage between R&D and land use in rangelands appears weak with poor research adoption rates; lack of community involvement in planning R&D; policy vacuum exists for rangelands; legislation does not promote long term sustainable management; limited biological and socio-economic data-bases; economic data don't include land degradation; ageing population; large scale social, cultural and economic changes are occurring adding complexity to planning and implementing R&D (p5-6, 14). Paper by Hodgkinson notes that policy research followed by economics and sociology were represented the least in current rangelands research (p41). Paper by Holmes argues that inadequate and under-resourced nature of current social science research in rangelands is a major impediment to effective implementation of natural science research (p38). Past R&D has been based in narrow technical paradigm and oriented to productivity issues; changing values and sustainability paradigm necessitates stronger social science inputs (p34).	(b) Identifies 8 areas of R&D and specific needs within these (p9-11). Relevant areas include: regional planning, communication, legislation, diversification. Holmes identifies a large number of more specific priorities for socio-economic R&D, which includes suggestions relating to research on institutional, legislative and policy settings (p37-39).
Regional resource use planning in Rangelands: an Australian Review. A. Dale and J. Bellamy (eds) 1998. Following above workshop, LWRRDC funded 3 regional planning projects in the rangelands. This review was conducted by the one of the projects with a view to identifying evaluation criteria and potential future directions.	Selected findings: past and current regional approaches are generally deficient because they: are too centralised; focus on non-integrated themes of economic, or social development or protected area conservation; make inadequate use of technical information and technologies; and do not facilitate negotiations or effective monitoring and evaluation (p1). Most R&D effort has focussed on technical assessment issues (p120); there has been little evaluative research, and least effort on social and cultural aspects of development (p122).	(b) Identifies 6 areas of R&D and priority needs within these (p119-125). Includes research on regional aspects of ESD and relationships with other scales/ processes; tools/frameworks for resource use trade-offs; sustainability indicators; learning and negotiation processes; social, cultural, and sectoral viability aspects of regional development; economic valuations and systems based approaches to economic modelling; and notes the need to build monitoring and evaluation into these research and planning processes.

Table 1 LWRRDC reviews and reports of research and development in natural resource management

Review and background	Relevant themes (significance or evidence of social and institutional factors in R&D failure relevant to NRM)	(a) Priorities or recommendations (b) R&D needs
A program of R&D into indicators of sustainable crop production systems. ACIL Economics P/L et al. 1994. LWRRDC and GRDC commissioned report into the identification of indicators of the sustainability of cropping practices.	Concludes that the use of indicators is important but not the primary concern (p80). Need for a much larger knowledge improvement process that focuses on what motivates farmers, and helps them to identify changes based on more sustainable practices which have tangible benefits (p81).	(a) Identifies a number of aspects of extension and information delivery which require attention including building communication between different groups (p84-87). (b) N/A
Groundwater issues in Australia: their significance and the need for research. Barber et al, 1995. Report into R&D needs on groundwater, and advice on need for a separate groundwater program within LWRRDC.	The study methodology was based on prior definition of groundwater research issues which, with the exception of one (community participation in aquifer protection), were largely phrased and treated as technical biophysical issues.	(b) identified priorities are technical/biophysical reflecting the study design. (However LWRRDC subsequently commissioned research by M Young on using right markets to handle groundwater pollution).
Irrigation research issues: a discussion paper. AITC et al, 1996. Part of a LWRRDC review of priority issues of the first phase of the National program for Irrigation R&D (NPIRD) and to establish priorities for second phase.	This program has been heavily focused on biophysical R&D and this review does not provide adequate discussion of need for any other R&D. Broadly notes that COAG water policy reforms have had great impact on industry and have highlighted a range of socio-economic issues not well considered previously (p12).	(b) potential impact of tradeable water rights basin to basin and between states; how security of seasonally variable entitlement can be achieved; socio-economic issues surrounding rehabilitation or decommissioning of irrigation areas (p12) (and identifies a number of other low-high priority research projects).
Assessment of R&D priorities for environmental flows in Australia for the National River Health Program (NRHP), AACM, 1994. NRHP was established in 1993 and was managed by LWRRDC; it is now managed by EA. Report recommended new R&D priorities to support the environmental flow management initiative (EFMI) part of the program in Phase 2.	Stakeholder perceptions that Phase 1 EFMI lacked focus or ultimate objective. Emphasis on biophysical R&D and collection of baseline data. Little investment in policy, economic or social areas (ie broad implementation and management issues; p39). Lack of multi-disciplinary teams. Current need for priority setting. COAG water reforms and ongoing privatisation of water industry important factors in evolution of R&D agenda.	(b) trade-off processes & tools including participatory processes, principles / practices for property rights, institutional arrangements, & policy frameworks to enhance adoption of environmental flow regimes; quantification of trade-offs & environmental, social and economic impacts of changed regimes; cost-sharing guidelines; tools to help evaluation of R&D investment.

Table 1 LWRRDC reviews and reports of research and development in natural resource management

Review and background	Relevant themes (significance or evidence of social and institutional factors in R&D failure relevant to NRM)	(a) Priorities or recommendations (b) R&D needs
R&D needs for River Restoration in Australia. CRC for Catchment Hydrology, in press. (summary only has been sighted) Report on information required for the development of a national stream restoration program by LWRRDC.	Problems with practice of stream rehabilitation include: narrow, unclear or unrepresentative goals/project objectives; wrong diagnosis of problem; poor communication between relevant actors; poor recognition of multi-disciplinary nature of task or catchment context; inadequate use of resources and knowledge; poor evaluation of effectiveness of works/activities; (draft summary p3, 5). Most R&D is focussed on the 'easy' parts of the task (selection of the tools to fix stream problems) but the main impediment can be social and political factors (p5).	(b) identifies several needs including investigation of existing state and federal legislation to establish whether sufficient power exists to rehabilitate streams, and consideration of application of international legislative models to Australia (p8). (Note that this recommendation has since been acted upon with the tendering of a project in this area.)
Social and economic feasibility of ameliorating soil acidification: a national review. AACM, 1995b. Review to identify significance of major soil acidification issues and to identify why amelioration technologies are not being widely adopted.	The problem is generally not perceived as a priority issue by producers and service providers and they also have different perceptions of importance of issues; social barriers to adoption (lack of understanding of low costs and positive benefits in managing) tend to be more important in farming systems, while economic barriers (economics of liming) tend to be more important in intensive production systems (pviii; 49).	(b) identifies several priorities for LWRRDC engagement in (i) applied and 'process' (externalities, role of government, cost sharing ratios) R&D, (ii) better extension, and (iii) policy development. The latter is not seen as a target of research—rather it identifies a need for development of national standards for best management practices and that LWRRDC could support same (p66).
Integration and adoption of R&D results at the catchment scale. AACM, 1995a. Report on the need for improved integration and adoption of R&D, efficacy of existing and new tools for same, and a R&D framework to support same. Based on interviews with 42 people from state and federal agencies, research and industry organisations, and catchment groups.	Participants perceived that policy/institutional deficiencies are more important barriers than deficiencies in tools used (p10). (Existing tools are defined as models eg bioeconomic models and expert systems, and planning frameworks eg strategic planning processes; p6). Available tools are adequate or can be integrated and 'scaled-up'—just need an enabling environment which creates incentives for on-ground works to manage land/water resources at catchment scale (piii). Report does not discuss what is meant by policy/institutional barriers.	(a) LWRRDC needs to extend its sphere of influence to on-ground actions of farmer groups and other land/water managers. Therefore it should deliver research investments through selected community groups in selected catchments. Integration and communication will also be enhanced if policy and inst environment provides market incentives for sustainable NRM (p. iv). (b) N/A
Review of LWRRDC funded investment in water policy research and development. J. Pigram et al 1997. Review to assist LWRRDC in identifying research directions in area of water policy R&D.	Water policy efforts have been problem-orientated and disjointed in economic, social and environmental terms. No overall policy framework exists to place policy responses in a consistent context at federal or state/territory levels (p3, 17). Perception that water policy issues have declined in importance since late 1980s with the increasing emphasis on integrated resource management (p6). Notes that LWRRDC funding arrangements potentially constrain water policy R&D (p 20-21).	(b) a national water policy; policy development to address the challenge of water resource management under federal system; financial and economic policies appropriate to the management of Australia's water resources; water policies for an urbanising nation and diverse society; policy needs to promote community awareness, education and technology transfer (p3). (A large number of subsidiary R&D needs under these broad areas are also identified on pages 18-20.)

Table 1 LWRRDC reviews and reports of research and development in natural resource management

Review and background	Relevant themes (significance or evidence of social and institutional factors in R&D failure relevant to NRM)	(a) Priorities or recommendations (b) R&D needs
Remnant vegetation in the rural landscape. J. Lambert, J. Elix, (Community Solutions) 1993. Report into national priorities for R&D programs on remnant vegetation, particularly those not addressed by current programs, and recommendations on LWRRDC's potential role. Based on 57 interviews and literature search. Contributed to development of the joint LWRRDC/ Environment Australia R&D Program: National Remnant Vegetation.	Selected findings: R&D in this area is ad-hoc and has not been coordinated nationally; there is no specific national policy on remnant vegetation; paucity of ecological research (as opposed to the production-oriented aspects of NRM); current research has been inaccessible or poorly communicated to end users; attitudes which favour traditional production patterns; no understanding of why one land manager will take action to manage remnant vegetation and another will not; proposed incentives such as fencing subsidies may help change behaviour but are not affordable; state governments don't enforce regulations adequately; lack of collaborative research involving stakeholders and integrating economic research (p7-11; 34). (See report for discussion of these areas.)	(b) targeted research into social, legal and institutional factors, including landholder attitudes and the provision of incentives and regulation (p9, 27); economic research to establish satisfactory methods of assessing short and longer term costs and benefits of vegetation retention (p29).
R&D priorities for environmental and resource management in the Australian sugar industry. P. Chudleigh et al 1997. Commissioned by Sugar RDC and LWRRDC; a pilot study for LWRRDC to assess whether it would be beneficial to fund R&D more integrated with industry needs in order to assist adoption; Sugar RDC also recently revamped to include a program on NRM. Based on surveys of 112 stakeholders and CBA methods. Notes difficulties with valuing non-market benefits of improving practice, and limited time, knowledge/ underdeveloped valuation techniques to explore same (p32; 42).	N/A	Selected R&D gaps (only the first two are identified as such in report; the others are termed sub-issues): incentive mechanisms to enhance acceptance of best practice; stronger support for Landcare/ICM groups by cane growers; allocating water among competing uses; attitudes of cane growers toward riparian zones; cost sharing for protection of such zones/remnant vegetation; better understanding of extension for cane growers.

Table 1 LWRRDC reviews and reports of research and development in natural resource management

Review and background	Relevant themes (significance or evidence of social and institutional factors in R&D failure relevant to NRM)	(a) Priorities or recommendations (b) R&D needs
Review of the National Climate Variability Program R&D Program. Hassall & Associates 1997. Mid-term review of Phase 2 of the NCVP which was established under National Drought Policy in 1992. Phase 2 began in 1995 and concluded mid 1998. NCVP is managed by LWRRDC with help from RIRDC. Review was to provide feedback on how program could be strengthened, and input for a possible Phase 3.	Government policies have helped to create socio-economic features of NRM approaches which may be inappropriate for drought-prone areas (p58). The National Drought Policy reflected a change from drought support to encouraging resource managers to be self-reliant. Subsequent R&D has focussed on climate forecasting, drought risk monitoring, and decision support for farm risk management (ie technical biophysical research with a significant component of developing farm-level decision support tools). Review found that R&D generally of a high standard and contributed to aims of program (p1). Relevant issues noted: forecasting may not be useful to managers unless they have ability (skills, lead times) to respond (p20) and thus far few DSS have been adopted in farmer decision-making (p1). Both issues suggest need for increased participation by managers in R&D (p15). Noted also difficulties in evaluating R&D performance (p29).	(b) projects to combine action learning with development of DSS tools (p23); a framework to relate socio-economic information to biophysical information (p11); policy instruments: biophysical /bioeconomic case studies into impacts of taxation/other policy instruments on resource sustainability (eg some software is useful to look at impacts on production but it can't inform whether policy instrument intent is met; DPIE should have input so that this R&D can lead to administration changes, p23); (Report provides brief discussion on NCVP role in policy research and policy development; p28.)
Assessing the impact of research projects related to Australia's natural resources. M. McGregor, et al 1994. 1993 ex ante impact evaluations of 7 projects and 1 program. Social CBA analysis, including efforts to estimate non-market impacts (p21). All bio-physical although two (DEP1, UNE11) have significant institutional elements associated with implementation.	Selected findings: imbalance in portfolio evident in low support for economic/social research (p111). Report does not discuss or make recommendations regarding 'social' however. Discusses evaluation issues arising from LWRRDC's emphasis on research which has significant non-market benefits (p91-107).	(a) facilitate communication between natural scientists and economists (including LWRRDC employment of economist). (b) valuation studies of natural resources to help evaluate research projects.
Evaluation of the impacts of Research Projects Related to Australia's Natural Resources (1995-96 Group; Phase 1), ACIL Economics & Policy P/L. 1997. Independent ex-ante evaluation of 8 projects which began in 1995-96; selected to represent main program areas, commissioned and general call, biophysical & socio-economic, and collaborative & non-collaborative. Standard social CBA. Evaluates 3 socio-economic projects (two commissioned, one general call).	Evaluation suggests that there are major uncertainties regarding potential of 3 projects to achieve changes: two socio-economic projects (VCA1; CWE11); one termed bio-physical but with significant socio-economic dimensions (AGS1). Prime reason is that projects have not focussed strongly on how agreed research outcomes will be implemented in absence of external incentives to change behaviour of land managers (p42, 43, 51, 57). Notes difficulties in evaluating the third socio-economic project as it too is an evaluation (Assessing effectiveness of WCM—CWW22). Notes difficulties with quantifying non-market benefits but attempts this 'where data available'. Considers market failure, underlying incentive structure for R&D investment, & consequent role for LWRRDC (p15).	(a) LWRRDC should encourage (i) researchers to consider economics of project design and outcomes; (especially prospective benefits, elements of risk in process, implementation issues); (ii) multidisciplinary approach to problem definition and project design; (iii) small scoping studies as precursors (p.x).

Table 1 LWRRDC reviews and reports of research and development in natural resource management

Review and background	Relevant themes (significance or evidence of social and institutional factors in R&D failure relevant to NRM)	(a) Priorities or recommendations (b) R&D needs
Evaluation of the Impacts of Research Projects relating to Australia's Natural Resources (1993 Group; Phase 2), S. Harrison, J. Tisdell, 1997. First update of 'life of project' evaluations of 7 projects and 1 program initially evaluated in 1993 (McGregor et al 1994; see above). Social CBA analysis, including efforts to estimate non-market benefits (p24).	Selected findings: difficult to evaluate projects which lead to protection/ management of large areas from salinity, loss of vegetation etc (eg wetland, floodplain research) as little economic information about asset and function values (p6-7; 154-155) and wide variety of public and private benefits can accrue.	N/A
Ex-Post Evaluation of Selected Research Projects. Sloane Cook & King P/L, 1997. Evaluation of 9 completed projects which were considered to have achieved intended outcomes. All were biophysical. Purpose to improve LWRRDC management of R&D programs.	Selected findings re barriers to adoption: projects often fail to think through to how adoption process will work; vague adoption objectives; budgets mostly built around scientific component not adoption; institutional inertia (especially where changes to NRM required); failure to understand potential adopter's perceptions of research importance; lack of resources; potential adopters perception of exclusion from research process (p1-5).	(a) LWRRDC needs a more rigorous statement of objectives for projects; place more emphasis on identifying potential adopters and their perceptions, and priority rankings; recognise different time scales for research and adoption (p4-5).
Data sheets on Natural Resource Issues. LWRRDC 1998b.	Data sheets are not summarised here. The publication identifies 19 priority areas in natural resource management and a number of issues relating to 'researchability'. It incorporates many of the recommendations or findings of LWRRDC funded reviews and other sources of information.	N/A

Table 2 Selected national reviews relevant to research and development in natural resource management

Review and background	Relevant themes (significance or evidence of social and institutional factors in R&D failure relevant to NRM)	(a) Priorities or recommendations (b) R&D gaps
Environmental research in Australia: the issues. ASTEC, 1991. Reviewed contribution of environmental research to resolution of NRM issues and identified obstacles to same.	Constraints to incorporation of environmental research into decision-making processes: (i) lack of a national focus and framework for such research (pxi); (ii) lack of long term and baseline environmental research and monitoring which is further constrained by the impact of competitive funding mechanisms, cost recovery policies, and pressure to produce quick results (p11); (iii) lack of inter-disciplinary research—study of environmental processes is often removed from social, economic and political framework (p17).	(a) need for a National Environment Strategy to identify research priorities and provide inter-departmental coordinating mechanism (pxi). (b) interdisciplinary science applied to large scale projects; special need for research into social sciences eg resource economics to better understand relationship between economics and ecology (p17).
Ecologically Sustainable Development Working Group Chairs Intersectoral Issues Report, Commonwealth of Australia 1992a. Recommendations on implementation of ESD principles, particularly from perspective of cross sectoral issues and require coordinated broad scale actions	Noted generally that funding and conduct of ESD related research was uncoordinated with no appropriate body to identify gaps and broad priorities (p231). Also noted that the nature of, and need for research on natural and physical sciences to support ESD was relatively well covered in ASTC's 1991 review and in the ESD working group sectoral reports however the broad range of crucial socio-economic research was less well reviewed (p223).	(a) establish some form of ESD research advisory body (pxxvi). (b) improved analytical procedures/techniques such as contingent valuation, option value estimation, and incorporation of scientific uncertainties, the interests of future generations and equity issues into risk-benefit analyses (pxxii).
Bridging the Gap: the social sciences and humanities in Australia. ASTEC, 1993. Focus of report is on contribution of humanities and social sciences to economic development and relationship with natural sciences and technology.	Concludes that government is poorly informed about the capacity of social sciences and has not identified its overall requirements for such research (p46). In part this is due to the lack of any meta-arrangements for such research to provide a national focus as exists for natural sciences and technology in ASTEC, or Britain's Economic and Social Research Council for Social Sciences (p6).	N/A

Table 2 Selected national reviews relevant to research and development in natural resource management

Review and background	Relevant themes (significance or evidence of social and institutional factors in R&D failure relevant to NRM)	(a) Priorities or recommendations (b) R&D gaps
Sustaining the agricultural resource base. PMSEC, 1995. Prepared by an independent working party for consideration by Prime Minister's Science and Engineering Council (PMSEC).	Notes that: (i) there is evidence of significant land degradation costs; (ii) continuing degradation of the agricultural resource is likely to undermine the national economy, the physical health of Australians, and the status of biodiversity; and (iii) the key players have shown commitment to change, a number of policies and actions have been undertaken to deal with the problems, and good scientific research is under-way. However a new stage of evolution towards more determined and coordinated actions is needed (p1-3). A particular area of concern is that the sustainability challenge is one for all land managers, however a significant proportion of existing producers (perhaps between 50% and 70%) may not have the financial resources to make the changes necessary for sustainable management (p2). With regard to ICM approaches in the MDB, a major constraint is insufficient funding for the necessary private and public works (p66). Traditional technology transfer model is inappropriate in these complex decision-settings (p12), and existing research emphasis on productivity and marketing improvements needs to be refocussed on sustainability of systems and practices (p15; 78).	(a) A national agenda for R&D in this area is needed which coordinates all industry R&D corporations to a common sustainability goal (p16). An argument is also made for LWRRDC funding to be enhanced to support an ongoing program to improve institutional arrangements for land and water management with topics such as organisational arrangements, corporatisation, dissemination of knowledge, property rights and transferable water entitlements (p29). (b) economic, environmental and social comparisons of alternative land uses for particular regions; evaluation methods for costing degradation; evaluation of appropriateness of policy instruments for good environmental management; analysis of how to mobilise social and economic development dynamics of agricultural communities towards greater diversity and resilience (p78).
Australia: State of the Environment, 1996. SEAC, 1996. Produced by State of the Environment Advisory Council. Documents 'pressure-state-response' relationships between land uses such as agriculture and the biophysical and social environment.	Paints a broad picture of the state of the Australian environment, and various information needs are scattered throughout the report. However specific R&D priority areas or gaps of relevance to this study are not identified.	N/A

Table 2 Selected national reviews relevant to research and development in natural resource management

Review and background	Relevant themes (significance or evidence of social and institutional factors in R&D failure relevant to NRM)	(a) Priorities or recommendations (b) R&D gaps
Developing long-term strategies for science and technology in Australia. ASTEC, 1996. ASTEC study using a foresighting process to identify areas for action to ensure science and technology system is better integrated with socio-economic and environmental needs and to identify R&D priority areas for Australia.	Recommendations are targeted primarily at the Commonwealth government. Discusses four forces for change including 'environmental sustainability'.	(a) strong national capacity in environmental economics, based on sound scientific knowledge (including resource accounting and analysis of long-term social benefits and costs). Requires an improvement in capacity to monitor and analyse changes in the environment, their impacts and values, and effective mechanisms to contribute such information to decision-makers (p103). Report also points to importance of research on risk assessment/management given the potentially large economic and social transformations that lie ahead (p252-3).
Reimbursing the future: an evaluation of motivational, voluntary, price-based, property-right, and regulatory incentives for the conservation of biodiversity. M.D. Young et al, 1996. Commissioned by DEST; based on a review of incentives in Australia and overseas, consultation forums, and six case studies.	Some governments have begun to address off-reserve protection of biodiversity but alternative incentive approaches remain neglected. Barriers to more individual / community action may be distribution of information about values and threats rather than lack of it. No single policy option is likely to be appropriate; will be a need for mixes of instruments for specific circumstances (pvii).	Makes 26 general recommendations and 63 specific recommendations to government on directions for biodiversity conservation (see p154-184). Many of these could be regarded as targets of R&D but are not framed in this way. Specific mention of R&D includes: the need for relevant RDCs such as LWRRDC to include biodiversity criteria in their funding guidelines (p168); research on economic value of native species as saleable products and benefits of remnant vegetation to farming system (p170).
Sustainable natural resource management in the rangelands. Centre for International Economics, Canberra (CIE), 1997. Report for DPIE on social, economic, institutional impediments to rangelands NRM; means of overcoming, and issues of Landcare. Based on a fairly basic literature review and interviews with 20 pastoralists in central western Qld.	Concludes there are lots of impediments identified in literature, and that Landcare is not working in the rangelands (p52), but there is little guidance available in quantifying or prioritising impediments, nor how trade-offs between social, economic, and ecological goals should be made (p30). Findings suggest that surveyed pastoralists do not see sustainability or Landcare as major problem (p45). They see resource degradation in relation to specific production problems (eg weed control) not diffuse concepts such as biodiversity (p46). They feel unable to adopt best practice due to the poor economics of enterprise (p39). They identify as a distinct group (p47). Pushing the need for change is therefore very hard.	(b) identify specific sustainability problems in rangelands (p49); social research into communicating better with pastoralists (p50); assess whether incentives for off-reserve conservation would be successful on leasehold lands (p51); examine evidence for significance of security of tenure on NRM; review NRM legislation for consistency and unintended consequences (p52). (Does not add a great deal to the Morton and Price (1994; see Table B.1) review with the exception of discussion of Landcare.)

Appendix C List of People Consulted

Jason Alexandra	Director, LWRRDC
Don Aitken	University of Canberra
Kevin Balm	Integra Pty Ltd
Jennifer Bellamy	CSIRO Tropical Agriculture
Alan Black	Edith Cowan University
Don Blackmore	Director, LWRRDC
Leith Boully	Director, LWRRDC
Tony Byrne	Rural Industries RDC
Alex Campbell	Chairman, LWRRDC
John Childs	CRC for Tropical Savannas
Sheridan Coakes	Bureau of Rural Sciences
Wendy Craik	National Farmers' Federation
Jeff Davis	Rural Industries RDC
Sarah Ewing	University of Melbourne
Tim Fisher	Australian Conservation Foundation
Chris Forster	Director, LWRRDC
Jane Garnaut	Australian Bureau of Agricultural & Resource Economics
Esta Knudsen	Murray–Darling Basin Commission
Warren Musgrave	NSW Premier's Dept
Phil Price	Executive Director, LWRRDC
Richard Price	Program Manager, LWRRDC
Nick Schofield	Program Manager, LWRRDC
John Taylor	Director, LWRRDC
Warwick Watkins	Director, LWRRDC
Alex Wells	Fisheries RDC
Charles Willcocks	Director, LWRRDC
Joe Williams	Grains RDC

Appendix D Social and Institutional Research Workshop, Australian National University, 20–21 October: Participants and Themes

As part of the consultancy, a workshop was held on 20–21 October, with two aims: to expose the four papers to review by an expert in that field; and to discuss amongst a small group of relevant researchers, professionals and stakeholders themes and issues central to the consultancy task. The workshop was not designed to arrive at specific recommendations, but rather to encourage a wide-ranging discussion, as an input of differing perspectives to be taken on board by the consultancy team. This appendix summarises the issues raised and themes emerging from the discussions. Those issues and themes with general support amongst participants have been taken into account in the consultancy report.

Workshop Participants

Jason Alexandra	Director, LWRRDC
Alan Black	Edith Cowan University
Leith Boully	Director, LWRRDC
Andrew Campbell	Environment Australia
Sheridan Coakes	(discussant – social research) Bureau of Rural Sciences
Steve Dovers	(consultancy team) Australian National University
David Farrier	(consultancy team) University of Wollongong
Neil Gunningham	(discussant – law) Australian National University
Esta Knudsen	Murray Darling Basin Commission
Michael Lockwood	(consultancy team) Charles Sturt University
Catherine Mobbs	(consultancy team) Australian National University
Warren Musgrave	(discussant – economics) Premier's Dept, NSW
Elim Papadakis	(discussant – policy/ institutional) Australian National University
Richard Price	Program Manager, LWRRDC
Helen Ross	(consultancy team) Australian National University
Heather Tomlinson	Agriculture, Fisheries and Forestry

Summary of workshop themes

Methodological issues

An initial statement was made regarding the problem setting from LWRRDC's perspective. LWRRDC reviews of research in NRM have all commented on the fact that while areas of biophysical research needs have been capably identified and addressed to a large extent, in many cases we are not seeing improvements to NRM policy and practice. This is viewed as indicating a need for more social, economic and institutional research to better understand NRM and what can be achieved. Currently, LWRRDC invests, with funding partners, around $30 million annually in NRM research. Less than 5% of these funds support social and institutional research. Over the past four years LWRRDC has tried to encourage such research through making social and institutional areas a top priority for the general call, but this process has not been satisfactory for several reasons. These include: fewer applications have been attracted than desired; some applications propose research which duplicates past research; it is often the case that research proposals have not been designed to be able to extend from a case study or case studies to more general application; and, questions of institutional design are rarely addressed—there often seems to be an assumption that current management frameworks are sufficient.

One response to this problem setting was a question from a participant as to whether there is a need for more 'social research' or rather is there a need to build social science perspectives into existing research. There was general agreement throughout subsequent workshop discussions that both approaches were needed. Related to this was the question (discussed but not resolved) of how more 'pure' S&I research can be implemented in terms of practical outcomes.

Workshop participants agreed that adoption and policy implications are too often an 'add-on' in the NRM research field and that this was a critical issue for the attention of social science perspectives. A related issue raised was the possibility that the outcomes of S&I research may not coincide with the readiness of decision-makers to utilise them. It was

noted that this can also occur with biophysical research. Both types of issues have implications for ex-ante and ex-post evaluation processes. For policy-related research, it was felt by some that the problem of sensitivity regarding policy recommendation could be addressed by framing research to enhance and inform the choices available to policy makers and others, rather than advocating one option or instrument.

There was widespread endorsement of an 'adaptive' approach to policy, management and to research, as proposed in the paper by Dovers (Section 7), but uncertainty as to how one researches such issues and how LWRRDC itself could become a more adaptive organisation.

The importance of institutional arrangements was recognised by the workshop, noting that what often are seen as problems of individual, firm or agency behaviour can be cast as institutional problems, as it is within the institutional setting that choices and behaviour operate.

A number of definitional issues were discussed. There was some discussion of how we define the terms 'science', 'research' and 'monitoring' and the potential need to extend current definitions to more appropriately encompass the areas of concern for social and institutional research. In particular, the problematic division between 'research' and 'development' in terms of S&I issues was recognised. The nature of the relationship between longitudinal research and research with a monitoring purpose was raised, particularly in terms of policy evaluation and monitoring, and the development of adaptive models of policy and implementation.

On monitoring, it was noted that S&I research projects would last for two-three years, and that this could not capture processes of policy, behavioural or institutional change, so other mechanisms of monitoring and review of R&D impact would need to be relied upon. Further, it was stressed that such change was not the responsibility of researchers, who could only put forward options for policy change, not implement them.

The classification of 'legal research' and modes of legal research were also of interest to participants. For example, one participant queried whether it was valid legal 'research' to devise a new set of legislation consistent with ESD, and who should or would undertake such research (see Farrier, Section 6). Similar issues were raised regarding the appropriateness of a body such as LWRRDC sponsoring research leading to policy recommendations at odds with current policy settings.

The issue of paradigms was of great interest and there was general agreement that LWRRDC and others needed a better understanding of the intellectual underpinnings driving research approaches (see Ross, Section 4). It was suggested that social scientists work within frameworks which explicitly recognise values. Some social scientists, like biophysical scientists, are often non-reflective. However, social scientists are taught to make their epistemologies explicit while biophysical scientists may have a sense that 'positivism', the paradigm that most work within, is inadequate for a NRM issue, but do not know how to mount research differently.

One participant reflected on experience that given the numerous emerging contexts where members of the community are stakeholders in the research process, there is a need for more low cost research and 'simple' analytical frameworks that can be understood and applied broadly. This was seen as useful for reasons of communication, but also because of limited budgets.

Finally, it was commented on by several participants that while LWRRDC's role in S&I research had concentrated on, and would probably continue to, the 'micro' level of policy, economic, legal, institutional and social dimensions of NRM, the 'macro' level was very important in shaping NRM and needed some attention (e.g. broader economic policies, legal and governance issues, institutional arrangements, etc.).

Organisational issues

There were two broad perspectives expressed on the theme of organisational options for LWRRDC to undertake S&I research. One perspective suggested that the scope and priorities for S&I research needed to be identified before there was any discussion of organisational options. The other perspective suggested that the issue for LWRRDC was not so much what specific social research is required, but how to undertake research programs in a more holistic manner. The latter perspective was generally adopted in subsequent discussion.

It was agreed that there were a number of ways to design research programs for NRM. Currently LWRRDC have a program/project framework wherein programs are thematic expressions of a major NRM issue (e.g. integration and adoption) or problem (e.g. dryland salinity) and numerous projects addressing some aspect of the theme are funded. Discussion was initially focussed around the advantages and disadvantages of place-based case studies versus 'themes' as ways of organising S&I research.

Issues raised about the case studies approach included: uptake and adoption in other areas (transferability); the possible applicability of methods from business studies; choice of cases and design of

research to maximise generic applicability; use of case studies for initial scoping inquiries; and the terminology of 'case' versus 'management' studies. Advantages were identified as including qualitative richness, contextual specificity, and close involvement of people in the area. Disadvantages included transferability problems, lack of design analysis, external stakeholders perceptions of bias such that outcomes are deemed to be irrelevant to their circumstances, and feelings from case study stakeholders that the research was imposed on them.

It was understood that thematic approaches could be considered in a number of ways including parts of the environment, ecological processes, jurisdictions, or problems/issues. Advantages of a thematic approach were identified as: the potential to build on research over time; relevance to a wider range of regions; greater likelihood of feeding into policy; helping to focus and build a critical mass of research around particular themes; a possible closer matching with management and policy institutions; and the ability to work with groups of stakeholders with common interests (e.g. land use type). Disadvantages included lack of connection with a wider range of stakeholders, and not being as 'grounded' in a real situation.

It was generally agreed that these approaches were not mutually exclusive; the issue for LWRRDC is deciding which is an appropriate response for the purpose at hand.

The issue of whether LWRRDC needed to establish a separate program for S&I research was of considerable interest to participants. The basic question was whether there were gaps in research that would not be captured unless there was some sort of dedicated program. It was suggested that many of the research themes under discussion would not easily fit into LWRRDC's existing program structure. It was generally agreed that a separate program would be required to establish legitimacy and visibility for S&I research. However it was understood that it would be inappropriate to construct a single way of organising and delivering S&I. As well as a program type approach, LWRRDC needed to put in place a *process* to: be more rigorous in ensuring that existing and new programs work closely together; design S&I research in from the very beginning; and, be more vigilant in monitoring programs. In particular, the importance of identifying biophysical R&D proposals with potential to profit from social science inputs was recognised, and the need for a mechanism to encourage such linkages to occur.

In terms of the above point, there was general agreement that looking at social, policy, legal, etc. implications *after* scientific research had been done should be avoided, and that integration would be far more useful if it happened in the research design phase so that the problem could be framed in a manner relevant to S&I needs.

It was noted that LWRRDC already has a program management framework which has the elements of a good planning process (objectives setting, etc.) but that this does not guarantee that linkages will always be made and integration encouraged.

Other points made regarding organisational issues

What skills requirements are needed, for both researchers and LWRRDC staff? How best to put interdisciplinary teams together, recognising that working in such teams will be an unfamiliar experience for many researchers? Some participants felt LWRRDC needs to take a more active role in bringing a interdisciplinary teams together. One comment was that general calls for research proposals will not result in effective teams.

How can the application process adequately account for the cases where adoption requirements, and indeed the findings, are emergent; that is, they are unknown and cannot be known at the beginning of the research process. This was seen as requiring a separate process of some kind, attending to adoption and communication issues post- or mid-research projects.

It was noted that it is frequently the case that social science expertise in NRM agencies is isolated, with little linkage or 'critical mass' either within or between agencies. More methodological development and application was seen as possible given attention to this.

One participant reflected on a LWRRDC funded project on the economics of remnant vegetation, noting that during project design the researchers did not realise that they would need a biophysical model, and that now they were in the instrument design phase they were striking problems because they did not have the necessary legal expertise to draw on. However, mid-project there is limited scope for adding expertise identified as needed as all project resources are committed. It was suggested that it would have helped if the application process had forced them to explicitly consider such requirements. It was felt that such potential would be quite often the case.

There was some discussion of the three LWRRDC funded S&I rangelands projects, and that this was an unusually high investment in S&I research in one sector. There is significant potential for comparing the efficacy of different approaches in situations such as this, but they were not designed as comparative projects; and it is difficult now to build comparative

lessons in. It was also felt that the logic and theoretical underpinnings of projects such as these were not often explicit and discussed at design/ application stage. Allowing such comparison as part of program design, and making core theoretical assumptions explicit across the Corporation's R&D portfolios was seen as desirable.

In light of such issues, it was suggested that there may be a need to consider contractual arrangements for funding projects, with the possibility that an amount could be set aside as a contingency fund which could be available to fund the adding of expertise or cross-project evaluation that were not perceived to be needed at the design stage. (LWRRDC procedures already permit some 're-jigging' to occur.) The application/approval process would require some attention for this to happen.

Finally, there was recognition of the very variable cost of S&I research, and that this cost was often underestimated. While reviews or desktop studies could be undertaken at moderate cost, more substantive work (eg. detailed law-in-context work, or that involving field work and interviewing) could not be done cheaply, and generally involved high demands on time and labour.

Research directions

As a focusing exercise, participants were asked to identify a new R&D project, or the redesign of a past or existing one, that would need the input of a number of the research areas discussed in the four papers. These were meant to be indicative rather than prescriptive, and are recorded below in summary form. Where possible, an indication of the magnitude of cost is given (small = $30-50 000; moderate = up to 100 000; large = more than this per year); but these are generally indicative only.

1. *Vegetation clearance legislation*: a multi-pronged inquiry covering (i) institutional history of South Australia's clearing legislation; (ii) extend research on attitudes towards vegetation clearance controls through exploring: who are the landholders? how much do they know about the relevant law in their state; why landholders clear land and whether it 'makes sense' economically; (iii) how decision-making bodies under different pieces of legislation (e.g. SA restrospectively, NSW prospectively—regional vegetation committees) made/make decisions; (iv) what kind of incentives do landholders want (e.g. compensation, stewardship payments)? (v) monitoring the state of vegetation which has been conserved under existing schemes—are they being actively managed? This would demand legal, economic and social research skills, and require a moderate to large investment.
2. What are *'good' practice models and processes* for improved NRM (as opposed to traditional 'instruments')? Research needs to be based on broad knowledge domains (biophysical, technical, institutional, socio-economic) and ongoing research for monitoring and evaluation (adaptive); based on region case studies including land holders and three tiers of government; would require moderate investment depending on the number of case studies.
3. Description and monitoring of ongoing shifts in *size and ownership of agricultural enterprises*: to chart shifts, patterns and trends regarding sustainability preconditions, policy implications such as voluntary versus other responses; note existing work of Burch, Rickson (e.g. LWRRDC GRU21), and Barr; would require moderate investment.
4. How to facilitate *institutional reform*: research historical cases of successful reform in ESD/ NRM; identify common factors, processes and preconditions which seem to operate during times of institutional reform; based on historical/ organisational ethnography perspective; consider linked post-graduate projects; moderate to large investment depending on number and depth of case studies.
5. *Environmental capacity building*: identify capacities in terms of configuration, skills, will of organised government and non-government proponents, and framework conditions for cognitive (info), political institutions, and economic (technological); how to utilise capacity over time. Based on law, public administration, institutional/social/psychological/organisational theories, business, media areas. Could involve small, moderate or large investment.
6. Development of coherent *national institutional arrangements* for NRM: consider options for constitutional amendment; understanding urban communities' values and expectations for NRM (not only rural Australia); investment and contractual arrangements with farmers to facilitate on-ground works; and cost of doing more of the same. Multidisciplinary research with stakeholders; small investment?
7. Developing the *institutional arrangements to underpin river restoration and management*: match the institutional/policy framework with biophysical models/approaches; consider coordination of competing agencies, social processes for objective setting, monitoring and adaptation of new knowledge, economic trade-

offs and the legal framework (including property rights). Would require large investment.

8. Transferable methodology to *define optimal levels of resource condition* at national, state, regional levels: what will stakeholders, communities and the nation accept? How will we deal with conflicts? Would require multidisciplinary research with stakeholders, and large investment.
9. *Rangelands*: redefining property rights, law, economic viability and social consequences; given the many past and current attempts at planning for change in the rangelands, what needs to be done next?
10. Analysis of *policy instruments and instrument choice*, and combinations of instruments: comparative research into a limited number of specific cases and selected instruments; consider social impact and acceptance; would be highly context specific and moderate investment; would require an appropriate analytical framework capable of informing other contexts; consider initial scoping exercise to develop same.
11. Rural *landholder decision-making relevant to adoption*: would require scoping research and grounded theorising.
12. *Farm adjustment*: use substantive theorising, scoping review and problem identification to review farm adjustment from different theoretical perspectives and also policy/evaluation perspective; note Barr's work; series of detailed qualitative case studies would follow; multidisciplinary research and small investment.
13. *Institutional reform and design* (planning for change with a foundation in reality): (i) refine the functional split model of resource management agencies proposed by Musgrave (see below; consider historical, spatial and sectoral splits) and link to designing the reforms for modifying such agencies in each state; (ii) devise management guidelines for the application of the Dovers process model/menu for APIM (including legislation); (iii) identify potential impediments to the adoption of the reform package/model and apply the divergent skills of the social scientist and institutional theorist to ensure that there is acceptance and participation in the design and implementation process, and so that the key assumptions and paradigms are made explicit. Would require multidisciplinary research and large investment.
14. Appropriate application of *multi-criteria analysis* (MCA) in land and water management planning: review relevant theory and applications and make recommendations; note that each of the CMAs in Victoria could be considered a case study in this respect and that Victoria has begun a review into why MCA has been unsuccessful; would require decision theory and the involvement of landholders, environmentalists, government; initial study would only need a small investment.
15. *Dryland* versus non-dryland contexts—research to identify appropriate instruments such as the development of property rights systems which have minimal transaction costs for implementation in both contexts, recognising that irrigated areas in some ways are more tractable for policy-related research.

Other issues raised regarding research directions:

It was stressed that LWRRDC has no interest in funding S&I for its own sake, unless for example a good argument can be made that such research is needed to build capacity. The particular concern is about the areas of research that LWRRDC should undertake and how you operationalise the outcomes of S&I research.

It was noted that it is very difficult to produce generalised statements about research needs across all LWRRDC's areas of interests.

Many governments and their agencies have adopted a 'social response' paradigm in relation to current meta-policy arrangements for addressing NRM problems; that is, Landcare, voluntarism, facilitators, planning processes, ICM structures, etc. The question is whether such a response is appropriate? How would you construct research to explore this issue? One approach would be through description and analysis of implicit or explicit paradigms that operate within resource management agencies. Also, such research would need to recognise other 'policy rationalities' influencing NRM, such as market-oriented reform.

Public administration of natural resources was described by Warren Musgrave as having four functions: standards or objectives development, stewardship, service delivery, and monitoring/ auditing (see Musgrave's commentary in Section 5). Ideally these functions should not be performed by the one agency; in practice they frequently are. An important area for S&I research is how to get these four functions to perform better. There is a particular need for social science inputs to the function of standards/objective setting. Interestingly, most of the research directions or possible projects discussed at the workshop were seen by their proponents as concerning most of these four functions. Given the recent market-led reform and the increase in community engagement in NRM, there is considerable change in the location of these functions

in the policy process. An alternative view was put that this portrays policy and management in a 'new managerialist' light, and that other conceptualisations were possible.

Legal research funded by LWRRDC (and in general) is focussed on 'black letter law', not 'law in society' or socio-legal research. While the former is very necessary ('explication'—see Farrier, Section 6), the latter is required to establish how the law actually works in practice, and allows the entry of other skills and perspectives (e.g. stakeholders, sociologists). Socio-legal research is where so many issues raised by LWRRDC and their reviews could be better addressed. However, it was noted that this area is not strong in Australia, and was an area where thought could be given to the encouragement of younger researchers. A number of participants stressed that the targeting of R&D money to post-graduate scholarships was effective in terms of enabling detailed research as developing the skills and expertise base.

While LWRRDC discussions tend to focus on rural communities, it is clear that the views of the rest of society are influential. The question was also raised: Why do we not target some social research into the attitudes of urban communities?

Appendix E LWRRDC's Template of Questions

1. **What is the national significance of the particular resource management issue?**

   This is an important question for LWRRDC, given our limited funding and clear direction to take a national focus in providing leadership. In order to be nationally significant, resource management issues need not necessarily be national in extent.

2. **What is the underlying cause of the current failure to manage the resource sustainably?**

   There are three potential causes of failure and the corporation needs to give greater attention to identifying accurately the underlying cause(s) in each case. The three main categories are:

   i. **Technical failure—**we lack the required information (or it is not widely available to resource managers) about how to use and manage the resource in a sustainable fashion. Up until now the corporation has focused almost exclusively on this category of failure and our current portfolio largely comprises technical R&D.

   ii. **Market failure—**the resource in question has little or no market value, or there is no direct cost to resource managers from its depletion or degradation. This is a common occurrence, and in many instances until market failure is addressed and rectified, further technical information will have little impact in improving resource management.

   iii. **Institutional failure—**where various forms of intervention by government through policies and programs either fail to effectively address unsustainable resource use, or may actually foster it. Again, this type of failure must be addressed adequately before value can be gained from the results of technical R&D.

   LWRRDC will have made a major step forward if it can apply this question consistently across all our activities. We are aware of many examples where market or government failure has meant that little benefit has been obtained from substantial expenditures on good quality R&D to address technical failure. The corporation has begun to move to address this in focusing its 1996-97 annual call on policy and socioeconomic issues, but we will need to do more and to apply this question to each of our existing or proposed programs. In many cases we are likely to find a mix of failures, and we will need some means of assessing their relative significance in order to determine an appropriate allocation of funds.

3. **What form of intervention to improve resource management is likely to be most successful, and what are the costs, anticipated benefits and risks?**

   Having identified the causes of failure in resource management, we next need to identify forms of intervention that are likely to be most effective and the resources and time scale required. The corporation may not necessarily need to support further R&D in every case. For example, simply publicising the cause and costs of resource depletion may be sufficient to galvanise other organisations or groups into action. This too is another essential question for the corporation to apply in order to work out how to make best use of its limited resources. It should become an essential part of the scoping exercise undertaken for each new R&D program.

4. **How can the risks associated with intervention be managed?**

   This is another important question which up until now we have addressed only in part. There may be a whole set of risks involved, for example, in achieving the objectives of technical research or, often more significantly, in ensuring the uptake of new knowledge in order to improve resource management. *Ex ante* assessment of risk as well as costs and benefits can result in substantial improvement in R&D programs and projects.

   In considering risk we need to distinguish between risk profile (LWRRDC may choose to support some high-risk projects because they have a high potential return), and the management of process risk (taking action to make sure project objectives are achieved and results implemented).

5. **What role, if any, should LWRRDC play?**

   By the time we get to address this question, the Board should have sufficient information available to it to make an informed judgment about the likely impact of involvement by the corporation. It is quite likely that in many cases, once the underlying causes of failure have been identified and considered in some detail, it will become apparent that responsibility for

intervention rests with another organisation rather than with the corporation. The additional information should also help the Board to focus more clearly on where the corporation *can* have a major impact in achieving its mission.

6. **What is the potential return from the specific opportunities available for LWRRDC investment?**

   Having made a decision to intervene and invest in a particular resource management issue, the corporation needs to make use of investment decision analysis or similar tools to help uncover how to maximise the return for a given risk profile from its limited resources. Some corporations use a standard cost/benefit analysis to determine an internal rate of return, but this would be difficult for many LWRRDC projects. The use of Investment Decision Analysis is one option but the lack of clear market values or economic outcomes, can make its application difficult.