

**Monitoring and Evaluation of  
the National Land and Water  
Resources Audit:  
Final Report**

**Report to  
Department of Agriculture, Forestry  
and Fisheries Australia**

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- those taking part in the various stakeholder surveys during the past two years; and
- those stakeholders who assisted the team in the assessments of individual Theme reports.

## Acronyms and Abbreviations

ABS	Australian Bureau of Statistics
ABARE	Australian Bureau of Agricultural and Resource Economics
ACRIS	Australian Collaborative Rangelands Information System
AFFA	Agriculture, Fisheries and Forestry, Australia
ANZLIC	Australian New Zealand Land Information Council
ASDI	Australian Spatial Data Infrastructure
ASRIS	Australian Soil Resources Information System
Atlas	Australian Natural Resources Atlas
Audit	National Land and Water Resources Audit
CRC	Cooperative Research Centre
EA	Environment Australia
EPA	Environment Protection Agency
ESCAVI	Executive Steering Committee for Australian Vegetation Information
GRDC	Grains Research and Development Corporation
LG	Local Government
LWA	Land & Water Australia (formerly LWRRDC)
LWRRDC	Land and Water Resources R&D Corporation (now LWA)
MDB	Murray Darling Basin
MDBC	Murray Darling Basin Commission
NAP	National Action Plan for Dryland Salinity and Water Quality
NDSP	National Dryland Salinity Program
NFI	National Forest Inventory
NHT	National Heritage Trust
NRM	Natural Resource Management
NVIS	National Vegetation Information System
R&D	Research and Development
RDC	Research and Development Corporation
SoE	State of Environment
WUE	Water Use Efficiency

## **Executive Summary**

### **Achievements**

The Audit has produced a set of products and outputs to date that are impressive in their coverage and depth. Of special note is the development and formulation of new approaches to aid in the interpretation of national NRM data sets. Through the Audit's systematic approach, access to this data is now freely available.

Overall, we consider the investment in the Audit to be sound and it has provided good value for money. The foundation provided by the Audit including the development of ongoing standards and protocols, the establishment of baselines, and a framework for ongoing monitoring at a national level of NRM information are expected to be the most valuable outputs.

The reports provide a snapshot of the health of Australia's natural resources and a "big picture" evaluation of the issues facing NRM. They also provide some guide to the priorities for action and the opportunities to improve NRM in Australia.

The Atlas and the Data Library are high profile products of the Audit and will be valuable for a range of NRM managers. These resources, together with the enhanced comparability of data sets, and the development of a range of new NRM information products targeted at decision-making needs, all represent a significant improvement in information availability and accessibility.

### **Objectives and Role**

All of the six objectives of the Audit have been at least partially met. However, for what the Audit tried to achieve, it was under-resourced and its objectives were over-ambitious for the time period, the complexity of the tasks, and the budget. The Audit could have been even more effective if it had been focused on a more limited role.

### **Information Provided**

The Audit has been successful in drawing on a wide range of existing data and has reworked it into comparable national data sets and products. This has been an outstanding achievement in itself given the difficulties faced. However, information about cause and effect, trends over time, and the 'condition' of some natural resources has proved difficult to provide, largely due to existing data inadequacies and different perceptions regarding condition. Also, information on management practices, important in understanding causal effects and impacts and leading to appropriate remedial activities, was scarce. This was not a principal focus of the Audit but where information was assembled, (eg. the dairy industry) its value is already being demonstrated.

Availability, accessibility and relevance of the data provided were generally good, but less confidence is held in the capacity for integration, repeatability and accuracy of the information due mainly to its different sources and methods of collection/estimation. However the Audit has developed and recommended means of addressing these issues.

Integration of data across Themes was generally weaker than integration within Themes. This was particularly so with regard to future monitoring systems that might evolve and become established from the existing Theme initiatives. The existing framework for monitoring needs to be better integrated to ensure that it is useful for natural resource decision making.

### **Outcomes**

There are difficulties in relating changes in policy and investment programs to improved information and also in attributing changes in the state of natural resources to policy and investment changes. The long lead times to measurable improvements is one reason. However, whatever the final outcome, it is clear that Audit information is already being used by a range of NRM decision-makers at national, State, industry and regional levels. Examples of this use are provided in the Audit's Final Report as well as this final evaluation report. It can be expected that such decisions in program planning (including issue identification, priority setting and allocating funding) and policies will result in improved natural resource management.

### **Management**

The management of the Audit via the Audit Management Unit has been outstanding, given the starting point, the very broad brief, the resources and the constraints faced due to the investment in existing data collection processes and the range of jurisdictions involved. The Audit Management Unit is held in high esteem by all those involved in the Audit and project management by the Unit has been accountable and of a high standard.

On the other hand, the Audit would have benefited from a better designed program plan and an integration model that was linked to decision making needs and that recognised the critical pathways needed to provide the integrated outputs and outcomes. Greater emphases could have been placed on the early consultative processes with regard to each Theme. Permanent Steering Committees should have been established for each Theme and representatives should have been drawn from a wider cross section of NRM interests and with a strong representation from users. An independent mid-term review of each Theme in order to refocus the highest priority Theme outputs would have improved outputs and built stronger ownership.

Consultation and communication with interested users outside of the Commonwealth and State agencies varied but generally only those engaged in projects or peak bodies were subject to regular communication. More general consultation with decision-makers, industry and community groups early in the process would have been beneficial in building support and knowledge. The last year has seen improved communication with these groups.

The Audit has made a start regarding team building and leadership in a nation-wide approach to natural resource data and monitoring. However, significant improvement in processes, institutional arrangements, and change in cultures is required for this to continue. Implementation of the recommendations in the reports would help address this.

Jurisdictional factors inhibit the efficiency and continuity of an integrated and comparable national data assembly program for natural resources. This particularly applies to coordination of effort between Departments and agencies within both Commonwealth and State governments.

### **Communication and Training**

Strong communication and extension of the Audit's products will be required to obtain the most value for the Audit investment. This communication should detail the products available, where they can be found, their limitations and how they can best be used. There should also be further efforts to communicate some of the key new NRM messages to emerge from the Audit.

Some form of training for using the Atlas and Data Library will also be required to maximise use and effectiveness of the Audit products outside the technical agencies. A "train the trainer" program, maintaining a help desk capable of supporting the existing documented training material and the use of the technical people who have been directly involved to demonstrate its use to regional users would be key areas to address. Funding needs to be allocated to training in future budgets and professional expertise sought to plan implementation.

### **The Audit Final Report**

The Final Report of the Audit, "Australia's Natural Resources 1997-2002 and Beyond" is well written and is considered appropriate in length and context. The recommendations are appropriate and supported by the evaluation team. The final recommendation covering the future independence of Audit activities is particularly important. If all participants are to work cooperatively within a common framework, the framework must be seen to be independent of special interests.

### **The Future**

To take advantage of many of the outputs of the Audit, it is essential that some manner of nationwide comparable data collection and monitoring continue. Future initiatives should be accompanied by a higher level of consultation and involvement with target groups particularly those who are involved in NRM decision-making.

An improved balance will be required in the future between regional and national level data assembly. It would be appropriate for any future Audit to focus on priority areas and be comfortable with investing greater effort in some areas compared with others. The tiered approach to priority setting used in some areas should continue. That is, use the interpretation of the existing data to point the way for setting priorities for future data collection and identification of priority locations (regions, catchments etc).

It would be worthwhile examining the Theme structure used in Audit 1 with the objective of providing a higher level of integration in future Audit products.

There is a significant existing investment in natural resource data collection and monitoring. A clearer understanding of the current NRM data collection and monitoring

programs and their funding would be useful in developing arrangements and priorities for any continuing Audit. It should also provide the basis for more efficient use of funds and other resources.

While the likely existence of separate national coordinators as part of any ongoing initiative is acknowledged, the experience from Audit 1 demonstrated the essential need for an independent 'coordinating' Audit Management Unit in order to balance and integrate across the overall effort.

# 1. Introduction

The purpose of this final report on the monitoring and evaluation of the National Land and Water Resources Audit (hereafter called Audit) is to provide an overall assessment of the Audit's performance over its five-year term.

Consistent with our terms of reference, the approach taken to reporting to date in this monitoring and evaluation activity has been to provide ongoing constructive comment on the activities of the Audit rather than emphasis on a final evaluation once the Audit was completed. This approach was taken in order to allow timely responses to be made as appropriate by Agriculture, Fisheries and Forestry Australia (AFFA), the Audit Management Unit and the Advisory Council. In this regard the Progress Monitoring Report of October 2001 was orientated towards a final assessment of the Audit up to that time so that comments and suggestions could be taken into account in the Audit's Final Report ("Australia's Natural Resources 1997-2002 and Beyond", published June 2002).

This final evaluation report is orientated towards AFFA's accountability needs. In this regard we have drawn on, and in some cases repeated, some key comments made in the October 2001 report where such comments are relevant to these needs. For example our earlier assessments against objectives and outcomes produced have been updated. No new stakeholder surveys have been effected since the survey carried out in the middle of calendar 2001.

The evaluation team's earlier monitoring and evaluation reports commented on the need for the Audit to report performance against its objectives in each Theme report. This has been undertaken by the Audit and these earlier Theme evaluations and the evaluation in the Audit's Final Report in themselves provide a fair report of the Audit's performance in these areas.

Further, since October 2001, all final Theme reports have now been published, with the exception of the report on Biodiversity. Hence this report updates earlier comments made on these Theme reports wherever appropriate.

It should be added here that this has been a rewarding project for the consultants as our comments and suggestions have mostly been actioned by the Audit team. This reinforces the approach of providing ongoing evaluation by an independent group with diverse skills (particularly on draft reports) during projects of this nature.

An assessment of the Audit's Final Report is also made here. Based on our review and the comments of clients of the Audit we have also provided some views on the imperatives for any future Audit arrangements.

Chapter 2 of this report presents updated comments on Theme outputs now that all but one of the final Theme reports are available. Chapter 3 provides some comments on the Audit's Final Report. Chapter 4 provides an updated assessment of the Audit's delivery against its original objectives and desired outcomes. Chapter 5 provides an updated assessment of the use of Audit information. Comments on the imperatives for future Audit arrangements are provided in Chapter 6. Conclusions are provided in Chapter 7.

## **2. Update on Theme Outputs**

### **2.1 Introduction**

The Audit has now completed and released final reports for all of its Themes except for Biodiversity. Letters providing critical comments were submitted to AFFA and the Audit by the evaluation team following the release of each draft Theme report and the completion of the final workshop for each of the Themes. The team then prepared more detailed evaluation reports on each Theme taking into account the views of selected stakeholders. These were submitted to AFFA and subsequently provided to the Audit. Summaries of the significant findings updated to take into account the final reports follow.

### **2.2 Summary Assessments of Individual Themes**

#### **Theme 1: Australian Water Resources Assessment 2000**

The Audit has successfully collated existing information on surface and groundwater quantity and quality to present and provide access to national information on water quality and quantity. It has established surface water management areas and groundwater management areas throughout Australia as the basis for reporting on water availability, quality, use and allocation. This data is in a form that enabled other Themes to easily integrate this information into their analysis and reporting.

The report identified the need for improved and cost effective protocols and frameworks to enable improved comparability and integration of data on availability, use, environmental needs and water quality across the States. A major achievement has been the establishment of reporting mechanisms, which enable easy and cost effective access to information on water resources in the Atlas and Data Library.

In terms of the four key question posed by NRM managers in the planning stage of this Theme the report:

- Provides information on surface water availability, allocation and use, provides information on drivers towards improving sustainability and improved water use efficiency and to a lesser degree reports on efficiency of use;
- Assesses the sustainability and environmental status of Australian rivers and provides an outline of methods and progress in moving towards establishing environmental flows;
- Has defined groundwater management units and established use, availability, and sustainability but contains limited “change in use over time” data. Information on groundwater quality is limited to salinity; and
- Has provided information on opportunities for investment, established a process for assessment of these opportunities, identified opportunities for improvement in water use efficiencies and established actions needed to improve water management.

Baseline information on condition and trend has been reported for both groundwater and surface water but it is based on limited data. Given the value of water resources in the Australian context, the Audit identified that the quality of information on trends

and condition for both water quality and quantity is inadequate. Again the Audit has targeted a need for cost effective approaches that would improve the availability and comparability of water quality attributes that take into account water quality issues such as toxic chemicals, algal blooms and pathogens.

Information on environmental flow requirements is limited and the Audit has not succeeded in developing protocols that could be used to assess these requirements across Australia. As a result the Audit did not provide adequate information on sustainable use of water although it did provide a valuable snapshot of the current state of commitment across Australia. While we realise that this was due to the different approaches being taken by the States, the development of comparable protocols will be required for the cooperative development of national and State policy.

Greater emphasis could have been placed on changes and trends in water resources use, the sustainability problems facing water use and in particular the benefits and costs of addressing priority issues and areas. We recognise the difficulties the Audit has had in collecting quality temporal data. However more material (both quantitative and qualitative) on the economic, environmental and social benefits and costs of these changes are reported in other Themes which draw on this data. The Audit has developed a strong case in Theme 7 for improved integration of data on catchment uses and changes in resource management and their impact on water quality and quantity.

More detailed information could have been presented on water use efficiency (WUE) across Australia and across the different uses to support the arguments in the report. Some significant statements are made on improvement in rural WUE without providing data or information on current levels. To some extent this has been covered in other Themes but it still falls short of the requirements. This would have provided an initial means of benchmarking efficiency of use. A clear understanding of the opportunities for improvement in WUE by river/basin systems should have preceded the analysis of sustainable development opportunities.

The Audit has done an excellent job in identifying the data and knowledge gaps for water resources and has identified actions to address these gaps. However information on the possible costs and benefits (or costing) of filling some of the knowledge gaps should be made available in any template for the future. The costs of the component parts of this should be documented otherwise it will be difficult to make decisions on priorities. It should include both national and States' costs and take into account efficiencies that will be made as a result of the Audit and the different levels of knowledge/systems in place in the States.

The sections on sustainable development did not include any information on water quality, a very important factor when the opportunities for development in both groundwater and surface systems are considered. However further integration and reporting on quality occurs in other Theme reports. The related issue of conjunctive use also received scant attention.

Overall our general conclusion is that the Audit has done an excellent job in bringing people together across a wide range of jurisdictions to provide access to information

on water resources, presented a valuable snapshot of the availability, use and quality of water and outlined priorities for improving knowledge. The Audit has developed a strong case for a better-coordinated approach to address these priorities Australia wide.

## **Theme 2: Australian Dryland Salinity Assessment**

This Theme report provides an assessment of dryland salinity risk/hazard based on an analysis of groundwater levels, or land attributes and dryland salinity incidence in those States where data on groundwater levels and trends were difficult to obtain.

A key achievement of the Theme is its work on classifying groundwater flow systems that provides a systematic conceptual framework for understanding the locational differences among these systems and how they impact on recharge and dryland salinity.

A further significant achievement is the development of Fact Sheets that describe the various groundwater flow systems, identify the critical factors that determine groundwater behaviour in response to land management and review the potential impact of management options. These Fact Sheets are backed up by more detailed case studies in selected catchments.

These outputs represent an important step forward in assisting decision-makers. The work has been integrated with other R&D initiatives and it establishes a common understanding about the underlying causes of dryland salinity and about which remedial actions will and will not work in particular groundwater flow systems. Because of the long response times in many systems, the Fact Sheets and case studies demonstrate that the choice of response measures is highly dependent on the nature of a particular region's groundwater flow system. They also highlight the importance of trade-offs in future decision-making on dryland salinity remedial measures.

Another achievement of the Theme is that it has had a significant effect on raising awareness of dryland salinity issues in a number of jurisdictions and has helped focus attention on the need for improved information and on the need to develop strategic approaches to management. The work on this Theme, together with the efforts of the National Dryland Salinity Program, has also contributed to the growing political awareness of dryland salinity and to the establishment of the National Action Plan on Dryland Salinity and Water Quality (NAP).

The development of a series of catchment and regional case studies helps to further illustrate the issues that confront those making policy and management decisions relating to dryland salinity. The case studies provide illustrations of how the catchment water balance approach can be used to assess required levels of recharge reduction to lessen salinity risk and to assess the effectiveness of possible remedial measures.

In addition the Theme 6 report uses four of the case study regions to apply an economic analysis to the remedial options in each catchment. While illustrative only, this analysis and the decision making framework developed in Theme 6 will provide a valuable guide to the key elements that need to be addressed in future decision

making on dryland salinity. They also provide a good guide to the information needed by decision makers at a regional or catchment level.

Reaching a common understanding of dryland salinity risk and hazard has helped highlight the need to give attention to salinity as a priority natural resource management issue. The result has been the NAP and a range of State salinity strategies. Audit data and protocols are being (and will be) used to determine priority areas and land use practice for action, involve the community in the program and monitor performance of the program.

Several qualifications need to be noted in relation to the Theme 2 outputs:

- An assessment of risk hazard based on groundwater levels is not necessarily an indication of where dryland salinity will occur;
- Future assessments are based on linear trends; and
- Although a common methodology had been developed by the Audit, some States were not able to apply this for a number of reasons, including data limitations.

Because of these qualifications the assessments need to be interpreted with care. There is a general reference in the Report to the lack of comparability among the States, but there could have been a more specific commentary on the implications of these qualifications for decisions on investments. For instance, it would have been preferable to provide a specific indication of how the methodologies varied among States so that those making decisions about allocating levels of investment among the jurisdictions could ensure that there were no biases resulting from different State methodologies.

There are also some issues in relation to the use of the Fact Sheets that could have been more specifically commented on in the Theme Report:

- The analysis is based on a hydrological definition rather than a biological one. This has an impact on the estimate of response times and may lead to an overestimation of these response times in some instances. As a result the analysis may not recognise the capacity of engineering solutions and options for using saline land to achieve responses in the short term in all systems; and
- The Fact Sheets address options for recharge management, engineering water table management, and managing saline resources, but they do not specifically address the issue of measures to lessen the impact of dryland salinity on the water resources at risk. Such measures will be of concern in those catchments where mobilised salt is moving into watercourses.

The catchment classification system is still broad and there are locational differences not reflected in the system. There may be a case for further refinement in the future. If the kind of analysis effected for the case study catchments is to be carried out more generally then it will be necessary to extend the understanding of the classification of groundwater flow systems among a broader range of practitioners and develop finer resolution categorisations in priority catchments. It will also be necessary to invest in catchment scale data so that the framework can be applied at the local catchment level in areas that have not already been well studied.

However, the classification system and the Fact Sheets do represent a useful starting point for individual catchment groups to build on with the addition of local

information. The Fact Sheets could be amended at a later date, drawing on the actual experience of individual regional and catchment groups in using them.

### **Theme 3: Australian Native Vegetation Assessment 2001**

The Audit has made significant progress in building a standardised framework for future vegetation monitoring across Australia (The National Vegetation Information System or NVIS). With the development of national standards, diverse data sets across jurisdictions are now comparable and can be integrated. This has been an important achievement and some States have already begun converting data sets and will eventually be able to match data across State borders. However, the NVIS data sets for most States are still incomplete with the States continuing to have their own mapping programs. On the other hand, it is understood that the States have agreed to the conditions in the Audit/ANZLIC Data Access and Management Agreement.

Public access has now been improved in that all States, except Victoria as at August 2002, have agreed to provide community access to most of the NVIS data they provided to the Audit. Also, derived data products are available through Environment Australia's Green Pages.

This Theme initiative brought together many personnel from different jurisdictions and improved communication between stakeholders due to a common language and common goals being pursued. In this regard the process has been as valuable as the more finite products that have emerged from the Theme.

There was serious under-resourcing for what the Vegetation Theme set out to achieve, partly due to an underestimate of the quality of the data sets available. Cooperation within the Theme was highly dependent on financial incentives. The progress of this Theme highlighted that the role of the States as data custodians could be given greater prominence if a totally integrated effort between State and Commonwealth needs is to be progressed.

The tension between the perspective of a 'data trawl' across the States by the Commonwealth agencies, versus cost shifting by the States to service their own needs is illustrative of Commonwealth-State relations regarding NRM. This will continue while both jurisdictions perceive themselves having an NRM mandate. However, some progress has been made in the past year with a restructuring of the NVIS database so that the State data can be inputted routinely into NVIS.

While there were differing perceptions of the original objective of this Theme, the evaluation team recognises that the emphasis on native vegetation was probably the most practical outcome to pursue in the short term given the limited resources available.

More information on trends in vegetation status over time would have been valuable, but the lack of primary data restricted such information. At least maps for each State showing pre-European settlement and current vegetation groups are now available. On the other hand, a greater focus on qualitatively assessing clearing and planting of native vegetation in past decades, the threat to remnant vegetation from dryland salinity, and the role of native vegetation providing ecosystem services could have rounded out the assessment and provided valuable linkages to other Themes.

The final Theme report acknowledged that no contribution to objective 2 of the Audit (cost/benefits of NRM changes and remedial action) was made by the vegetation assessment. Further there appears to have been no attempt in the Audit as a whole to value any of its diverse roles or costs and benefits of vegetation retention even though:

- native vegetation is often at the centre of arguments about development and productive land use;
- can play a major role in preventing land degradation processes; and
- is at the centre of biodiversity issues.

Benefits from the investment in this Theme will mainly be at the national/international level, with some State level benefits emanating from the investment (particularly some of the projects), but not necessarily from NVIS itself, at least in the short term. There may be some value to regional groups through the availability of a State and national vegetation perspective that may assist priority setting, at least in broad terms. Some regional groups in some states will have access to vegetation information for the first time. There will also be added long-term efficiencies if all States eventually accept the data standards and data management protocols developed in the Audit. While the direct use of NVIS data in the NAP may be restricted, there will probably be input to NVIS from data assembled in the development of regional vegetation plans.

It is understood that there has been a high demand for copies of the vegetation reports and maps. The NRM Council Monitoring and Evaluation Working Group has also highlighted vegetation data as critical to meeting a number of the core indicators for the National Monitoring and Evaluation Framework.

The final report provides little focus on the information needs of decision makers with only a brief acknowledgment to the initial Needs Analysis where the client needs of vegetation management, land use pressures, and threats to vegetation are identified.

The final assessment report has provided a very useful analysis of information gaps and this leaves the report well rounded in what the investment has and has not achieved. In this regard it provides a key platform for future efforts.

ESCAVI, a Commonwealth-State Agency joint Committee, has been formally established as a result of the Vegetation Theme. ESCAVI has had several meetings and has provided some certainty and security regarding progressing vegetation data assembly between AFFA, EA and the States post the Audit.

The NFI has been assembling forest statistics for about 13 years and the Audit's Commonwealth-State model was to a large extent based on that of the established National Forest Inventory (NFI). As the NFI moves towards assembling more information on the sustainability and resource aspects of forests under the Montreal Process, there is scope for at least some integration. It is understood that the potential for at least partly integrating NVIS with the NFI has now been explored and a memorandum of understanding established between AFFA and EA regarding data exchange where appropriate.

The Audit Management Unit should be commended for its efforts in moving the Vegetation Theme to where it is at present, despite the institutional constraints that exist in the Australian vegetation management arena and in operational relationships, both between the States and the Commonwealth, as well as within States.

#### **Theme 4: Rangelands – Tracking Changes**

The key achievement of the Rangelands Theme has been the definition of a framework for assessing rangelands status and trend as well as the compilation of historical information sets as a context and benchmark for monitoring trend. The investment in this Theme has provided the first coordinated national approach to monitoring the rangelands that has received a reasonable level of commitment from the Commonwealth and the States.

It is likely that without the funding of a Rangelands Theme as part of the Audit, each State would have continued its own monitoring activities, with little consideration of the activities of other States, or the need for the data collected to be comparable across jurisdictions. Despite serious attempts in the past, the Commonwealth and the States would not have developed a national framework due to a lack of political and/or financial commitment.

Other key achievements and benefits associated with the Theme were:

- The establishment of a dialogue between various State governments on data collection, monitoring and information reporting relating to the rangelands;
- Improved awareness of knowledge gaps;
- A new emphasis on landscapes;
- The development and delivery of the web based Atlas, which was not considered in relation to rangelands monitoring prior to the Audit;
- The rangelands areas of the Atlas website are informative and easy to navigate;
- The inclusion of a Rangelands Theme in the Audit has kept rangelands monitoring on the agenda of national and State governments, at least in the short term. However, if rangelands monitoring proceeds, thought needs to be given as to how the individual components fit within the Australia-wide monitoring of natural resources in non-rangeland areas;
- Proving and then training across states of remote sensing techniques; and
- Building the awareness of those monitoring rangelands in regards to the need for assessment and interpretation of collected data.

In the past there has been no agreement on the condition of the rangelands in order to develop priorities. The Australian Collaborative Rangelands Information System (ACRIS) will hopefully provide rigorous, credible facts about the condition of rangelands in order for an effective policy dialogue to occur. In this respect it is recognised that most benefits from the investment will occur in the future, and that work to date has provided a strong platform to achieve these.

Several key weaknesses of the Theme outputs were identified:

- The lack of completion of the socio-economic aspect of the framework and concerns about some of the methods and findings again associated with socio-economic aspects. However, the Audit notes that there were few socio-economic data sets with a richness of data appropriate for collating in this Theme;

- Some concern was also noted relating to the biodiversity work, however the recognition of the need to include biodiversity as a part of the assessment of landscape function is a significant achievement in itself. Further biodiversity work has been undertaken in Year 5 of the Audit but this report has not yet been released;
- The lack of progress on the integration of biological data across State jurisdictions;
- The lack of field-testing of the framework as a whole (this could have been done for a specific region). However it is noted that while this would have been valuable, it was not part of the original brief of the Theme;
- The lack of focus on the decision making framework in which the data and information will be used. While the monitoring framework is conceptually sound, detail is lacking; and
- ACRIS holds interest within the science and technology groups but there previously appeared little interest by others including politicians and senior bureaucrats. Many were reported to view rangelands monitoring as a black hole with little political or economic benefit. It is thought that this view may be changing following the development of ACRIS. However, if this view remains, the impact of the outputs of this Theme may be marginal.

An issue of concern for the future is coordination and commitment between agencies within jurisdictions at both a State and Commonwealth level. Stronger communication will also need to be developed with rangeland users (eg major pastoral companies), and indigenous and other regional groups (tourism is a major user and income earner in rangelands) making decisions in rangeland areas. The Audit further developed the monitoring system in Year 5 through efficacy testing in the States. For the monitoring framework to be utilised in future will require stronger commitment than demonstrated in the past from both Commonwealth and State agencies. There is some evidence that commitment has improved, with work on ACRIS likely to continue in Audit II, in conjunction with the State governments.

The final report for the Rangelands Theme (Rangelands – Tracking Changes) was released following the submission of the October 2001 Evaluation report and therefore several improvements to the final draft in comparison to the draft commented on originally should be noted. These include:

- The reasons for and benefits from ACRIS are now more clearly articulated;
- The context of the Rangelands Theme and ACRIS is more clearly articulated;
- What the Audit has and has not done in relation to this Theme has been more clearly reported;
- Links to other Themes and to wider NRM reporting are clearer;
- The contribution of this Theme to the overall Audit objectives is more clearly expressed;
- The final report provides examples of decisions by various user groups and rangeland managers that may benefit from ACRIS;
- Institutional and other considerations are highlighted, as are relevant international conventions;
- There is a time-line that shows the past development in Rangeland monitoring and other existing State initiatives; and

- There is a description of the projects that made up the Theme, and contributed to the final report.

In summary, the Audit has produced a satisfactory monitoring framework, the principal aim of this Theme. However, any implementation of the monitoring framework will depend on commitment from governments and agencies.

### **Theme 5: Australian Agriculture Assessment 2001**

The focus of Theme 5 is defined as “soil and land degradation issues most significant to the future viability of agriculture”. The key achievement of the Theme is the development of a rigorous conceptual framework for modelling, measuring and reporting on some major environmental and sustainability issues resulting from agricultural land use. The Theme provides a comprehensive new assessment of:

- The landscape balances for the key factors of water, carbon, nitrogen and phosphorus;
- Water borne erosion and sediment transport;
- Acidity;
- The balance in usage of nutrients on farms, undertaken with the assistance of the Australian fertiliser industry; and
- River nutrient transport.

These are also presented as detailed budgets for Australia’s main agricultural river basins.

Other major outputs include:

- An assessment of soil acidity and amelioration requirements relating to agricultural land use;
- The trends in production and the importance of a small area of the nation for most of the agricultural production;
- Development of the Australian Soil Resources Information System, designed as a nationally conformable database from the soil point and survey map data already collected and collated by State and Territory Governments; and
- Industry specific studies on natural resource management such as the case study carried out in partnership with the dairy industry.

The Theme has brought together information that has not been collated at this level before. For the first time, regional assessments are provided allowing State comparisons to be made. Most government respondents in a survey conducted when the draft Theme report was released in May 2001 commented that the Theme provides useful new national and regional level information, particularly relating to nutrient and sediment flows, nutrient balance and acidity.

The modelling work was regarded as very good and explained well. Quality of the data sets was seen as the main limiting factor, with particular reference to the variability of the coverage, the dangers of extrapolating too much from soil test data, and the historical nature of some data sets. However these reservations should not detract from the achievements of this Theme, given the Audit’s need to draw principally on existing data sets.

The Theme outputs should result in a clearer understanding of these issues as sources of natural resource degradation and should provide a better basis for prioritising them at national, State and regional levels. Broad decisions about priorities and investment within Government natural resource management programs, such as the NAP, should be assisted by the Theme information particularly where this biophysical information can be complemented with economic assessments.

Some relevant economic data is provided in the report on Theme 6. This covers, for individual river basins, the costs and benefits of ameliorating acidic and sodic soils and estimates of the downstream costs of 1, 5 and 10 percent increases in turbidity and sediment loads. In addition, choice modelling was used to provide a national estimate of the additional investment the community would be willing to make for improving a range of nominated adverse off-site environmental consequences. While the river basin estimates will be useful in assisting regional decisions on investment priorities, there remain significant gaps in the Audit's economic information due to data and conceptual limitations. Addressing some of these gaps should be a priority for the next stage of the Audit.

Other benefits from the outputs from this Theme will probably accrue in the main to the Commonwealth and the States from having improved broad national level data that could be used for national reporting and general benchmarking.

The Theme 5 report will also provide some benefits for industry. It draws out the management implications of the land degradation issues covered and Chapter 8 on the profile of Australian agriculture discusses sustainable agricultural practices at an aggregate industry level.

It would have been preferable to be able to link the data on the natural resource outcomes with the practices causing them at a regional level so that the Theme outputs could be used to target regional changes in land use or management practices and to monitor the impact of these changes. This was not possible because management practices are not spatially referenced. The availability of land use data will provide a basis for making assumptions about management practices particularly for those pilot regions where the data is at a scale of 1:100,000. However, ideally the geo-referencing of data on land management practices should be a priority for a continuing Audit.

The Audit's Strategic Plan indicates that the primary focus of the Audit will be on the needs of Commonwealth and State agencies and that "where possible" the Audit will provide data that will assist planning at the catchment and regional level. On this basis it might be argued that the Theme's focus is the right one given the broader scale uses identified for its information and the finite resources available to cover a wide range of issues.

However, it is at the industry level that the main changes in practices are needed if the nutrient, sediment and acidity issues are to be addressed on the scale necessary to lessen their impact. Finding mechanisms for building the Theme's outputs into decision-making at the farm level should therefore be a high priority. This might be done in collaboration with the R&D Corporations and the dairy module contained in Theme 5 appears to provide a good model for such collaboration.

Regions that are in the process of planning would find the Theme information useful as a check on the issues in the plans that originally are likely to have been developed on the basis of local knowledge. The Theme outputs are also regarded as useful for the State Assessment Panels when prioritising NRM funding proposals.

The Theme workplan does not identify specific objectives but it lists a set of five questions from the Audit's Strategic Plan that provide the focus for its projects and outputs. These are:

- (i) What is the nature of land use across Australia and how is it changing?
- (ii) Where are changes in land use and management practices in conflict with stated national, regional and state objectives?
- (iii) Where is production potential declining or improving?
- (iv) Which processes (eg. acidification) are contributing to this decline or improvement?
- (v) Where are current land use practices sustainable?

In summary, the Theme 5 report makes a significant, but selective, contribution to answering questions (i), (iii) and (iv). As the report itself acknowledges, there are a number of soil-based issues not covered due to resource limitations and data availability. The absence of data on weeds is a major gap. It would also have been useful to include a case study on irrigation to draw out links with the other land degradation issues covered in the Theme, particularly given the importance of irrigation as a source of agricultural output. It will be necessary to go to other sources or undertake further assessments to provide a fully comprehensive answer to questions (ii) and (iv). The Theme will make a contribution to questions (ii) and (v) but, as indicated earlier, this is in aggregate terms and limited by the lack of spatially referenced data on management practices. However the Theme should provide a new authoritative basis for raising awareness among producers and regional groups about the resource management issues that have been covered.

In terms of presentation, the final Theme 5 report is a substantial improvement on the draft report that was commented on in the October 2001 evaluation Progress Report. Its scope is now clearly defined as focusing on selected soil and land degradation issues rather than the broader, and misleading, sustainable agriculture focus in the draft report. It is now well structured with a logical flow to the subject matter and there are clearly identified links to the other relevant Theme reports. In fact, the presentation of the complex subject matter is a major achievement, with a good balance between technical detail and accessibility.

### **Theme 6: Australians and Natural Resource Management 2002**

This Theme report identifies and assembles socio-economic information relevant to Australian natural resource management. Apart from providing socio-economic data associated with landholder attributes and capacity to change, the report provides a useful framework for decision-making. The case studies and the methods/processes presented in the report are particularly valuable outputs from this Theme.

#### *Information and Monitoring*

Theme 6 activities have resulted in new socio-economic information regarding natural resources, particularly the regional breakdowns of farm profit, economic return and

cost of on-farm and downstream land degradation and the benefits from mitigation of some degrading processes. Despite the deficiencies admitted in making these estimates, these data provide a useful, if not comprehensive, platform for priority setting by governments and for consideration for planning at regional and local levels.

Other useful socio-economic data noted is relevant to capacity to change - the original name for this Theme. Information presented on factors that affect the level of adoption of specific management practices contributes to understanding of constraints to sustainable management and policy effectiveness, and the need for multiple approaches to maximise the effective management of Australia's natural resources. Suggestions where initiatives may be undertaken by existing organisations to improve the monitoring of social landscapes hopefully will be well received and actioned. For example, the suggestion on page 188 of the report regarding the integration of environmental statistics and other data is strongly supported by the evaluation team.

#### *Decision Making Framework*

The final Theme 6 report places strong emphasis throughout on the decision making framework presented in Chapter 2 of the report. As the Audit was strongly directed at the outset towards improving decision making (particularly by governments) this is a very important framework. In some respects it is a pity that this framework was not placed up front in the Audit structure as an integrating process in itself. Other Theme activities and reports may well have benefited from this framework with information being more strongly directed to a decision making context.

The issues of the role of government, the difficulties with quantifying environmental and social benefits where markets do not exist, and the nature of private and public benefits are all effectively covered in the report. However, cost-sharing between government and the private sector and the process of assembling information required to develop cost-sharing policies in regard to remedial actions could have been highlighted more in the framework. This would have acknowledged that the concept of cost sharing is a key area to explore in addressing capacity to change.

#### *Framework Regarding Costs and Benefits*

A key weakness identified in an earlier draft by the evaluation team was that the report lacked a comprehensive framework within which issues, current and future costs associated with each issue (given "business as usual"), and the costs and benefits of undertaking additional actions can be viewed. This weakness is still somewhat inherent in the final report, although it is recognised by the reviewers that not all degradation processes could have been addressed in any detail.

A valuable baseline of areas and costs has been provided for sodicity, acidity and dryland salinity. The concepts of degradation costs and their measurement through a 'yield gap' are useful. Baselines for the three issues above were provided effectively via the concept of a 'yield gap', using information drawn from other Themes, particularly Theme 5. However the measure used of reduced profits in a business as usual scenario may need to be placed in a wider context. For example, the net present value of profits foregone over the next 20 years due to dryland salinity is stated as 1.5%. However, on affected farms the net profit decrease may be significantly more and on some of these farms, a significant change in current land use may ensue affecting profits much more significantly than represented by the 'yield gap'.

It is recognised by the evaluation team that costings for all natural resource degradation on-farm would have been impossible, and that a sub-set of degraded natural resources had to be chosen for specific attention. While the areas subject to other land degradation processes were provided, there was no framework presented showing the relative values, even in broad terms or results from other studies, of other land degradation issues on-farm such as water salinity, erosion, soil structure decline, and weeds. By default it may be assumed from the report that sodicity, acidity and dryland salinity are the major on-farm costs and hence are key priorities for attention, whereas this might not be the intention.

Only downstream costs of water quality (salinity, turbidity) are valued, some at a regional level. However, the report (Chapter 5) has provided a classification of a range of all off-farm impacts and recognises that there are difficulties in valuing those off-farm impacts associated with non-market goods and services. Again it would have been useful to place downstream costs in some relative cost framework as other data have been produced in reports external to the Audit (eg. costs of eutrophication).

Further, while the report focuses on the agricultural industries and partly covers direct on and off farm degradation costs, there is little recognition of associated impacts in other industries such as fisheries, tourism, and irrigation farming whose total income could exceed that of dryland agriculture. The value of vegetation or alternative forms of water use, or the costs associated with degraded vegetation, are not addressed, except to recognise the high level of total profits in agriculture that stem from use of water in irrigation. This gap is particularly important given the emphasis in the reports on recommendations relating to maintaining native vegetation.

The choice modelling project that addressed the valuation of non-market goods was well based and interesting. However, the potential application, and its costs, desirability and validity, of including such choice modelling results as input to policy development including cost sharing is not pursued.

Chapter 6 of the report provides excellent case studies that illustrate the decision making process for addressing dryland salinity using physical and economic data. The three case studies reported on in Chapter 7 move away from dryland salinity and place less emphasis on benefits and costs but nevertheless illustrate processes for moving forward using logical structures and processes.

The case studies and some of the other studies that the Audit team were involved in (ie Action Planning for the Great Barrier Reef) created an awareness in industry and regional communities about the Audit and the value of decision makers having access to NRM information to make decisions about improved management and priorities for action. However the Great Barrier Reef study also demonstrated the need to have stakeholders involved in such processes to understand the logic and achieve ownership of the priority actions.

The data in Appendix 1 and throughout the report develops a strong rationale for directing rural reconstruction but this has not been developed or priority areas identified.

### *End Users*

The major users of the Theme 6 report and associated information are likely to be State and Commonwealth government policy makers as well as consultants to governments. Community and catchment groups will also find it useful, however they are likely to need assistance in interpreting the information, otherwise it could be used without appropriate qualifications (eg. spatial profit information).

### *General*

The report is successful in terms of providing acknowledgment of other Theme reports. In particular, it provides strong links to Themes 2 and 5. However, the links to actual data from other Themes are selective in that Theme 6 deals only with a subset of NRM issues.

The stakeholder survey effected in 2001 showed that varying expectations were held regarding the outputs from this Theme. Some may have been expecting the placement of values on the issues and impacts defined in other Themes. Some were expecting information on context and the relative seriousness of issues and associated options for remedial action. Others were expecting more information on the capacity to change, in particular on the people and social issues affecting decision-making and change. Most were expecting institutional factors to be discussed. The report delivered something in each of these expectation areas (except perhaps for the institutional factors) but the reader is left with the feeling that concentrating in more depth on one or two of these issues may have been more useful in the long run. For example:

- If the major objective was to provide a framework for future monitoring then the profit and cost data by region and the methods used to produce, refine, and extend such data could have been a major focus.
- If the major objective was to provide information on the capacity to change then more information on socio-economic characteristics of landholders, their practices and likely responses to policy would have been useful.
- If the major objective had been to provide a decision making framework and priority setting processes for regional and national decision making, then more emphasis should have been on the decision making structures and future priorities, and a wider set of natural resource issues and a wider set of relevant case studies addressed.

In conclusion, the report has raised important issues about benefits and costs, social drivers and constraints and the use of existing data to drive reconstruction, land use change and land management practices. However it has not taken full advantage of the data that was available to suggest priorities and drive change.

### **Theme 7: Australian Catchment, River and Estuary Assessment 2002**

The two volumes provide for the first time a national picture of the comparative condition (health) of Australian Catchments, Rivers, Estuaries and Landscapes. While not all catchments and rivers are included the most significant ones are covered. The important linkages from the ranges to the sea are recognised and this helps draw conclusions for priority NRM actions.

The reports successfully integrate data from other Themes and through this analysis highlight the data and information gaps in our knowledge to draw conclusions on

trends in these resource systems. They provide snapshots in time and provide a framework for revisiting the data in five years thus easing the criticism that they do not provide trend information. It is unreasonable to expect good time series given the gaps in data - particularly in regard to information on aquatic biota and the natural hydrological attributes of rivers.

The performance of this Theme's activities against the Audit's objectives is summarised in Table 4.2. In terms of performance against the 8 key questions identified by key clients in the planning process the Audit has performed well. It has:

- Established a very useful snapshot of status of the catchments, rivers, estuaries and landscapes given the quality of data and resources available;
- Established change against pristine (or pre-European) or reference areas and established procedures and recommendations for ongoing monitoring;
- Identified the range of condition for the areas studied and while this does not indicate trend the report does give an understanding of the trend in most locations;
- Identified the critical processes, practices and policies driving change in condition;
- Established the links between land and water use and management and stream degradation;
- Identified key practices affecting overall health and flow and to a lesser extent productivity;
- Established links between catchments, rivers and estuaries and their impacts on each other and developed a simple estuarine response model to explain the different response of estuaries to inputs based on their tidal, wind and flow processes; and
- Provided limited information on time taken for a management practice change to produce measurable change in condition.

The Way Forward section provides a very useful summary integrating findings from the various Themes and sub-Themes and provides some direction and challenges for future Audit activities and NRM managers based on an integrated assessment of Audit data. The report identifies the major problems facing Australia in sustaining production and conservation systems and the strategic land use and management actions that need to be taken to address these.

The reports develop strong cases for preventative actions to be a priority in any future national programs such as NAP and NHT2. It has demonstrated that the costs of remedial actions to repair resource degradation are high, difficult to implement and time consuming. It also provides examples of criteria for integrating NRM and the tool-kits available to address these issues. In the Integrated Findings section the regional priorities for action are highlighted.

This Theme identifies and demonstrates the need for, and benefits of, good quality data and data sets and accessible data management systems that are freely available. This has been a nation-wide problem for NRM decision-makers at the national, State and regional level. The successes with data integration now need to be built on and include improved socio-economic data and management practices information.

The integrated approach used in this Theme has introduced some new concepts and protocols for evaluating the health of catchments, rivers, estuaries and landscapes that

are major steps forward. The approach has led to improved coordination between the Commonwealth and States. Access to quality data has limited the reliability of the findings but these gaps have been identified and priority areas for data collection should be addressed in the next phase of the Audit and by other agencies.

The report findings and the data will be useful to Commonwealth decision-makers in developing policy and making investment decisions. The procedures will be useful for evaluating national program and policy performance. At the State level information is being used for reporting upwards, policy development, priority setting and benchmarking performance. Catchment managers, the community and industry are also interested in, and using, the results to identify priorities for action programs associated with NAP and NH2T. The tools and frameworks will also be very useful in the development of regional approaches.

While some States and regions have developed more sophisticated approaches to assess the health and carry out audits of Catchments, Rivers and Estuaries they will benefit by ongoing coordination and further development of protocols and the frameworks to achieve reliable and comparable results.

Other key achievements and benefits were:

- Identification of the important drivers of condition for catchments, rivers and estuaries;
- Development of models/classification of estuaries to be able to cope with inputs from catchments and rivers;
- Staged approach to assessment of condition is an efficient approach to establishment of priority areas and activities;
- Priorities for monitoring established;
- Establishment of existing and needed institutional arrangements to deal with priority issues; and
- The bringing together and availability of a huge amount of data and information on catchments, rivers, estuaries and landscapes.

Some weaknesses were:

- Limited information on socio-economic data relevant to blockages/drivers in improving health of catchments, rivers and estuaries. Data in the Australian and Natural Resource Management 2002 and Australian Agricultural Assessment 2001 Reports identify some of these but the linkages haven't been made to the extent that they could have been;
- Subjective nature of much of the information particularly in the estuary assessment;
- Limited information on wetlands that are very important parts of this continuum and which constitute priority areas for action; and
- Absence of data on inland rivers and catchments.

The evaluation team and the stakeholders interviewed in 2001 felt that the Theme provided excellent value for money, developed cooperative linkages for the future and established well thought through processes to holistically address NRM. Stakeholders felt that the exercise should be repeated in 5 years but this would require some ongoing coordination and further development of protocols.

## **3. The Audit Final Report**

### **3.1 Introduction**

The Audit's Final Report 'Australia's Natural Resources 1997 -2002 and Beyond' is a well written and readable document. The report is considered also to be of an appropriate length and content for reporting on such a long-term and expansive project as the Audit. The recommendations are also considered appropriate, have been well argued in the Final Report and the Theme Reports, and are supported by the evaluation team.

The following provides some brief comments on each of the three chapters of the Report.

### **3.2 Australia's Land and Water Resources (Chapter 1)**

This introductory chapter is informative and provides an appropriate historical background to Australia's natural resources, the purpose of the Audit, and its outputs, including its Theme structure, the Data Library and the Atlas. It was pleasing to see the mandates of the Commonwealth and State governments described specifically and an overall framework for current decision making presented up front.

### **3.3 Australia's Natural Resources Today (Chapter 2)**

This chapter on assessments of natural resources provides the bulk of the Final Report and is structured through separate land, water, biodiversity and people sections. While the linkages and integration framework on page 13 are useful, the framework has not been applied across the various Theme reports. For example, the Vegetation Theme lacks much information on condition and while the links between catchment processes and river and estuary condition is well covered, any direct linkages to land use are undeveloped in most of the Audit Theme reports. Also, Figure 8 does not show the integration of socio-economic information. This highlights the weakness of the current integration plan and the need for greater emphasis on this in future planning.

This assessment chapter provides statements of issues and opportunities regarding the status of resources. Options for addressing these issues through information provision and use in decision making are covered in Chapter 3 (Australia's Natural Resources: Looking Ahead) of the Final Report.

The content of each of the four main sections in Chapter 2 (Land, Water, Biodiversity and People) is a series of statements and graphics, most of which have been extracted from the Theme reports. It is difficult to extract any general messages even though there is some emphasis on resource condition, cause and effect, geographical extent of degradation, costs and remedial actions. However the content is possibly an unavoidable mix in a final report of such a large project. Many of the examples could have presented a more integrated approach if some additional information had been

included. Examples are Figure 11 where irrigated area/total area (or irrigation water used) and income (or milk price) could have demonstrated some integration with the productivity trends. Having said this, the soil acidity/soil salinity/sodicity interpretation is a good example of integration of data. It is only limited by socio-economic data relating to the impediments to adoption. Priorities are rarely defined but where they are (eg page 45, soil erosion versus salinity) they are welcome. Perhaps more could have been done in this regard in both the Theme reports and in this Final Report, although it is recognised that the Audit has not covered all land degradation issues.

It could have been useful for this Chapter to define all the new and important initiatives and material derived from the Audit investment; as opposed to what major new data sets were provided at a national level, and what new tools were developed (eg. groundwater management areas).

In many respects, the Audit's multiple purposes impact on this Chapter. For example, the development of ASRIS and NVIS are reported together with the assessment of resources. A clearer separation of the 'information framework' and the 'assessment' could have made more impact on the reader as to what the Audit has achieved.

The Biodiversity Theme Report has not yet been released. There is a section on biodiversity in the Final Report, although most material was drawn from the Vegetation Assessment and Landscape Health Reports.

Examples of a wide range of uses of various Audit products are provided at the end of this Chapter. Most uses cited are those by government agencies, consistent with the Audit's main focus.

It is suggested that more could have been done to highlight some of the key issues that arose in the assessment, perhaps in a concluding section of the Chapter. For example,

- The dilemma regarding economic importance of irrigation (half the profits from agriculture at full equity) and the overall pressure on water resources;
- The pristine state of estuaries and rivers in northern Australia versus southern Australia; and
- The economic importance of acidity.

### **3.4 Australia's Natural Resources - Looking Ahead (Chapter 3)**

We had anticipated that this chapter would provide options for the future, including priorities. The initial emphasis is on decision-making frameworks to assess options. However Figure 80 needs to identify clients/stakeholders in the Questions and in Figure 81 Steps 1 and/or 2 needs to identify what are the blockages (particularly social) causing problems or preventing land users from acting, rather than leave this to Step 5.

In fact the framework for options assessment on page 79 could have been used more broadly than its central location in Theme 6. It could have been made a central feature of all assessments made in the Audit and could have driven the priorities that had to be set in the various Themes. If this had been done, there may well have been an

improved guide for decision making currently and a better framework for future information assembly established.

The first recommendation concerns an increase in strategic investment in information by all concerned with NRM. While this can be accepted as worthwhile in a general sense, it would be useful if the benefits of increased investment in information were related to improved decision making. For example, while not appropriate for the Audit itself to pursue, in order to support this recommendation in future, it would be useful to assemble evidence of where a lack of technical information has led to poor decision making in NRM in the past. In fact the blockages are quite frequently related to socio-economic issues and lack of knowledge.

The second recommendation, that of information packaging and transfer activities to service stated goals and targets concerning NRM, is currently being pursued by a range of industries and agencies. However, the recommendation is useful as it enforces the utilisation of information and the imperative of developing and using improved practices.

On page 81 an interesting statement is made. 'In some cases, change in land use may have to occur, particularly where the current land uses are unsustainable'. No doubt intentionally, the reader is given no indication throughout the report as to what constitutes sustainable/unsustainable land use. It would have been useful to at least discuss the concept of unsustainable land use and integrate this into the decision making process for the assessment of options. If such a concept can not be at least addressed or discussed in an assessment of NRM in the Audit, what chances are there for such issues to be raised without polarisation of views in other forums?

Recommendation 3.1 addresses the implementation of land/soil productivity monitoring. It is unclear whether a national framework or a national program is being advocated outside of existing initiatives. If the latter, it should not be divorced from existing initiatives (eg NAP), and it may be better for data and information from existing initiatives to feed into a national framework. A similar comment applies to Recommendation 3.2 to 3.5.

There follows some useful integrating aspects between economic, social and biophysical factors leading to a recommendation (Recommendation 4) for a resource accounting approach to be developed. While this recommendation appears sound in principle, there could have been more attention given to a definition of resource accounting. It is stated that it should involve economic, social and environmental attributes. Some leads as to how to do this and whether the existing information sets are sufficient would have been valuable.

Recommendation 5 covers the need for future and regular assessments that are based in legislation. The arguments for legislative backing are not advanced but are assumed to be independence, legitimacy and continuity.

A good case is made to build on the existing assessments and to step up activity in filling information gaps (where examples are given), extending the scope of the Audit (for example to include weeds) and to integrate data sets better than has been done so far. The associated recommendation (Recommendation 6) provides a future direction

for Audit activity at a broad level so that information supply is targeted, cost effective and coordinated.

Recommendation 7 recognises the scope for improving data and information through the Australian Spatial Data Directory, the development of data library systems and distributed and linked atlases including the Australian Natural Resources Atlas.

Recommendation 8 stresses the need for continuation of coordination and partnership building to achieve relevant and cost-effective data collection. The final recommendation involves the need for an independent information agency to continue on where Audit 1 has left off and to service a range of functions.

In conclusion, the Final Report is a fitting end point for this 5 year investment in improving the NRM information base. While the evaluation team supports all of the recommendations in the Final Report, the final recommendation regarding an information agency with independence is critical.

An information and knowledge based approach to Australia's natural resource management requires the cooperative participation of all tiers of government, industry and the community. If all participants are to work willingly within the same framework and from the same information base it must be seen to be independent of special interests. Achieving consensus on NRM decisions will be difficult enough and it should not be compromised by disagreement about the information base itself.

## **4. Overall Assessment**

### **4.1 Program Logical Framework**

The logical framework of a program provides a basis for analysing its strategic goals and directions and assessing progress in meeting them. The Audit was not developed in a formal ‘logical framework’, but to assist their evaluation the consultants analysed the Strategic Plan in a modified logical framework form as the basis for identifying the expected outputs, outcomes and performance indicators. This analysis, which was also used in previous evaluation reports, is presented in Table 4.1.

The Audit Strategic Plan identifies six objectives and a set of related “tasks,” actions, outputs and performance indicators. Expected outcomes are not specifically defined, but the tasks are framed in a way that gives an indication of broad intended outcomes. This is the source of the outcomes we have defined in Table 4.1.

It is also noted that, although there are performance indicators, they largely relate to specific outputs and the timing of their completion. This is understandable, given the problems in relating the Audit products to particular outcomes, but it does make the evaluation of outcomes more difficult.

While the Strategic Plan does not specifically have a section on the purpose of the Audit, it was possible to derive this from the section in the Plan on the “Planning Context”. It is important for the evaluation to be clear about the Audit’s purpose and focus. The primary focus is on the needs of Commonwealth and State agencies, but there is also reference to the Audit benefiting local government, rural industries, community groups and a range of other users. This has implications for the expectations of the potential users identified and on the capacity of the Audit to meet their needs, bearing in mind that the scale of information required by the different groups is likely to be different.

The purpose of the Audit also identifies four areas of decision-making that will be targeted:

- Policy assessment and development;
- Investment decisions;
- Evaluation of program and policy performance; and
- Direct resource management, particularly by government.

While there are overlaps, these areas apply to different levels on the decision making continuum and presented a particular challenge to the Audit in providing useable data at each level.

**TABLE 4.1: NATIONAL LAND AND WATER RESOURCES AUDIT – LOGICAL FRAMEWORK**

<b>Mission</b>	To provide nationwide assessments of Australia's land, vegetation and water resources to support sustainable development now and in the future.					
<b>Purpose</b>	<ul style="list-style-type: none"> <li>To provide data, analysis and appraisal which facilitate improved natural resource management decision making in the areas of policy assessment and development, investment decisions, evaluation of program and policy performance, and direct resource management, particularly by government.</li> <li>The primary focus is on the needs of Commonwealth and State agencies, but the Audit will also benefit local government, rural industries community groups and a range of other users.</li> </ul>					
<b>Objectives</b>	1. Providing a clear understanding of the status of, and changes in, the nation's land, vegetation and water resources and implications for their sustainable use	2. Providing an interpretation of the costs and benefits – economic, environmental and social - of land and water resource change and any remedial actions	3. Developing a national information system of compatible and readily accessible resource data	4. Producing national land, vegetation and water - surface and groundwater - assessments as integrated components of the Audit	5. Ensuring integration with, and collaboration between, other relevant initiatives	6. Providing a framework for monitoring Australia's land and water resources in an ongoing and structured way
<b>Actions</b>	1. Select priority needs 2. Define methods to collect data for Themes 3. Report on status and change in natural resources 4. Recommendations for monitoring	1. Develop methods to collate and apply economic, environmental and social data 2. Interpret each Theme in an integrated manner 3. Identify opportunities for remedial action	1. Develop transfer protocols to facilitate data transfer 2. Improve data access 3. Address data gaps 4. Formulate data standards	1. For each Theme, collect and collate data, analyse it and assess trend and condition 2. Use biophysical, social and economic data to provide reports on particular issues	1. Develop collaboration across NHT programs and related activities 2. Support and build on other relevant initiatives	1. Provide baseline data 2. Recommend on ongoing monitoring, including appropriate institutional arrangements and guidelines 3. Recommend on future Audit arrangements
<b>Outputs</b>	Scientific assessments on the status of and, where possible recent changes in, the nation's land, vegetation and water resources to assist decision makers.	Reports on the economic, environmental and social dimensions of land and water resource change, including land cover and remedial actions.	Integrated, nationally compatible data sets to support the Audit process which are suitable for ongoing maintenance and development as a readily accessible information system.	National water resources assessment to show the extent of the surface and groundwater resources, quality, supply capacity and use.	Defined and agreed reporting links between the Audit and other relevant activities at State and Commonwealth level.	Framework for the long term monitoring and assessment of health and management of Australia's land and water resources.
<b>Outcomes</b>	Australian communities have a clear understanding of the status and trends in condition of natural resources and are using information to make decisions about managing natural resources in an ecologically sustainable way.	Better targeted investments by Commonwealth and State agencies, and other resource managers including farmers, industry, regional authorities and community groups.	Availability of data sets, defining Australia's natural resources and trends in their use and condition, that facilitate effective policy decisions on the allocation and management of natural resources.	Audit products that effectively demonstrate the linkages between land, vegetation, surface water and groundwater and the linkages between these natural resource issues and economic, social and environmental factors.	Audit products that are compatible with and add to other Australian natural resource management information initiatives.	Availability of a framework that uses compatible and readily accessible natural resource data in an integrated manner and is widely used and accepted by natural resource management decision makers.
<b>Performance Indicators</b>	1. Needs analysis – by March 1998 2. Methods for data collection and collation -by March 1999	1. Detail methods to integrate data – by March 1999 2. Reports on each key Theme – by December 2000 3. Recommendations on	1. Data Protocols – by May 1998 2. Distribution of a readily accessible network of data by May 1999 3. A range of data collection and	1. Reports on each key Theme by December 2000 2. Recommendations on how data can be best integrated and applied in a cohesive	1. An MOU with SoE reporting – by May 1998 2. Progressive implementation of collaborative arrangements	1. Reports on each key Theme by December 2000 2. Integrated final report on NRM in Australia that recommends Australia wide monitoring

<p>3. Reports on each key Theme – by December 2000 4. Recommendations on data standards, monitoring systems and management – by June 2001</p>	<p>remedial actions and analysis of costs and benefits of various strategies included in Theme reports 4. Systems and processes to ensure decision makers have access to data on costs and benefits - by June 2001</p>	<p>collation activities brokered within each of the Themes by December 2000 4. Recommendations on data standards and monitoring systems – by June 2001</p>	<p>manner in decision making included in each Theme report 3. Integrated final report on NRM in Australia – by June 2001</p>	<p>across States and Territories over the life of the Audit 3. Contribute to and link with key reporting activities such as SoE, ABS initiatives, greenhouse gas emissions etc.</p>	<p>systems and institutional arrangements – by June 2001 3. Final report on ongoing data capture management and access – by June 2001 4. Report on future Audit activities – by December 2001</p>
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Source: National Land and Water Resources Audit, Strategic Plan 1998-2001, June 1998 (Note that while the Plan does not specifically refer to outcomes, these have been defined on the basis of the material in the Strategic Plan)

## 4.2 Meeting Clients' Needs

One of the first steps in the Audit process was a Needs Analysis, which was undertaken by Hassall & Associates through a series of workshops and interviews covering all States and Territories. The process was carried out from December 1997 to March 1998. The results of the Needs Analysis were presented in a final report in March 1998.

The specific needs contained in the Hassall report were not directly incorporated into the Audit planning documentation. However, the needs analysis was drawn on in the development of the Strategic Plan, particularly in establishing the Themes and their coverage and in the definition of a set of 66 key questions facing Australia's natural resource managers found in Appendix 2 of the Plan. Based on our review of the Themes in Chapter 2, our overall assessment is that the Audit has met the principal needs as identified in the key questions.

We also analysed client needs on the basis of the four areas of decision-making included in the Audit Purpose in our log frame analysis (see section 4.1). In our October 2000 progress report, we allocated the 66 key questions to one of the four areas of decision making that in our judgement was the most relevant. The results are shown in Table 4.2.

**Table 4.2: Key NRM Questions by Category of Decision**

	Per cent
Policy assessment and development	52
Investment decisions	9
Evaluation of program and policy performance	23
Direct resource management	17

Source: Agrans (2000) Monitoring and Evaluation of the National Land and Water Resources Audit: Progress Report 3, 13 October 2000

Not too much weight should be put on this analysis, since the number of questions is not necessarily an indication of their relative importance in the Audit Program. However the data does provide some indication of orders of magnitude. Around half of the questions relate to policy assessment and development, while a further quarter are concerned with the linked issue of evaluating program and policy performance. Only 9 per cent of the questions relate directly to investment decisions.

The client survey conducted in 2001 contained a question on how respondents rated the Audit in meeting the needs of these four decision making areas. Details are provided in Table 4.3.

**Table 4.3: Rating of Audit in Relation to Meeting Natural Resource Management Needs (%)**

<b>NRM need</b>	<b>Good</b>	<b>Satisfactor y</b>	<b>Poor</b>
(i) Policy assessment and development.	19	55	26
(ii) Investment decisions.	6	55	39
(iii) Evaluation of program and policy performance.	7	43	50
(iv) Direct resource management, particularly by government.	3	45	52

Source: Agrtrans (2001) Monitoring and Evaluation of the National Land and Water Resources Audit: Progress Report 6, 10 October 2001

A majority of respondents rated the Audit as good or satisfactory in meeting the needs of policy assessment and investment decisions, but views on whether it met evaluation and direct resource management needs were evenly spread between good/satisfactory and poor. It might be concluded from these two tables that, on the assumption that the decision areas of policy development and evaluation are the highest in client's priority, the Audit has been more successful in meeting expectations for the former and less successful for the latter.

It is also worth noting that in answer to another question in the 2001 survey, 72 percent of respondents replied that the Audit had provided value for money, while 28 percent of the 29 respondents disagreed.

The difficulty of precisely defining and meeting clients' needs for natural resource management information should be acknowledged. This particularly relates to the decision areas of policy development and evaluation. As we noted in our October 2000 Progress Report, the policy making process is characterised by uncertainty and discontinuity and the information required for this purpose is likely to be relatively unstructured, difficult to predict and relatively selective. It is also clear that once the Audit work started, data limitations became clearer and in some cases presented obstacles to achieving planned outputs.

Having said that we repeat our view that, given the range of potential clients and their expectations of the Audit, there could have been a useful second stage of the needs analysis. This could have tested what the Audit had tentatively concluded it would pursue through further consultation with senior decision-makers, before the work plans for the themes were settled.

### 4.3 Assessment Against Objectives and Outcomes

This section comments on how well the Audit has delivered on the six Audit objectives and the related outcomes defined in Table 4.1.

**Objective 1:** *Providing a clear understanding of the status of, and changes in, the nation's land, vegetation and water resources and implications for their sustainable use.*

**Outcome:** *Australian communities have a clear understanding of the status and trends in the condition of natural resources and are using information to make decisions about managing natural resources in an ecologically sustainable way.*

The Audit has provided for the first time comparable information which will lead to a significant improvement in general community understanding of the status of the nation's natural resources and changing perceptions about some issues. However, there are some qualifications resulting from limitations in data quality and availability and constraints on the Audit in terms of resources and time in being able to develop new data sets:

- While some trend information has been provided, it is mainly limited to changes between current condition and a supposed natural state or limited to a few points in time as in the water quality and water use information. While more data on trends was available in some States this could not be used to present a national picture. The key Audit achievement has been to provide a more comprehensive set of benchmarks on the state of the natural resource issues covered so that trend data will be able to be reported in the future;
- There are a number of important natural resource issues not reported on. Some examples cited by respondents surveyed in earlier Theme assessments include weeds, effluent disposal, the impact of developments in intensive agricultural industries and issues relating to pest management and pest control. However it should be noted that there were limited resources available to the Audit, and that there was no mandate to report on some of those issues identified;
- The data sets and information products developed by the Audit are sometimes limited by scale or methodological issues in the extent to which they can meet particular community or industry needs; and
- While the status and change information provides a basis for drawing implications about the sustainable use of resources it is again limited by trend information on resource use and management practices.

Having said this it is noted that the primary focus of the Audit is on the needs of Commonwealth and State agencies, so promoting more general community understanding at a relatively aggregate level is an appropriate focus.

Understanding will become more widespread as knowledge of the Audit outputs grows. Through the Atlas, the Data Library and the use of the Australian Spatial Data Infrastructure (ASDI), the Audit has implemented some significant mechanisms to promote this knowledge. These need to be supported by enhanced communication

activity. Each of these mechanisms also requires some level of technical knowledge to be used effectively.

A number of potential users of Audit products have raised the need for formal training to be able to understand their capabilities and access the underlying data in more detail. The User Guide to the Atlas and Data library makes a valuable contribution to this understanding, but provision of training remains a key requirement if the Audit's impact is to be optimised. This could take the form of a 'train the trainer' program, maintaining a help desk, and using technical people already involved in the Audit to demonstrate to regional users.

It is a longer-term challenge to be able to assess how the greater understanding promoted by the Audit will translate into management of Australia's national resources in an ecologically sustainable way. Some specific developments that relate to this outcome include:

- The participation by the dairy industry in case studies as part of Theme 5 on Productivity and Sustainability.
- Recognition by some industries that the Audit provides a new authoritative basis for raising awareness among producers about resource management issues.
- Anecdotal evidence about a growing use of the Audit products by NRM managers and researchers.

**Objective 2:** *Providing an interpretation of the costs and benefits - economic, environmental and social - of land and water resource change and any remedial actions.*

**Outcome:** *Better targeted investments by Commonwealth and State agencies, and other resource managers including farmers, industry, regional authorities and community groups.*

Again, this is a difficult outcome to assess, and in the absence of a definition of "better targeted" the criteria for assessing it are likely to be subjective. The Audit products and data should contribute to achieving better targeted NRM objectives, particularly by governments, regional authorities and community groups. However, Objective 2 has been met only partially. Useful analysis of some costs has been provided in Theme 6, but as noted earlier there are limitations in its coverage of forms of natural resource degradation, the possible action options to address these and in estimating the costs and benefits of remedial actions.

Areas where the Audit's outputs have the potential to influence better decisions include:

- The Audit has provided a new perspective on salinity through a better understanding of groundwater flow systems and the associated fact sheets on relevant remedial measures, as well as the cost estimates in Theme 6. As indicated in Chapter 2, the underlying classification of groundwater flow systems is still broad and it will not necessarily show more local variations. However, compared to the information available prior to the Audit it is a major step forward and should allow better targeting of preventative and remedial measures,

particularly by governments and catchment/regional groups. This is a significant outcome given the fact that governments have agreed to a large increase in expenditure through the NAP and recognising that this program will operate on the basis of performance targets.

- The Theme 5 work on nutrient and sediment flows, nutrient balance and soil acidity should provide particular assistance to governments and regional groups in prioritising investment decisions in government expenditure programs, although associated economic analysis is limited.
- The Themes covering Water Resources, Catchments, Rivers and Estuaries provide physical assessments of priorities for action but the limited integration with economic social and land management information means they only partially meet this outcome. These Themes provide information that could be evaluated in terms of the benefits and costs of preventative and remedial actions.
- The regional information on profit at full equity and net economic returns will help relate economic performance to resource management problems and give some indication on priorities for action and the actions that government should support (reconstruction versus management).
- The work in establishing NVIS and ACRIS will provide nationally consistent data in two areas of NRM decision making where it has been lacking before.

While not necessarily a criticism, given the Audit's primary focus, the scale of much of its data will benefit NRM decision making by governments and regional groups more than industry investors who will be looking for information at the farm or paddock scale. There would be considerable value in developing closer links between the Audit and industry representative bodies and RDC's in the future. The objective would be to ensure that where possible information from the Audit is packaged so that it is accessible to potential industry users, and therefore it is desirable wherever possible to produce spatial information.

Another potential constraint on the Audit's use in making investment decisions is the limited data available on land use practices and the difficulty of linking this information with the various forms of natural resource degradation covered by the Audit. The capacity to make these links and draw stronger conclusions about the causes of degradation and drivers that might be influenced to address these would provide a significant additional basis for determining investment priorities. It is recognised that current data limitations prevented the Audit from undertaking this analysis, and we note that it should be a high priority for any future NRM information initiative. It is an Audit outcome in itself that many more now appreciate the importance of practice information, however there is still a lack of understanding of the blockages to action.

**Objective 3:** *Developing a national information system of compatible and readily accessible resource data.*

**Outcome:** *Availability of data sets, defining Australia's natural resources and trends in their use and condition, that facilitate effective policy decisions on the allocation and management of natural resources.*

This is a core Audit objective, defining the nature of the resource information system that should result from its activities. The associated outcome (derived from the "Task" defined in the Audit Strategic Plan), focuses on the information system facilitating effective policy decisions on the allocation and management of natural resources.

Our assessment is that this objective has been met. The Audit outputs represent a significant advance in knowledge about Australian natural resources and considerable effort has gone into ensuring that the databases and other products are national and compatible. This has not always been possible for a number of reasons, including the nature of the data available (eg. the different approaches in estimating dryland salinity risk in various States) and the fact that there is not full State commitment to and ownership of some of the Audit products.

As a result of the Audit many States have seen the value of having data and information accessible to a wide range of users and have used the Audit's access models to improve access to their data. Community representatives and other decision-makers have highlighted how difficult it has been to obtain this type of information in the past and they see the Audit's system as a breakthrough in accessing valuable information on natural resources. Many see access to data as important in raising awareness of issues and in allowing them to be informed and involved in setting national priorities, developing policies and programs such as the NAP and NHT2 and monitoring changes as a result of investments.

The Audit has contributed to facilitating effective policy decisions on the allocation and management of natural resources. Some impacts of the Audit in this area are already evident from the responses in the mid 2001 stakeholder survey where it was reported (October 2001 Progress Report) that:

- Two State agencies had already used Theme 2 outputs for salinity planning and action;
- One Commonwealth agency and one State Agency were using information from the Audit in targets and policies associated with the NAP;
- One State agency was using the estuarine evaluation process developed in the Audit; and
- One Commonwealth agency was using the Audit results in the design of aspects of their NHT2 program.

The Audit Final Report notes that the Audit has established bilateral protocols with custodians of data in each State/Territory to streamline data access for Audit assessments. Also, an agreement with the Australia New Zealand Land Information Council ensures ongoing community access to Audit data. These issues are discussed further in Chapter 5.

**Objective 4:** *Producing national land, vegetation and water - surface and groundwater - assessments as integrated components of the Audit.*

**Outcome:** *Audit products that effectively demonstrate the linkages between land, vegetation, surface water and groundwater and the linkages between these natural resource issues and economic social and environmental factors.*

Integrated products might include indicators, consistent time series across a range of variables and the capacity to carry out map overlays for different resources. The availability of integrated products, or the capacity to produce them, allows more informed and effective decision making, bearing in mind the extensive interaction among natural resource management issues.

Our assessment is that the Audit has only been partially successful in achieving this goal and outcome. Some of the problems in achieving integration included:

- The independence of Theme teams, their separate workshops, their independent reporting events and their sequential delivery over more than a year;
- The large amount of material to be covered and divided up in some manner;
- The perceived necessity to focus initially on the technical issues and what was known about each resource individually (analysis before synthesis);
- The associated requirement to focus initially on expertise specific to each resource; and
- The necessity of producing outputs in a constrained timeframe.

Having said this we note a number of areas where the Audit has achieved integration.

Linkages between resources are demonstrated in the various Theme reports. The cross-referencing to data in other Themes improved as the Audit produced more and more Theme reports. This was understandable as the latter Themes were incomplete when the initial Themes' reports and products were being produced.

Examples of integration of fundamental data sets identified in the Audit Final Report include:

- An evaluation of Australia's water resources, which has been accessed by the National Competition Council in overseeing the National Water Reform Agenda;
- Water and native vegetation data sets have been used as integral components of river and catchment health and as inputs to the Audit's assessment of biodiversity;
- Catchment and river health have been linked with carbon, water and nutrient budgets, evaluated from a perspective of nutrient and sediment transport;
- Theme 6 provides some integration of selected biophysical and socio-economic data; and
- An Australia-wide land use map has been produced.

However as a general comment, while the Audit has achieved considerable improvements in setting ground rules and developing some compatible NRM data sets, decision-makers will still not have access to a fully comprehensive set of data across different resources over time and at the same scale and spatial accuracy. In any ongoing Audit, improved integration may be more easily effected now that improved

frameworks for monitoring and decision making are available, and hopefully, future reporting processes will not require all reports to be produced at the one time.

A specific tool of integration is the use of indicators. Theme 7 is one of the major integrating Themes of the Audit and this Theme has used indicators quite prominently to report on the condition of catchments, rivers and estuaries. Such indicators can be used to identify priority areas for investment and policy initiatives. Even more important are spatially referenced attributes that relate to cause/management practice as they are valuable in informing management, but such data were limited and hence could not be reported.

Another dimension of integration is the capacity to link the range of information needed for decision-making. Constraints to a more effective framework include:

- Many resources require non-market valuations where difficulties still pertain;
- Unspecified or uncertain relationships between cause (eg land management practices) and resource condition;
- The variable and long time frames to be considered in decision making; and
- The avoidance within the Audit reports of mentioning a spread of potential policy options (industry and government) and the sets of information that might be required if such options are to be examined in more detail.

The importance of social and economic factors influencing change was recognised in the Audit, but the difficulty of integrating relevant socio-economic data into new products that can be used in decision making was evident. This is discussed in the review of Theme 6 in Chapter 2.

Regarding integration with environmental factors, there was a lack of biodiversity implications in much of the resource data, but this is being remedied to some extent in the yet to be published “Biodiversity Report”. It might be expected that a higher level of integration with biodiversity outcomes may be produced. However, the lack of cause and effect knowledge with regard to biodiversity changes may also inhibit improved decision making in some instances. Also this was not a part of the original brief set for the Audit.

Finally, we note that the framework for decision making in Theme 6, which is repeated in the Final Report, is valuable and could have been applied more consistently throughout other Themes in the Audit in order to direct priority data assembly.

**Objective 5:** *Ensuring integration with, and collaboration between, other relevant initiatives.*

**Outcome:** *Audit products that are compatible with and add to other Australian natural resource management information initiatives.*

This objective is tending towards a process objective with the desirable outcomes expressed as an enhancement of the Audit products due to successful collaboration, encouraging other initiatives, and incorporation of material from other initiatives.

The 2001 stakeholder survey (October 2001 Progress Report) indicated that the extent of collaboration with other assessments (such as the State of the Environment reporting, ABS, ABARE etc) and with resource management agencies in the States/Territories was considered either good or satisfactory. This was in contrast to the views expressed regarding collaboration with industry or community groups where there was a poorer assessment result. It appears that where the Audit engaged an industry group in a project sense, the collaboration was excellent. Consultation with industry and community groups in the broader sense of seeking their views on priority information areas was less apparent and effective.

For example, Audit projects that included collaboration with the Fertilizer Industry Federation of Australia and with the dairy industry are excellent examples of collaborative activities where the Audit has benefited greatly in terms of new data and information and where the industry group has also benefited. As an illustration, the data on management practices assembled in the joint dairy project resulted in the development of regional action plans for NRM, a national strategy for NRM, and the engagement of the political wing of the dairy industry into NRM discussions. Such stimuli can only result in better informed NRM decision making in future.

A high degree of integration with other natural resource management data is illustrated via the ability in the Atlas and the Data Library to access other databases and information. Compatibility among Audit and between Audit and non-Audit data sets can probably be improved and this will be a challenge for improving NRM for the future.

Overall, the collaboration of the Audit with other initiatives and the degree of integration that is evident should lead to improved future decision making. Process-wise the Audit has met this objective as well as could have been expected.

**Objective 6:** *Providing a framework monitoring Australia's land and water resources in an ongoing and structured way.*

**Outcome:** *Availability of a framework that uses compatible and readily accessible natural resource data in an integrated manner and widely used and accepted by NRM decision-makers.*

The evaluation team surveys indicate that stakeholders and users rate the Audit highly in terms of providing data standards and protocols, access to more compatible data and an improved framework for ongoing measuring and monitoring of natural resources.

The Audit has identified gaps in knowledge and data across Australia. It has developed with the data custodian standards, guidelines and protocols for the data management framework and the institutional arrangements to underpin any resource audit in the future.

In our evaluation of the Theme reports there have been obvious successes in developing frameworks for soils, salinity, nutrients, surface water, groundwater, rangelands, vegetation and estuaries, and at the industry level, management practices

in the dairy industry. There is also some commitment to approaches in catchments and rivers but there is considerable concern among the States on costs and the indicators to use. Some States see the frameworks as useful for national monitoring at three to five year intervals but have concerns about their relevance to their own State situations as they believe they have systems in place that are more accurate and relevant to their own needs. There is obviously much negotiation to be done before agreement is reached but at the same time there is strong support for nationally compatible systems that allow users to drill down to more detailed regional information when required.

A weakness identified earlier in this report is the lack of emphasis on land use and land management practices data and information on weeds and pests. These will need to be considered in the finalisation and ongoing development of the framework and protocols.

The lessons learnt from the Audit should not be lost and it is our view that these lessons and the momentum created by the Audit to improve the quality and compatibility of national data sets should be used to guide future frameworks. However greater emphasis should be on improving integration and identifying and meeting the needs of NRM users.

#### 4.4. Contribution of Themes to Audit Objectives

Within each of the first seven Theme evaluation reports the contribution of the Theme to each of the Audit objectives was assessed. A summary of the views of the evaluation team results is shown in Table 4.4. It would not have been realistic to expect that each Theme would have contributed fully to each Audit objective. Also, there were other outputs from the Audit apart from those within Themes that contributed to the Audit objectives. ‘Theme 8’ (data and information) contributed to all objectives, and is not included in this assessment, as it can be viewed as the tool by which the outputs for the seven Themes were integrated in order to help them achieve the objectives.

**Table 4.4: Assessment of Contribution of Each Theme to Audit Objectives**

Audit Objective	Has the Theme contributed to the achievement of the objective?						
	Theme 1: Water	Theme 2: Salinity	Theme 3: Vegetation	Theme 4: Rangelands	Theme 5: Agriculture	Theme 6: People	Theme 7: Catchments, Rivers and Estuary
1. Understanding of status and trends	Yes; over a limited time span and range of attributes	Yes for status; yes for trends on basis of future risk or hazard	Partially for status; partially for trends, changes since pre-European times only	Yes, for status; partially for trends over a limited set of attributes	Yes for status for selected priority issues; no for trends	Partially for both status and trends regarding economic data	Yes for status; partially for change (changes against pristine); good understanding of drivers
2. Costs and benefits of resource changes and remedial actions	NA	Partially covered in Theme 6	No	No	No	Yes, but limited for remedial actions	Needs for action and some benefits identified; limited cover in People and NRM
3. National information system	Yes	Partially; but still methodological differences among States	Yes	Partially, but has not been put to the test	Yes	Partially for compatible data; yes for improvements to accessibility	Yes; established system for Audit in future but still differences across States
4. National	Partially; data has	Yes	Partially	Will contribute if	Partially through	In so far as socio-	Yes

assessments as integrated components	been integrated in other Themes and across Agencies			ACRIS implemented	Atlas	economic information is an integrating process	
5. Integration and collaboration with other initiatives	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6. Ongoing and structured framework for monitoring	Yes	Yes	Yes	Partially	Partially	Partially	Yes

## **5. Information Outputs, Access and Use**

### **5.1 Introduction**

Any examination of Audit outputs and outcomes will need to recognise the difficulties in attributing particular impacts on the ground to improvements in natural resource management information. Further, even when these links can be identified, there will often be long lead times between the availability of the information and an on-ground effect.

An emphasis on information outputs is therefore appropriate for two reasons:

- (a) the Audit's central function is about providing information; and
- (b) an emphasis on information outputs, their use, and potential use, is appropriate at this point in time.

This Chapter addresses the following questions:

- What information products have been produced by the Audit?
- How easy Audit data and information are to access and use?
- Will users try to and be able to integrate information? and
- Is Audit information and data being used (or planned to be used) by a range of users to make decisions on natural resource use and management?

### **5.2 Information Outputs and Accessibility**

The principal Audit outputs can be summarised as:

1. A set of databases relating to
  - Land use;
  - Soil properties;
  - Native vegetation type and extent;
  - Water use allocation and availability;
  - Dryland salinity risk and hazard;
  - River health; and
  - Estuaries.
2. A distributed network of web-based natural resource information systems involving
  - The Australian Natural Resources Atlas;
  - The Australian Natural Resources Data Library;
  - Links to the Australian Spatial Data Directory; and
  - Links to other State and Territory atlases.
3. A series of interpretative reports covering the Audit Themes and an Audit Final Report.
4. Reports on specific Audit projects.

In summary, the Audit has developed some new national data sets. However, the main approach has been to draw on a wide range of existing data that has not been extensively

used or accessible in the past. Where necessary this data was reworked into national compatible data sets and frameworks and used to develop new information products matched to the management and policy requirements identified in the initial needs analysis. This was seen as the best way to achieve results, given the Audit's wide scope, available resources and the fragmented nature of Australia's existing natural resource data.

Our overall assessment is that the Audit has devoted considerable effort into making its information and data accessible and that it has been largely successful in that effort. However less confidence is held in the capacity for integration, repeatability and accuracy of the information due mainly to its different sources and methods of collection/estimation. However the Audit has developed and recommended means of addressing these issues.

The web-based Atlas and Data Library are the main entry points for Audit information. They are excellent resources and provided they are maintained and not allowed to become outdated, they can be expected to be extensively used in future NRM decision making. This is particularly so at the national, State and large catchment level.

In the evaluation report submitted in October 2001, we tested the 'useability' of the Atlas and website. The exercise was conducted without reference to the metadata in order to simulate how an everyday lay user would use the website. Following the publication and release of the 'User Guide – Australian Natural Resources Atlas and Data Library' this exercise was repeated, using the Guide. Many of the concerns highlighted in the October 2001 report no longer apply, due to both upgrades and advances to the site, as well as the User Guide.

The general appearance and graphics etc are excellent, and the speed of the various pages downloading also appears satisfactory. However, at times there appears to be too much 'squeezed' into a single screen, requiring a significant amount of scrolling both across and down the screen.

Navigation appears satisfactory, but there is sometimes difficulty in moving back to the starting point. For example, when identifying what information was available for the Cowra region, accessing data on three separate factors such as agricultural statistics, water availability and salinity required much moving back and forth. However, this is only a minor problem, which with more experience or training using the website may be overcome.

With the help of the User Guide, the Map Maker tool was utilised much more successfully than it was for the October 2001 report.

Links to other organisations and data sources and to the Data Library are excellent, as are links to project reports and Theme reports.

The Atlas also has a comprehensive search facility for Audit publications, providing access to project reports and Audit assessments, although when tested (eg for “salinity”) we noted that a number of the links to documents were not working.

No attempt was made to download data sets from the Data Library but a survey of the metadata provided suggests that this will be an excellent user facility.

A major achievement of the Audit is the actions it has taken to open up and extend access to natural resources data. It developed and signed protocols with the States and Territories and key Commonwealth agencies for access to this data. It also signed a national agreement with ANZLIC to improve access to natural resources data for the community. This agreement is supported by data custodians and streamlines access to and the transfer, sharing and management of natural resources data. The Audit has also supported ANZLIC’s Australian Spatial Data Infrastructure and its Directory as the vehicle for promoting the availability of its data and thereby avoiding the duplication of effort in searching for data. The Data Library operates as a node of the Australian Spatial Data Directory.

An important aspect of using Audit products is knowing where to find specific information, as in some cases there are several possibilities as to where it might be found. If using the Atlas or the data directory this is not really an issue as the search routines are adequate. However, there can be a problem of where to ‘search’ if a user does not have internet access, and is therefore relying on the Theme reports for information on a particular topic. For example, when looking for information on the extent of perennial grasses in Australia for grazing does one go to the Vegetation, Dryland salinity or Agriculture report? In this respect the report “Australian Natural Resources Information 2002” will be an important resource document as it does provide in an appendix a catalogue of data products from Audit assessments.

### **5.3 Users and Uses of Audit Products**

As shown in section 5.2, the Audit has produced and is still producing a range of products and outputs. These range from the knowledge, protocols and tools contained in the project reports, data bases and frameworks for monitoring (eg ASRIS, ACRIS, NVIS), the Theme Reports and the associated summaries, the Operational Manual, the Atlas and the Data Library.

Respondents to the survey conducted by the evaluation team in mid-2001 identified several uses of Audit outputs at that point in time. These were reported in Chapter 4 of the October 2001 report, and are repeated here in Table 5.1.

**Table 5.1 Examples of Use of Audit Outputs**

<b>Respondent</b>	<b>Use of Output</b>
Commonwealth Agency	Catchment categorisation work has been used as a foundation for ABARE /MDBC salinity project.
State Agency	Ensuring that national policy recognises that the situation with respect to Salinity in our State/Territory is different to that of other parts of Australia. Placing vegetation data sets within a national framework. Allowing us to progress a rangeland monitoring system.
Commonwealth Agency	We have used Audit findings in better targeting NHT2 program design.
State Agency	Use of salinity findings.
State Agency	Development of a detailed land use map for the State/Territory is cutting edge and has already been used for locust plague control; mapping of present vegetation extent is very detailed and sets a new benchmark for monitoring clearing etc.
Catchment Management Organisation	Have used water and salinity maps extensively to emphasise sustainability message especially in respect of National Action Plan for Salinity and Water Quality.
Land Management Officer	Used to generate generic descriptions of areas.
RDC representative	Development of a national strategy for NRM in the dairy industry Development of Regional Action Plans for the 8 dairy regions in Australia. Engagement of a political wing of the dairy industry into the NRM debate. These initiatives were made possible because of the improved access to and quality of data relating to resource management and the role/impact/attitudes of the dairy industry that were brought to the surface by the Audit.
Commonwealth Agency	Groundwater flow systems developed through Theme 2 are contributing to the understanding of salinity management -they are being picked up in the MDBC/NDSP tools project and will inform development of targets under the NAP.
State Agency	Continued support for land use information; EPA have adopted the estuary evaluation process.
Consultant	Policy work for MDB Ministerial Council using salinity and water outputs for general summary (although the actual data already existed in ABS Water Audit and ABARE/MDBC statistics).
RDC representative	Targeting R&D investment across GRDC regions; providing a snapshot; indicating to panel members linking commercial and environmental performance data.
Local Government (LG) representative	It may be too early to tell from a LG perspective. The level of LG involvement in the Audit has been relatively low to date given that it has been focused on a 'nation' picture. There is increasing interest in the Audit given the opportunities that could emerge from the

	development of the NAP and NHT extension. That is, Local Government's interest in the Audit will be primarily in the utility of the data in supporting LG's involvement in these programs. Until the role of LG in these programs is clarified and exposed to the material I believe that it is too early to talk about outcomes from a LG perspective. This should be in no way taken to mean that LG is not interested. On the contrary, LG is extremely interested in being engaged in the Audit and the programs.
State Agency	The forms of water use and allocation in the MDB.
State Agency	Policy development in relation to NAP use of data to support arguments for funding.
State Agency	Applied Theme 2 to our salinity program; use of Theme 5 data for further hazard assessment in the State.

There have also been other stimuli and contributions from the Audit that have allowed the development of other products such as the State of the Environment Report. Process outputs, such as improved communication between personnel in State Agencies, have also been produced by the Audit investment. A list of uses of the Audit's products and outputs is provided on pages 74-75 of the Audit's Final Report. A summary of these uses is provided here:

- The WA Water and Rivers Commission revised its surface water and groundwater data systems as part of the Australian Water Resources Assessment 2000 activities. The Commission has since produced a State-wide report and continues to build on the Audit activities by developing water resource information and monitoring systems to link with water and resource data.
- The technical framework for a hydro-geological assessment and identification of salinity management options developed as part of the Audit's Australian Dryland Salinity Assessment 2000 activities has now been refined at regional scales and adopted by the MDBC, several state agencies and catchment groups.
- The groundwater flow systems classification has been used as a basis for defining monitoring and evaluation guidelines for NHT2 and the NAP.
- The SA Dept of Environment and Heritage has adopted the NVIS database and mapping framework.
- Many universities recognise the Australian Natural Resources Atlas as a valuable information resource for graduate and postgraduate courses.
- Audit data was used as inputs to a model to calculate water quality targets for Great Barrier Reef catchments and identify priority catchments.
- Community groups such as the Fitzroy Basin Association and the Mackay-Whitsunday Water Quality Group are using the Audit data to help identify key sites and sub-catchments for erosion control activities.
- The MDBC used the results of the Assessment of River Condition as the primary source of data, methods and information for its publication "Snapshot of Murray-Darling Basin River Condition".
- As a result of the Audit, the CRC for Coastal Zone, Estuary and Waterway Management and lead State agencies have formed a consortium for Australia-wide estuary monitoring and management.

- The Western Australia Land Information System has adopted and adapted the MapMaker software developed for the Atlas, and the Queensland DNRM is doing likewise.

The Audit products and outputs will be valuable to both R&D and other programs (eg RDCs, NAP and NHT2). Examples of potential uses by these groups includes:

- Priority setting in regards to issues that need attention;
- Priority setting in regards to regions that need attention;
- For understanding of issues in general, including in some cases cause and effect; and
- For input to program evaluation and benefit-cost analysis.

In summary, it appears that Audit outputs and information are already being used by a wide group of users. Potentially the user group is substantially larger. It would be advisable for the ongoing Audit to assess the degree of, and constraints to, use and usefulness of Audit products in about one year's time. This would not only contribute to confirmation of the value of the Audit investment, but also assist the ongoing Audit in guidance regarding priorities and enhancing the results of the initial investment.

## **6. Imperatives in Future Audit Arrangements**

### **6.1 Introduction**

We recognise that the Government has made a financial commitment to an ongoing Audit and that decisions have been made about its structure. This chapter aims to consolidate comments on the operations of Audit 1, summarises what lessons have been learnt, and outlines some key principles and arrangements that are believed critical for the management of Audit activities in the future.

### **6.2 Lessons Learnt from Audit 1**

Despite some of our criticisms of the Audit's activities and reports our assessment is that the Audit has been very well managed. It has partially achieved its objectives bearing in mind the constraints of its resources, changes in focus part way through its program and the variable quality of data across the nation. While it may not have met the original time schedule, much of the variance from the schedule was outside the control of the management team, was unrealistic because of the size and complexity of the task and involved additional activities not planned for at the beginning of the program.

The Audit has demonstrated the value of different organisations working together across institutional barriers and the Audit team has put in place an excellent framework and protocols that should provide a firm basis for future operations. The recommendations and comments on the way forward, if fully implemented, will address our concerns about maintaining the value of the current investment and set the scene for future improvements.

Future funding of the Audit should be based on clear needs such as:

- The need for national co-ordination, quality assurance, integration and facilitation roles;
- The need to provide comparable information for improving the efficiency/ effectiveness of government intervention in natural resource management where market failure, statutory requirements, and externalities are present; and
- The maintenance of an Audit data management and monitoring function and the capability to repeat a comprehensive Audit.
- The need to support planning and decision making requirements at regional and catchment levels.

Given this focus, the important issues to focus on for the future are:

- Consulting with clients and stakeholders on work program priorities;
- Building support of the States and other data providers;
- Understanding the needs of regional groups, industry and the community;
- Communication with the above groups;

- Monitoring, assessing and reporting trend in condition of resources;
- Availability of quality socio-economic data and information on resource management practices;
- Independence of the Audit;
- Data quality;
- Efficiency of data collection across the nation; and
- Interaction with other national resource assessment and monitoring systems.

During the early phases of the Audit the evaluation team was concerned that the processes being undertaken were not building support from the States for adequate data sharing arrangements and protocols. However as the Theme Reports have reached draft and final stages some of these issues have come to a head and been resolved to some degree with the development of model agreements for data sharing between State and Commonwealth agencies. Support for an ongoing national activity has strengthened and clearer understandings developed about the need to provide nationally relevant information for:

- Policy assessment and development;
- Investment decisions;
- Evaluation of programs and policy performance; and
- Resource management.

Experience from the Audit has highlighted the need for arrangements that are clearly client focused and directed. This is fundamental to an effective program. The program must clearly identify its clients and their needs and frame its program around them.

We feel that greater national benefits and efficiencies may stem from arrangements that also support improved NRM decision-making in States, regions and catchments. Even if the client focus remains on Commonwealth and State/Territory policy makers, there is a need for more regular and formal interaction with these other clients. This would enable the Audit to respond to particular priority policy needs as they arise and broker the provision of necessary information that needs to be assembled and interpreted.

The needs analysis conducted by the Audit at the commencement provided useful information on priorities but some of these seem to have been lost in the early strategic planning. To avoid this, representatives of non-government interest groups should be built into the planning and evaluation processes of the Audit. The Theme working groups and Theme contacts played an important role in consultation with clients although these contacts were mainly with technical users.

It was not until late in the Audit's operations that effective links were made with industry, regional and community groups regarding their ongoing needs and views. To some extent the evaluation team through its surveys provided feedback on clients views on performance and relevance of the Audit's data and information. Rigorous surveys should be built into future Audit activities to assess performance and evaluate the ongoing needs of clients.

Funding allocations for client consultation, communication and training were low in the current Audit. Best practice demands significant investment in the early consultative stages of system development and greater investment in ongoing consultation, communication and training.

The States will continue to be the major data managers and suppliers of data and their investment in NRM data collection is huge. However they do not have a good record in (or systems for) making this data available to outside users. A key issue is to build on the Audit's achievements and ensure that data assembled for use in the States can also be used and accessed nationally and in regions on a cost-effective basis.

The Audit has achieved much through the development of model data sharing agreements and the goal of a fully distributed system Australia wide with data and information added from a wide range of NRM data and information programs. If resources were concentrated on priority regional level data, all three levels of decision making would be served. A critical issue will be setting priorities for data management and brokering funding arrangements between all levels of government. The Audit has been useful in identifying some of the priorities for future investment, but important decisions lie ahead regarding confirming and implementing these future directions.

A problem in establishing such approaches is that both Commonwealth and State agencies involved in collecting and managing NRM data have not been well coordinated in the past, even within their own jurisdictions. While the Audit has helped to improve this situation, coordination of effort is still a major need to improve the use of existing data systems.

Perhaps the biggest challenge in the establishment of any future arrangements will be maintaining the momentum of the Audit by achieving real commitment and ownership by the States. Without this any new arrangements will be sub-optimal. Some leadership in this could be provided by the Natural Resources Ministerial Council members as they oversight the huge investment in data collection and are major users of information.

Future arrangements must maintain professional independence of any Coordinating Unit and hence avoid directions being captured by interest groups. This will be essential if a future Audit is to hold the confidence of both its clients and stakeholders in the broader community. The management of any future Audit arrangements should be transparent and separated from the policy functions of government so that its data and information products are not seen to be influenced by particular policy positions.

### **6.3 Key Principles for Future Audit Arrangements**

The following outlines the preferred role for any ongoing Audit and some of the important principles for continuing activities. These are based on the successful activities of the Audit, national needs identified through the results of the Audit's activities and the surveys of users in 2000 and 2001.

## **Role**

*The role envisaged for any future arrangements is to improve the co-ordination and integration of strategic natural resource management data and information to assist in the ongoing use, management and assessment of the nation's natural resources.*

The aim should be to improve access to comparative data and information (national, State and regional data), promote more effective use of data in natural resource management decision making and add value to data both nationally and within States. Awareness of, and access to, up-to-date information and data that can be integrated across natural resources, and that is consistent and targeted to public and private natural resource management strategies are fundamental requirements for future sustainability. Such information is also essential to provide better prioritisation of future on-ground investments, particularly if they are more focused at a regional/catchment level.

The need for better-targeted investments is one of the key messages from the evaluations of the Natural Heritage Trust programs (see for example Howard Partners (1999) *“Review of the Administration of the Natural Heritage Trust”*). While the current Audit has identified priorities for future data and system needs that better target investment decisions down to a regional level, actioning these will need to be further negotiated with potential users and funding agencies.

Improved natural resource information is also needed for future policy development. However, the discussion paper, *Managing Natural Resources in Australia for a Sustainable Future* (AFFA 1999), contains a set of “principles to guide the way forward” that provide some clear pointers to future data and information needs.

Key themes in these principles are the need to determine policy and program priorities on an informed basis and the need for continuous improvement, recognising that natural resource management is complex and requires regular assessment and adjustment of particular management approaches. This implies measuring performance so that appropriate adjustments can be made.

## **Functions**

Against the background of the general role envisaged above and based on our experience with the Audit, we have identified a range of possible functions for future national arrangements. These are:

- Continued assessment of priority needs of clients for nationally relevant information, particularly policy/decision makers within Government and the community;
- Quality control for comparable national data sets and progressing standards and protocols for national data collection, access, analysis and display;
- Maintenance and continued development of partnerships between Commonwealth, States and Territories, community (particularly through Local Government) and industry concerning national data management systems;

- Maintenance and continued development of information systems such as the Australian Natural Resources Atlas and the Data Library;
- Integration across data sets to provide status and trends of natural resources and socio-economic information at the national, state, regional, landscape, catchment, estuary or waterway levels;
- Co-ordination and support for data providers, possibly through working cooperatively with national agencies that specialise in particular data areas;
- Improving national awareness and promoting use of information, data and reporting systems that assist in NRM, including program delivery and evaluation;
- The development of information products to meet client needs that involve more interaction with decision-makers and add value (the “resource accounting” approach identified in the final report is an example); and
- Continued development and application of monitoring and reporting systems that assist in NRM including program priority setting, delivery and evaluation.

Integration of data to produce status reports to monitor trends in priority natural resource management areas and identification of the cause and likely impacts of these changes should be key objectives of future arrangements

## **6.4 Future Arrangements**

Current planning in the Audit is to have national custodians for the fundamental data sets with these custodians having a special interest in ensuring that the data set is widely available to the community through the Australian Spatial Data Directory. These responsibilities have been shared in Audit 1 by both the coordinating unit and various Commonwealth agencies.

It can be argued that this may lower the cost of a coordinating unit, lead to ownership by the custodian and have value if there are no future arrangements in place. However the custodians could also capture the agenda, reduce the likelihood of integration, complicate negotiations with the States and jeopardise access to data.

Our view is that national custodians alone are not sufficient for any future Audit arrangements. They can not integrate efficiently as by definition they tend to be specialised and somebody has to balance across the overall effort. The arguments raised earlier support the case for an ongoing Audit with a “coordinating” Audit Management Unit. To be fully effective and efficient the details of the role, functions, funding and management arrangements should be negotiated with the State and Commonwealth agency custodians and long-term agreements developed.

If national custodians are used, the coordinating unit would still need to focus on integrating across data sets, setting priorities for improving existing data sets and new data set initiatives, producing integrated products, and identifying users’ information needs. This last function is indeed one that has been originally specified for a national custodian, so there could be potential overlap between the coordinating unit and the

national custodian, unless roles are clearly identified and the governing body monitors this aspect. This also recognises that any Audit arrangement should be based on a distributed system of data with collections embedded in the structure of individual provider's data arrangements.

## **6.5 Communicating Audit Messages**

The Audit assessments contain some significant messages that will change some current perceptions about the state of Australia's natural resources (eg the new understanding of groundwater flows and the new information on sediment and nutrient transport). While the principal target for the Audit's products were State and Commonwealth decision makers, many of these messages also have major implications for future management in individual rural industries and for future R&D directions. The Audit products provide a good platform for delivering these messages, but there are several other ways in which to optimise their communication. These could include:

- Developing methods for packaging relevant Audit information in a way that allows it to be incorporated into industry delivery vehicles such as PROGRAZE; and
- The Minister for Agriculture, Fisheries and Forestry could draw the attention of such bodies as industry associations and rural Research and Development Corporations to the relevant messages and request that they are taken into account in future strategic planning.

## **7. Conclusions**

### **General**

1. The investment in the Audit was sound judged by the products, the outputs produced and the outcomes observed to date. Overall, the investment provided very good value for money.
2. It is expected that the development of national standards and protocols, greater comparability of data sets and the improved availability of information will be the major achievements of the Audit. The development of a range of new NRM information products targeted to decision-making needs is leading to improved outcomes for NRM.

### **Objectives and Role**

3. In general all of the six objectives of the Audit have been at least partially met.
4. For what the Audit tried to achieve, it was under-resourced and its objectives were over-ambitious for the time period, complexity of the tasks and budget. The Audit could have been even more effective if it had been focused on a more specific role.

### **Information Provided**

5. The Audit has been successful in drawing on a wide range of existing data and has reworked it into comparable national data sets and products.
6. The Audit has established new standards for providing cost effective access to NRM data and information that has previously been difficult to access. This has led to positive changes in attitudes across the States and will encourage greater use of data and information by resource managers who in the past have not had easy access to State data bases.
7. Information about cause and effect, trends over time, and the 'condition' of some natural resources has proved difficult to provide, largely due to existing data inadequacies and different perceptions regarding condition.
8. Information on management practices, important in understanding causal effects and impacts and leading to appropriate remedial activities was scarce. This was understandably not a principal focus of the Audit but where information was assembled (eg. the dairy industry) its value is already being demonstrated. It is hoped that other primary industries will initiate similar strategy development and activities as this will be important in developing and monitoring the performance of Best Management Practices.

9. Availability, accessibility and relevance of the data provided are generally good, but less confidence is held in the capacity for integration, repeatability and accuracy of the information due mainly to its different sources and methods of collection /estimation. This should improve over time.
10. Integration of data across Themes was generally weaker than integration within Themes. This is particularly relevant for future monitoring systems that might evolve and become established from the existing Theme initiatives. The future framework for monitoring needs to be integrated to provide the maximum benefits for natural resource decision-making.
11. The ‘ User Guide’ for the Atlas and Data Library is a welcome and useful directory for using these key Audit products. However, it is still apparent that some form of training for using the Atlas and Data Library will be required to maximise their use and effectiveness. The use of “train the trainer” programs could be cost effective.

## **Management**

12. The current Audit would have benefited from a better designed program plan and an integration model that was linked to decision making needs and that recognised the critical pathways needed to provide the integrated outputs and outcomes.
13. Permanent Steering Committees should have been established for each Theme and representatives should have been drawn from a wider cross section of NRM interests, with a strong representation from users.
14. An independent mid-term review of each Theme may have been beneficial in order to refocus the highest priority Theme outputs.
15. Consultation and communication with interested users outside of the Commonwealth and State agencies varied with those engaged in projects and in some cases peak bodies being involved in regular communication activities. More general consultation with industry, and regional and community groups would have been beneficial in building support and knowledge.
16. The Audit has made a significant start in team building and leadership of a nation-wide approach to natural resource data management and monitoring. However, improvements in processes, institutional arrangements, and change in cultures are still required. Based on some of the activities over the past year it is evident that some steps in these directions are already being undertaken.

## **Constraints**

17. Jurisdictional factors inhibit the efficiency and continuity of a comparable national data assembly program for natural resources. This particularly applies to coordination of effort between Departments and Agencies within both Commonwealth and State governments. This has been an endemic problem in the past and the Audit has provided some directions for addressing these issues.

## **The Audit Final Report**

18. The Audit's Final Report 'Australia's Natural Resources 1997-2002 and Beyond' is well written and is of an appropriate length and content for reporting on such a long-term and expansive project as the Audit.
19. It may have been useful for the report to summarise in the one place the various categories of outputs, the most significant products and achievements of the Audit, and some of the key issues that arose.
20. All of the recommendations contained within the report are considered appropriate and are supported by the evaluation team. The final recommendation regarding independence is particularly important to observe, otherwise the ongoing Audit may not encourage integration and service NRM decision making at all levels.

## **The Future**

21. It will be necessary to continue to support an Audit coordinating unit to lead future activities, to ensure independence, to develop priorities, and identify users' information needs.
22. Some of the other key principles and activities to guide effective Audit operations in the future include:
  - Consulting with clients and stakeholders on work program priorities;
  - Building support of the states and other data providers;
  - Understanding the needs of and communicating with regional groups, industry and the community;
  - Assessing and reporting trend in condition of resources;
  - Ensuring information is available on resource management practices;
  - Ensuring independence and data quality;
  - Interacting with other national resource assessment and monitoring systems;
  - Implementing the "resource accounting" process outlined in some case studies; and
  - Ensuring that data is assembled that address issues of greatest importance to the Australian economy and to Australian society

## REFERENCES

Chudleigh, P., Byrne, T. Dawson, N. and Simpson, S. 2000, *Monitoring and Evaluation of the National Land and Water Resources Audit: Progress Report 3*, Agtrans Research, Brisbane.

Chudleigh, P., Byrne, T. Dawson, N. and Simpson, S. 2001, *Monitoring and Evaluation of the National Land and Water Resources Audit: Progress Report 6*, Agtrans Research, Brisbane.

National Land and Water Resources Audit (NLWRA) 2000, *Landscape health in Australia – a rapid assessment of the relative condition of Australia’s bioregions and subregions*, National Land and Water Resources Audit, Canberra.

National Land and Water Resources Audit (NLWRA) 2001a, *Australian Water Resources Assessment 2000*, National Land and Water Resources Audit, Canberra.

National Land and Water Resources Audit (NLWRA) 2001b, *Australian Dryland Salinity Assessment*, National Land and Water Resources Audit, Canberra.

National Land and Water Resources Audit (NLWRA) 2001c, *Australian Native Vegetation Assessment 2001*, National Land and Water Resources Audit, Canberra.

National Land and Water Resources Audit (NLWRA) 2001d, *Rangelands – Tracking Changes – Australian Collaborative Rangeland Information System*, National Land and Water Resources Audit, Canberra.

National Land and Water Resources Audit (NLWRA) 2001e, *Australian Agriculture Assessment 2001*, National Land and Water Resources Audit, Canberra. (Volumes 1 and 2)

National Land and Water Resources Audit (NLWRA) 2002a, *Australians and Natural Resource Management 2002*, National Land and Water Resources Audit, Canberra.

National Land and Water Resources Audit (NLWRA) 2002b, *Australian Catchment, River and Estuary Assessment 2002*, National Land and Water Resources Audit, Canberra. (Volumes 1 and 2)

National Land and Water Resources Audit (NLWRA) 2002c, *Australian Terrestrial Biodiversity Assessment 2002*, National Land and Water Resources Audit, Canberra.

National Land and Water Resources Audit (NLWRA) 2002d, *Australian Natural Resources Information 2002*, National Land and Water Resources Audit, Canberra.

National Land and Water Resources Audit (NLWRA) 2002e, *User Guide – Australian Natural Resources Atlas and Data Library*, National Land and Water Resources Audit, Canberra

National Land and Water Resources Audit (NLWRA) 2002f *Australia’s Natural Resources 1997-2002 and Beyond*, National Land and Water Resources Audit, Canberra.