

# Data Collection for Environmental Monitoring of the Agriculture Industry

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**ABSTRACT:** Australia faces a number of environmental issues, many of which have emanated from agricultural activity and land management practices. In the last decade, problems associated with limited water resources, the fragility of soils and land degradation, and loss of biodiversity have prompted governments at all levels to develop specific programs to address these issues.

The ABS has been collecting data on a range of environmental issues over a number of years. Until the early 1990s, these were collected in response to specific localised problems. Since then, the ABS and the large number of government agencies charged with the responsibility for developing indicators of sustainable agriculture have used the ABS agricultural collections to obtain data necessary to develop and monitor those indicators. However, the lack of coordination of the requirements of these agencies has resulted in a set of data which is at times inconsistent, with the specific requirements of some agencies remaining unmet.

The ABS has experienced several difficulties in the development, collection, processing and dissemination of the data collected. These have included question development, data validation and provider reaction. However, a considerable amount of experience has been accumulated during the past 7 years that has proved to be invaluable in the development of questions on environmental issues.

## 1. Introduction

### *1.1 Australia's Natural Environment*

The Australian continent is a land mass covering 7,682,300 square kilometres. Australia is the smallest, lowest and flattest continent, with a mean elevation just exceeding 200 metres [ABS 4601.0].

Australia is known as the "dry continent". Its climate is characterised as having dry air, low rainfall and plentiful sunshine, with temperatures that are generally high in comparison with other land masses of similar latitudes. Rainfall in Australia is highly variable and strongly seasonal. Most of Australia's land is classified as arid or semi-arid. Hot summers accompanied by an abundance of sunlight result in high rates of evaporation. Consequently, Australia has a runoff (i.e. rainfall that is yielded as stream flow and ground water) of 12 percent. These conditions render water a precious resource in Australia.

Australia's climate variability results in part from being in close proximity to the centre of action of the Southern Oscillation. With an unpredictable cycle ranging from 2 to 7 years, the Southern Oscillation is a large disturbance in the circulation of the atmosphere over Australia and the eastern Pacific, and is closely linked to the phenomenon, El Niño, the occasional and quite remarkable warming of the surface waters of the central and eastern Pacific Ocean. At one extreme of the cycle, when the west Pacific Ocean is less warm than usual and the atmospheric pressure over Australia is relatively high, the El Niño - Southern Oscillation (ENSO) causes drought conditions over eastern Australia because there is less moisture available in the atmosphere. At the other extreme, ENSO is associated with more frequent tropical cyclones and floods in the Australian region.

Soil resources in Australia, when compared with those of much of Europe and North America, are relatively fragile and susceptible to erosion, structure and nutrient decline, salinisation, sodification and acidification. Australian soils are geologically very old and relatively infertile. That is, they are generally low in nutrients like nitrogen and phosphorus.

The unpredictable nature of Australia's climate and its generally poor soils makes management of the land resources and associated agricultural industries difficult.

### *1.2 The Importance of the Agricultural Industry*

Agriculture has traditionally played a significant role in the Australian economy and society. In 1995-96, gross farm product was 3.4 percent of GDP, agricultural exports represented 10 percent of the total value of Australia's merchandise exports, and the agricultural sector employed 5 percent of the labour force. Transformation of agricultural products, including food and fibre, is also an important component of Australia's manufacturing industry.

As the economy has expanded and become increasingly diverse, agriculture's direct contribution, as a percentage of GDP and employment, has fallen (from 16.1 percent of GDP in 1951-52). Nevertheless, it remains a vital and thriving sector and is particularly significant in export terms. Australian agriculture occupies an important place in global trade with wool, beef, wheat and sugar being particularly important in terms of volume. Australia is also a significant source of dairy produce, fruit, cotton, rice and flowers.

Agriculture relies heavily on the natural resource base. It is Australia's most extensive form of land use and also the largest sectoral user of water. Approximately 60 percent of Australia's land is used for agricultural purposes and over 70 percent of Australia's stored water (including ground water) is consumed by the agriculture sector [ABS 4601.0].

Agriculture also has a significant impact on the environment. Over the last 200 years of European settlement agriculture has transformed the landscape. Large areas of Australia's forest and woodland vegetation systems have been cleared. The areas that have been altered most are those which have been opened up to cultivation or intensive grazing. This transformation has had important implications for surrounding natural ecosystems, including problems such as land degradation and the deterioration of water quality.

The economic and social importance of agriculture coupled with the sector's dependence and impact on the environment highlight the need to recognise the linkages between each of these elements in shaping the agricultural process in Australia.

### *1.3 Sustainability and the Agricultural Industry*

In 1991, the issue of sustainability in the agricultural industry in Australia was recognised with the former Ministerial Standing Committee on Agriculture (SCA) defining the concept of sustainable agriculture as "the use of farming practices and systems which maintain or enhance: the economic viability of agricultural production; the natural resource base; and other ecosystems which are influenced by agricultural activities." [SCA 1991]

Along with productivity and social benefits derived from agriculture, issues associated with the impacts on the natural resource base were also identified as influencing the sustainability of agriculture.

Specifically, five guiding principles were developed to judge sustainability in the agricultural industry [SCA 1991], these being:

1. farm productivity is sustained or enhanced over the long term;
2. adverse impacts on the natural resource base of agricultural and associated ecosystems are ameliorated, minimised or avoided;
3. residues resulting from the use of chemicals in agriculture are minimised;
4. the net social benefit derived from agriculture is maximised; and
5. farming systems are sufficiently flexible to manage risks associated with the vagaries of climate and markets.

Identification of these principles has raised awareness of the impact agricultural activities have on the quality of Australia's land and water environments, such that the development of sustainability indicators includes a focus on these impacts. To assist in the overall assessment of the sustainability of this industry, certain environmental indicators have been identified as important to measure over time. These are discussed later in the paper.

## **2. Environmental Issues and the Agriculture Industry in Australia**

### *2.1 Land Degradation*

Australian soils are naturally susceptible to various forms of land degradation. Human land use and practices have further contributed to these processes. Land degradation may result from, among other things, overgrazing, excessive tillage, vegetation clearance, urbanisation and waste disposal. In the 1992-93 Agricultural Census, farmers estimated that over 16 million hectares (about 3 percent) of agricultural land were affected by land degradation.

The principal forms of land degradation suffered in Australia are:

- water erosion, which is the most widespread form of land degradation;
- wind erosion, which affects land to a much lesser extent than does water erosion;
- soil acidification;
- salinisation, which is widespread; and
- soil structure decline, which is second in prevalence to water erosion.

### *2.2 Water and Water Quality*

The term "water quality" encompasses a range of characteristics concerned with the physical and chemical properties of materials dissolved or suspended in water. These can include gases, heavy metals, organic materials and pesticides. Agricultural processes can impact on water quality. The major issues associated with agriculture and the quality of surface water in Australia are river regulation, river turbidity, river salinity, and nutrient loads. The major impact associated with over-exploitation of groundwater is the intrusion of saltwater into previously good quality aquifers.

### 2.3 Loss of Biodiversity

Biodiversity is the variety of all life forms — the different plants, animals and micro-organisms, the genes that they contain and the ecosystems of which they form part [Wilson 1992]. Natural conditions around the Australian continent vary greatly and this is reflected in the diversity of ecosystems that exist. Australia is recognised as one of 12 “megadiverse” countries alongside Indonesia, Brazil, Mexico and Madagascar. It supports approximately 10 percent of the world’s species and most of Australian species are endemic, that is, they are found nowhere else in the world. Australia is thought to be home to more than a million species of plants, animals and micro-organisms, although less than 15 percent have been formally described.

Since European settlement 200 years ago, over 140 plant and animal species have become extinct. Vegetation clearance and modification associated with agricultural land use, as well as urban land use, have severely impacted on native habitats and have been linked to many of these losses of biodiversity. As well, 40 percent of forests and 35 percent of woodlands have been lost due to land clearing. In some wheat growing areas, for example, less than 10 percent of the original area covered in native vegetation remains [State of the Environment Advisory Council 1996].

### 2.4 Atmosphere

The main issue involving agriculture with relation to the atmosphere is the emission of greenhouse gases. The principal greenhouse gases released from the sector are methane, nitrous oxide and carbon dioxide. While the size of sources and sinks relating to Australian agricultural systems is yet to be fully resolved [Ecologically Sustainable Development Working Groups 1991], the first National Greenhouse Gas Inventory identified that agricultural land clearing could be contributing as much as a quarter of Australia’s total greenhouse gas emissions. Agriculture is also the largest emitter of methane, where it is primarily produced as a by-product of livestock digesting feed. Other greenhouse gases are also emitted by the practice of controlled burning of grasslands.

## 3. Australian Government Policies and Programs

Over the past decade, Australia has developed a clear policy direction with regard to the use of its natural assets. The *National Strategy for Ecologically Sustainable Development* [Council of Australian Governments 1992] is a key overview document in this regard. The “ecologically sustainable development” (ESD) strategy is designed to bring about changes to patterns of resource use, including improvements in the quality of air, land and water, and in the development of new, environmentally friendly products and processes. This strategy also called for regular national state of the environment reporting. The 1996 State of the Environment Report [State of the Environment Advisory Council 1996] forms the first stage of a continuing and independent assessment of the condition of Australia’s performance in meeting internal commitments (e.g. Strategy for the Conservation of Biological Diversity, and the Framework for Climate Change). The development of a nationally agreed upon set of indicators is the next stage in the state of the environment reporting process. Studies on environmental indicators of land [Hamblin 1988], estuaries and the sea [Ward 1998], inland waters [Fairweather and Napier 1998], biodiversity [Saunders, Margules and Hill 1998] and atmosphere [Manton 1998] have been commissioned by Environment Australia to provide a key set of indicators for each of these themes.

Other national strategies important for the agriculture industry include the National Strategy for the Conservation of Australia's Biological Diversity, the National Greenhouse Strategy and the National Strategy for Rangeland Management.

The Australian Bureau of Statistics (ABS), as Australia's official statistical agency, provides statistical support to Federal and State Governments while maintaining its independence from the policymaking organisations within those Governments. Specifically to assist the development of indicators for sustainable agriculture, agricultural collections have included questions related to environmental issues since the early 1990s.

The Agricultural and Resource Management Council of Australia and New Zealand through the Standing Committee on Agriculture and Resource Management (SCARM) has, since 1991, overseen sequential projects to develop indicators for sustainable agriculture. SCARM comprises the heads of the Federal Department of Primary Industries and Energy (DPIE) and each State Government department of agriculture. The State Governments have primary responsibility for the development and implementation of policy in the field of agriculture, including environmental policy as it impacts each State.

SCARM, through the National Collaborative Project on Indicators for Sustainable Agriculture (NCPISA), has developed a draft set of indicators which may be used in assessing implementation of the sustainable practice in Australian agriculture at broad regional and national levels. Indicators have been developed as a composite set of measures or attributes which embody a particular aspect of agriculture, with the attributes preferably being numerical descriptions of individual parameters. The key indicators selected and their attributes are:

- *Long-term Real Net Farm Income* — real net farm income, total factor productivity, farmers' terms of trade, debt servicing ratio;
- *Land-Water Quality to Sustain Production* — water utilisation by vegetation, nutrient balance of farm, rangeland vegetation condition, agricultural plant species diversification;
- *Managerial Skills* — level of farmer education, extent of participation in training and landcare, implementation of sustainable practices;
- *Off-site Environmental Impacts* — chemical contamination level, dust storm frequency, impact of agriculture on native vegetation; and
- *Off-site Social* — trends in annual rate of population change, trends in level of workforce unemployment, age structure of agricultural workforce.

The role of the NCPISA includes specifying and negotiating for the collection of farm survey data needed to compile the agreed upon indicators, further developing the attributes and compiling a "report card" about the sustainability of agriculture in Australia. The first report card is expected to be available shortly. It is expected that there will be further development and refinement of the draft indicators and their attributes when this report is considered.

The ABS has actively participated in NCPISA. The Agricultural Census of 1995-96 included a range of questions specifically intended for the project. Questions were asked on the maintenance and management of established pastures, disposal methods of crop and pasture stubble, cultivations for broadacre crops, irrigation scheduling, soil conditioner usage, total area of trees and shrubs planted or sown on cleared agricultural land, and fencing for grazing management.

The earlier Standing Committee on Agriculture Working Group on Agriculture [SCA 1991] was involved in the development of a regional framework that reflected physiographic regions for Australia. This resulted in the definition of a set of 46 agro-ecological regions based on common agricultural practices within relatively homogeneous regions as regards climate and geography. A simplified version of this regionalisation was then developed for the Commonwealth Government's Ecological Sustainable Development Strategy. This divides Australia into eleven larger agro-ecological regions. These regions formed the basis of the work undertaken by NCPISA.

#### **4. ABS Collection of Environmental Data**

##### *4.1 Type and Range of Data Collected*

The ABS has traditionally conducted two main annual data collections covering the agriculture sector: the Agricultural Census and the Agricultural Finance Survey (AFS). These two collections have provided comprehensive coverage of the production and financial aspects of Australian agriculture.

Principally due to budgetary constraints, users of environmental data have increasingly been required to provide funding to the ABS to collect environmental data. This has applied to both the annual Census and the AFS. Although the cost of collecting data can be quite high, accessibility to and affordability of the results has generally not been a problem for the majority of users of the data.

##### *4.1.1 Agricultural Census*

Data relating to some of the environmental issues outlined in Section 2 have been collected in the Agricultural Census on an irregular basis since the early 1980s. Specific issues for which data have been collected include land clearing and soil salinity. However, these data were collected in response to concerns within individual States of Australia rather than on a coordinated basis for the whole of Australia, and their usefulness is therefore limited.

For many years, the Census has been used to collect a range of information about:

- area of pasture and crops irrigated, method of application, and source of water;
- artificial fertilisers, (area fertilised, quantities applied and type of fertiliser used);
- use of insecticides, herbicides and fungicides; and
- soil conditioners (lime, gypsum and dolomite).

While data on fertiliser usage and area irrigated have been collected annually, the dissections have varied from year to year. The use of insecticides, etc., and soil conditioners has been collected irregularly and not necessarily on a consistent basis. Thus, longitudinal analysis of the data has not always been possible for these topics.

Since the 1991-92 Agricultural Census, detailed environmental questions have been included on a national basis each year. Much of the impetus for this came initially from the establishment of an Environment Statistics Unit (ESU) within the ABS in the late 1980s. The ESU and the Agriculture Program have worked closely with the major Federal authorities (DPIE and the Department of Environment) to develop questions which have provided data to support the development of indicators.

The following list indicates topics which have been included in Agricultural Censuses since 1991-92, and which are likely to be included at appropriate intervals in future.

Land degradation:

- area of degraded land, as perceived by the farmer

Water usage/water quality:

- river or creek frontage on the holding and the length protected from grazing animals
- irrigation of crops, pastures, including quantity of water used
- irrigation scheduling/methods

Biodiversity:

- area of native vegetation protected from domesticated animals

Land management practices:

- source of farmer's information about sustainable land use
- use of fertilisers and soil conditioners
- use of pesticides, herbicides and fungicides
- fencing for grazing management
- tillage/cultivation methods
- organic farming, particularly whether the producer has been certified by an approved organisation
- planting of trees, whether from seedling or seed, and main reasons for planting
- harvesting of timber for wood/pulp production
- disposal of crop stubble

Additionally, indicators of sustainable land use can be derived using "non-environmental" data collected annually in the Census. These include stocking rates and crop yields.

Many of these topics have been covered on an on-off basis, and those which have been covered in more than one Census have been changed from year to year. This makes inter-year comparisons and longitudinal analysis very difficult. A further complication has been the requirements of the various State Government agencies involved with the monitoring of environmental issues, most of which are quite different from those of the Federal agencies.

Information collected has been published in *Australian Agriculture and the Environment* [ABS 4606.0]. Such sectoral publications are also compiled by other countries and international agencies such as the Organisation for Economic Cooperation and Development (OECD) [OECD 1997]. The data in these publications show the relationship between particular sectors and the natural environment in greater depth and detail than is possible in general environment statistics compendia such as *Australia's Environment: Issues and Facts* [ABS 4140.0], and *Australians and the Environment* [ABS 4601.0], both produced by the ABS in recent years.

A distinct advantage of the Census as a collection vehicle is the availability of results at small geographic levels. The move to a sample survey approach to the collection of commodity and environmental data will result in a loss of detail at finer geographic levels. As many users of the data

focus on relatively small geographic areas, the inability of the ABS to provide detailed data at those levels, 4 years out of 5, will cause significant problems for many of these users.

#### *4.1.2 Agricultural Finance Survey (AFS)*

The AFS is an annual survey which covers all economic units classified to subdivision 01-Agriculture of the Australian and New Zealand Standard Industrial Classification (ANZSIC) based on their principal activity. It had an estimated value of agricultural operations of A\$22,500 or more. The prime objective of the AFS is to collect and publish financial statistics for individual agricultural industries, and for the agricultural sector of the economy as a whole, on a basis similar to other economic collections undertaken by the ABS.

Since the 1991-92 financial year, a section has been included in the AFS which enables measurement of farmers' expenditures on a range of land management initiatives. Topics covered since 1992 include:

- use of, and expenditure on, a farm management plan;
- expenses for self education relating to land care issues;
- membership of landcare groups;
- total area established with trees and shrubs primarily to control or prevent land degradation;
- educational qualifications of people involved with farm management;
- expenditure on the eradication of plant growth, animals or insects affecting sustainable land use;
- expenditure on waste water management;
- expenditure on the removal/disposal of hazardous and non hazardous wastes; and
- expenditure on the control/prevention of land degradation, protection of waterways from contamination, protection of native plants, animals and habitats.

The AFS is a suitable vehicle for collecting data relating to expenditure on environmental issues and the more complex topics as the majority of data are collected via personal interview. The major drawback is the lack of small area data as the sample is not sufficiently large to produce estimates at this level.

The results from this collection activity are published in *Environment Protection Expenditure Australia* [ABS 4603.0]. Three editions (1990-91, 1991-92 and combined 1992-93 and 1993-94) have been released to date, with compilation work underway to produce the next publication covering the 1994-95 and 1995-96 financial years.

Environmental protection expenditure statistics are collected for manufacturing, mining, utilities and service industries as well as for agriculture. These expenditure accounts are one aspect of the environmental and natural resource accounts being developed by the ABS, and to be linked to the national accounts.

#### *4.2 Issues in Data Collection*

The inclusion of environmental questions in the Census and AFS has not been without considerable difficulties. Major problems have included question specification and development, conceptual and definitional inconsistencies and the impact upon and reaction of providers of data. At times, providers



have had difficulty interpreting questions and providing data on the bases required. Additionally, the sensitivity of some of the issues covered has caused some difficulties with some groups of providers and resulted in loss of quality of data.

#### *4.2.1 Question Development*

The development of questions and questionnaires within the ABS generally follows a four-step process:

1. specification of requirements by users (internal/external),
2. consultation with broader user community concerning the topics specified,
3. development of test question schedule and testing program involving a sample of respondents, and
4. finalisation of questionnaire.

Although most users are operating within the same broad frameworks, the varying requirements of the data have caused difficulties in the specification and design of questions. It is not always possible to design questions to provide data which are of use to all potential users of those data. Exacerbating the problem has been a (short) history of developing questions and collecting data in parallel with the development of indicators for which the data are required. This has necessitated several attempts at developing questions which provide information of acceptable quality and meet the specific requirements of organisations charged with the responsibility of assessing performance against the criteria as set out in indicators.

Testing programs can also prove inadequate in resolving all issues identified during the specification and initial phases, and may also fail to reveal problems encountered in the operational phase of the collection. For example, it is sometimes not possible to select a completely representative sample for testing purposes given the lack of knowledge about the behaviour of the population in relation to many of the topics being covered. Hence, it is sometimes the case that difficulties with specific questions are not fully understood until questionnaires are in the field and responses are received. From this perspective, there has been an element of experimentation in the development of questions. The continued inclusion of questions, refined to take account of the experience gained, results in data of good quality.

#### *4.2.2 Standard Concepts and Definitions*

The ABS is one of several agencies collecting data related to the environment. In this context, an important requirement identified by the Commonwealth Industry Commission Inquiry into Ecologically Sustainable Land Management [1997] is the development of standard classifications and definitions covering a wide range of the data collected by these agencies. Criticisms presented to the Inquiry, and in other forums, have included a lack of detail sufficient to take management decisions at regional or local levels and a lack of comparability and uniformity of data. These have resulted in gaps in data collection. Although these criticisms have been directed at all organisations collecting and disseminating data relating to environmental issues, they are specifically relevant to the data collected by the ABS because the ABS is attempting to satisfy a wider range of users. As a consequence and in recognition of the role of the ABS, the Inquiry has recommended that the ABS be responsible for the development of standard classifications and consistent measurement protocols for the collection of state of the environment data.

### 4.2.3 *Data Validation*

Validation or editing of data collected on an irregular basis presents specific problems which ultimately affect data quality. There are several specific problems which have to be considered:

- historical data comparisons are not possible for most data collected either because the data have not been collected previously or the questions vary from the previous collection;
- for some topics of a qualitative nature, there is a range of plausible responses;
- defining and testing logical relationships with other data reported can be difficult; and
- regional differences in terminology and patterns of operation can result in inconsistencies in data reported.

Because of these difficulties, the validation of environmental data can often be more resource-consuming than other data on the collection forms.

As previously mentioned, the AFS has proved to be a more effective vehicle for collecting some of the more complex data requirements, particularly those of a financial nature, because the majority of selections are subject to a personal interview. A trained interviewer will be more likely to elicit the information required as the concepts and definitions will have been covered in training, and manuals are more detailed in providing background explanations than can be provided on mail questionnaires. In addition, interviewers will generally have access to the detailed accounts of farm businesses and will be able to extract the information required.

The principal problems with the collection of data on mail-based questionnaires are ensuring the question wording is not ambiguous, the terminology is easily understood and the provider will actually read the questions.

### 4.2.4 *Provider Load/Reaction*

It is our experience that providers are generally quite willing to provide the information required as long as the questionnaires are non-controversial, they are aware in advance which data they will be required to provide, and there is a clear understanding of the reasons for collection of those data.

In order to assess if a question or set of questions is likely to be controversial or elicit a negative response from providers, the ABS regularly consults with the industry organisations at the Federal and State level. Generally, these types of questions are not included in ABS questionnaires.

While it is highly desirable to give providers advance notice of the intention to collect specific data, given the nature of the development of questions in both collections, this has rarely been possible. Similarly, provision of detailed explanations of the reasons for collecting the data is a difficult area as it increases the amount of material to be provided to farmers and there is little guarantee that they will read and digest that material and respond accordingly.

## **5. Planned Developments in the Collection of Environmental Data**

It is expected that the continued development of indicators resulting from such studies as NCPISA and others mentioned earlier will ensure that the ABS agricultural collections will continue to be used to

collect environmental data. However, there are several other developments which will also generate environmental data requirements. These are briefly described below.

### *5.1 Geocoding of Agricultural Establishments*

The ABS, in association with the Bureau of Resource Sciences (a Division within DPIE), is currently developing a proposal aimed at value-adding the information collected through the Agricultural Census by geocoding individual farms to enable the production of lower level survey data and the mapping of land use and land management practices data. At the time of writing, several decisions, including the funding of the work, have yet to be made so its future is somewhat uncertain.

### *5.2 Environmental and Natural Resource Accounting*

The requirement for environmental accounting has been expressed in the National Strategy for Ecologically Sustainable Development [Council of Australian Governments 1992] and Agenda 21 from the Rio Conference 1992. The ABS is developing a system of environmental accounts for some of Australia's natural resources and will link these to the national accounts. The proposed system will account for depletion of natural resources, expenditure on environmental protection and repair, and degradation of the environment.

Over the four year planning period from 1995-96 to 1998-99, the ABS is undertaking a program of work designed to:

- provide estimates of environmental protection expenditures,
- develop resource, materials and waste/emissions accounts,
- publish monetary estimates of natural assets which provide economic benefits, and
- assess valuation methodologies for environmental degradation.

Many aspects of this work will relate to agriculture, including physical resource accounts concerning livestock, land and water, as well as the expenditures on environmental protection. Physical accounts showing the stocks and major flows are being developed for water, land use and land coverage. Such accounts enable the assessment of changes in the quantity and quality of our environmental assets due to natural increase/depletion through use, degradation or destruction.

### *5.3 National Land and Water Resources Audit*

The Commonwealth Government policy documents *Sustainable Agriculture* and *Saving Our Natural Heritage* include a commitment to conduct a National Land and Water Resources Audit at a cost of about A\$32 million over five years. The Audit is expected to be the first coordinated and comprehensive audit of Australia's land and water resources and their rates of degradation on a national scale. In particular, the Audit's data set will combine economic value, production and resource data sets into a single coherent structure. Both the SCARM and the Standing Committee on Conservation will participate in the initiative and facilitate its implementation. Strong linkages will exist between the Audit, SCARM indicators, State of the Environment Reporting and indicators development, and ABS activity.

#### 5.4 Natural Heritage Trust

The Natural Heritage Trust (NHT) is an approximately A\$1 billion trust set up to address a wide range of environmental problems. The NHT will fund 18 major projects over the next five years, covering such areas as vegetation, river health, weed control, endangered species, farm forestry, feral animal control, waste management, air pollution, wetlands and World Heritage.

About A\$280 million from the NHT will be directed towards the National Landcare Program (NLP) administered by the Department of Primary Industries and Energy. The NLP places emphasis on helping more than 3200 community groups. Priorities for this program include improving the capacity for communities and individuals to manage land, water and vegetation in a sustainable, self-reliant manner to boost economic efficiency and make regions and industries more environmentally sustainable. The community-based groups tackle local environmental problems using results of research commissioned by bodies such as Rural Industries Research and Development Corporation (RIRDC) and the Land and Water Resources Research and Development Corporation (LWRRDC).

#### 6. Conclusion

The formulation of the strategies and the development of indicators of sustainable agriculture described earlier in the paper has resulted in the development of a much wider range of specific requirements, covering the whole of Australia since the early 1990s. Organisations at both the Federal and State levels involved in policy development and land care management and monitoring have been, in recent times, required to more clearly articulate their requirements for data within more rigorous frameworks than in the past. This has resulted in some questions being modified and new questions developed to collect data in a more useful form. However, there is still a considerable way to go before there is a fully coordinated approach to the development of a long-term plan to define and collect data for environmental monitoring.

From a data collection, processing and dissemination perspective, the coordinated approach is essential if a fully coherent and consistent data set of acceptable quality is to be made available for decision-making. Of specific concern is the development of standard concepts and definitions and the development of a long-term plan for data collection so that questions and questionnaires can be properly developed and providers can be made aware of the data which they will be expected to provide.

Notwithstanding these problems and issues, the data collected to-date have been used extensively by government and industry organisations in the development of policy relating to sustainable agriculture and the development of indicators of sustainability. It is expected that the type and range of data required will expand considerably over the next decade.

#### References

- Commonwealth Industry Commission (1997), *A Full Repairing Lease: Inquiry into Ecologically Sustainable Land Management*, September 1997 Draft Report.
- Council of Australian Governments (1992), *National Strategy for Ecologically Sustainable Development*, Canberra: AGPS.
- Ecologically Sustainable Development Working Groups (1991), *Ecologically Sustainable Development Working Groups, Final Report - Agriculture*, Canberra: AGPS.

Fairweather, P. and Napier, G. (1998), *A Recommended Set of National State of the Environment Indicators for Inland Waters*, Report to Environment Australia, Canberra.

Hamblin, A. (1998), *A Recommended Set of National State of Environment Indicators for Land*, Report to Environment Australia, Canberra.

Hill, R. (1996), Statement by Senator the Honourable Robert Hill, Minister for the Environment, 20 August 1996 in *Investigating our Natural Heritage*, Canberra: AGPS.

Manton, M. and Jasper, D. (1998), *A Recommended Set of National State of the Environment Indicators for Atmosphere*, Report to Environment Australia, Canberra.

OECD (1997), *Joint Working Party of the Committee for Agriculture and the Environment Policy Committee - Agri-environmental Indicators: Stocktaking Report*.

Saunders, D., Margules, C. and Hill, B. (1998), *A Recommended Set of National State of the Environment Indicators for Biodiversity*, Report to Environment Australia, Canberra.

Standing Committee on Agriculture (SCA) (1991), *Sustainable Agriculture - Report of the Working Group on Sustainable Agriculture*, SCA Technical Report Series No. 36, Melbourne: CSIRO Publishing.

State of the Environment Advisory Council (Eds) (1996), *Australia: State of the Environment 1996*, An independent report to the Commonwealth Minister for the Environment, Melbourne: CSIRO Publishing.

Ward, T. (1998), *A Recommended Set of National State of the Environment Indicators for Estuaries and the Sea*, Report to Environment Australia, Canberra.

Wilson, E.O. (1992), *The Diversity of Life*, London: Penguin Press.

#### **Related ABS Publications**

(1301.0) *1997 Year Book, Australia*

(4140.0) *Australia's Environment: Issues and Facts*

(4601.0) *Australians and the Environment*

(4603.0) *Environment Protection Expenditure Australia*

(4606.0) *Australian Agriculture and the Environment*

(7113.0) *Agriculture, Australia*

(7507.0) *Agricultural Industries - Finance Statistics, Australia*