

THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA

THE EFFECTIVENESS OF LAND DEGRADATION POLICIES AND PROGRAMS

Report of the House of Representatives
Standing Committee on Environment, Recreation and the Arts

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1. Mr M.A. Burr replaced Hon. M.J.R. MacKellar on 1 June 1989.

2021年12月31日

TERMS OF REFERENCE

That the Committee inquire into and report on land degradation with particular reference to:

- a. on-going causes of land degradation;
- b. effectiveness of policies, programs and practices designed to alleviate land degradation; and
- c. measures required to protect the environmental and productive values of land.

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LIST OF RECOMMENDATIONS

RECOMMENDATION 1:

- . that the Commonwealth government should take up the concept of "sustainable land use by 2000" as proposed by the Australian Conservation Foundation and the National Farmers' Federation, and use it as the theme of the proposed Decade of Landcare and as the basis for all its policies and programs.

(Paragraph 3.28)

RECOMMENDATION 2:

- . the Commonwealth take responsibility for developing definitions, methodologies and programs to establish the extent and costs of land degradation in consultation with the States and Territories; and
- . that the co-ordination of this program should be allocated as a priority task for the Bureau of Rural Resources which should be provided with the necessary additional resources.

(Paragraph 4.14)

RECOMMENDATION 3:

- . the Commonwealth should allocate resources to help establish and maintain a national data base;
- . this data base be used to integrate existing land resource and land management information and present it in a usable and accessible form; and
- . land capability assessment projects should receive priority funding and the Commonwealth should work with the States to develop a National Land Capability assessment and Mapping Program.

(Paragraph 4.24)

RECOMMENDATION 4:

- . additional funding be provided through the National Soil Conservation Program for extension and related research to improve the preparation and delivery of information to land managers;
- . the Soil Conservation Advisory Committee conduct an open review of the Research Component of the National Soil Conservation Program and other land degradation funding programs in consultation with the States, research agencies and professional associations, with a view to ensuring that research is co-ordinated, integrated, relevant to land degradation priorities and that multi-disciplinary research is being adequately funded; and
- . that the role of the CSIRO in land degradation research be included in the review by the Soil Conservation Advisory Committee.

(Paragraph 4.44)

RECOMMENDATION 5:

the Commonwealth Government develop a forum such as an expanded Soil Conservation Advisory Committee comprising representatives of Commonwealth and State Governments, researchers, industry and land holders' associations to:

- . develop national land degradation research priorities and promote related research programs; and
- . monitor the adequacy of research in relation to the priorities.

(Paragraph 4.57)

RECOMMENDATION 6:

- . the Commonwealth recognise the special importance of land degradation research carried out by the CSIRO and the difficulties involved in attracting external funding for this research;
- . the Commonwealth make a special allocation of funds to at least restore the resources of the CSIRO Division of Soils to 1982 levels; and
- . the CSIRO establish a consultation and co-ordination panel to facilitate co-operation with the states and to integrate activities within CSIRO.

(Paragraph 4.70)

RECOMMENDATION 7:

the Minister for Primary Industries and Energy and the Minister for Employment, Education and Training establish a joint departmental working party to urgently:

- . identify tertiary education and continuing education requirements in the land conservation area;
- . develop programs to promote the courses that are available, and identify measures to attract more students; and
- . identify assistance measures required to support key institutions.

(Paragraph 4.92)

RECOMMENDATION 8:

the inter-departmental tertiary education working party operate in close consultation with the States, through the relevant ministerial councils and with CSIRO.

(Paragraph 4.93)

RECOMMENDATION 9:

- . the Commonwealth require the States to set aside part of the funding they receive under the National Soil Conservation Program for contingencies so that their management of project funding can be flexible; and
- . the Commonwealth set aside some of the funds that it provides to individuals and groups, under the National Soil Conservation Program, for contingency purposes.
(Paragraph 5.22)

RECOMMENDATION 10:

the National Soil Conservation Program be reviewed at the end of the 1990/91 financial year to assess if it is achieving its goals and if it is effectively and efficiently delivering project funds to community groups of landholders.
(Paragraph 5.28)

RECOMMENDATION 11:

a panel including community representation drawn, at least in part, from groups with direct experience of the National Soil Conservation Program be involved in the proposed review of the Program.
(Paragraph 5.29)

RECOMMENDATION 12:

the Commonwealth require that consultative bodies like the Soil Conservation Advisory Committee be appointed in each State as a prerequisite for continued funding under the National Soil Conservation Program.
(Paragraph 5.35)

RECOMMENDATION 13:

the Commonwealth government continue to use Greening Australia to manage and administer the National Tree Program/One Billion Trees Program.
(Paragraph 5.41)

RECOMMENDATION 14:

program guidelines be adopted for the One Billion Trees Program which will ensure that special emphasis is given to tree planting projects that are specifically designed to prevent or repair land degradation.
(Paragraph 5.42)

RECOMMENDATION 15:

in considering the findings of the Drought Policy Review Task Force the Commonwealth government adopt an approach consistent with the " sustainable land use by 2 000 " policy and seek to integrate drought assistance programs with the Natural Resource Management Program.

(Paragraph 5.59)

RECOMMENDATION 16:

the Department of the Treasury, in conjunction with the Department of Primary Industries and Energy, urgently develop procedures to regularly identify, on a timely basis, the level of expenditure claimed as deductions under tax provisions related to land degradation and the cost to the Commonwealth in terms of tax expenditures.

(Paragraph 5.74)

RECOMMENDATION 17:

the Commonwealth government commit it self to urgently implementing the findings of the review of tax provisions and land degradation by the Department of Primary Industries and Energy without further recourse to another detailed review.

(Paragraph 5.75)

RECOMMENDATION 18:

. the Department of Primary Industries and Energy undertake a detailed review of the provisions of the Rural Adjustment Scheme and the Income Equalisation Deposits Scheme in relation to land degradation with a view to using these programs, modified where necessary, to provide incentives to land owners to carry out soil conservation and rehabilitation projects;

. this review be carried out in the same way and with similar terms of reference to the review of taxation provisions; and

. the Commonwealth government commit itself to implementing the findings of the Departmental review as a matter of urgency.

(Paragraph 5.83)

RECOMMENDATION 19:

the Commonwealth government, early in the Decade of Soil Conservation, convene a confernece of all levels of government, representatives of primary producers and the conservation movement to discuss the co-ordination and integration of all programs which impact on land degradation prevention and repair.

(Paragraph 5.99)

RECOMMENDATION 20:

the Commonwealth consider expanding the National Soil Conservation Program to become the National Land Conservation Program with the objective of integrating all Commonwealth land degradation policies and programs.

(Paragraph 5.100)

RECOMMENDATION 21:

. the Commonwealth initiate discussion through the Australian Soil Conservation Council and the Australian Agricultural Council on the development and adoption of land use codes of practice commensurate with the National Soil Conservation Strategy; and

. that compliance with these codes be a requirement for Commonwealth involvement in any project.

(Paragraph 6.15)

RECOMMENDATION 22:

the Commonwealth convene a reforestation working group to evaluate the CSIRO paper on Regreening Australia and to identify ways in which the reforestation program proposed in the paper can be implemented.

(Paragraph 6.19)

RECOMMENDATION 23:

the proposed reforestation working party as a priority task investigate and develop ways to promote agroforestry.

(Paragraph 6.30)

RECOMMENDATION 24:

the Commonwealth through the Australian Soil Conservation Council and the Australian Agricultural Council establish a working group to investigate, in consultation with the farming community, ways and means to develop and promote whole farm planning.

(Paragraph 6.39)

RECOMMENDATION 25:

the Commonwealth review of the impact of tax provisions on land degradation consider the extension of tax provision to encourage and assist whole farm planning.

(Paragraph 6.40)

RECOMMENDATION 26:

the Commonwealth establish a program to provide funds for grants and subsidised loan schemes operated, and partly funded, by State and Territory authorities, for land degradation prevention and repair works.

(Paragraph 6.44)

RECOMMENDATION 27:

the Bureau of Rural Resources give a high priority to research into, and formulation of, cross compliance provisions linked to all Commonwealth measures related to land degradation.

(Paragraph 6.54)

RECOMMENDATION 28:

the Australian Bureau of Agricultural and Resource Economics review the role that the policies and activities of rural finance institutions and business houses have on land degradation and develop schemes to involve a more positive and direct contribution from this sector to programs aimed at the prevention and repair of land degradation.

(Paragraph 6.61)

1. INTRODUCTION

The Context of the Inquiry

1.1 Before the Committee commenced its inquiry into the adequacy of land degradation policies it was aware that land degradation was a serious problem which had been described in some quarters as Australia's most pressing environmental issue. In a letter to a Committee member in May 1986, Dr Brian Roberts, then Chairman of the Soil Conservation Association of Australia and a member of the Commonwealth Soil Conservation Advisory Committee referred to the critical need for action.¹ He discussed the possibility of a parliamentary inquiry and suggested that the Committee should concentrate on identifying those corrective actions which the Parliament would be committed to supporting. The view of the Soil Conservation Association of Australia was that it was not necessary to set up another inquiry to again consider if there was a soil conservation problem or how serious that problem was.

1.2 Dr Roberts' approach and the earlier work on an inquiry into Fiscal Measures and the Achievement of Environmental Objectives by the Committee's predecessor in the previous Parliament served as the stimuli which prompted the present Committee to discuss the need for a parliamentary inquiry with the Hon. J J Brown, then Minister for the Arts, Sport, the Environment, Tourism and Territories. The Minister formally referred the matter to the Committee which then commenced the inquiry with the premise that the extent, cost and causes of land degradation were understood as were the potential solutions. The intention was to focus the inquiry on identifying those factors that were limiting efforts by the Government and the community to prevent land degradation. This basic approach, which reflected the views of the Soil Conservation Association of Australia, was retained throughout the inquiry. The Committee found however that its assumption about the extent to which land degradation had been adequately quantified and described had to be modified in the face of significant gaps in our knowledge and information.

1.3 One of the factors that appeared to be holding back progress was the low priority given to land degradation as an issue by governments and the community in general. The Minister in referring the inquiry to the Committee stated that "...the issue has not been regarded as a sexy issue and therefore had stayed unresolved for far too long."² The Minister's approach reflected the general view at the time that land degradation was both an urgent and a neglected area of concern. The previous

1. Brian Roberts, Letter to Mr Peter Fisher, MP, 27/5/86.
2. Hon. J.J. Brown, Letter 8/12/87.

House of Representatives Standing Committee on Environment and Conservation in its report on Fiscal Measures and the Achievement of Environmental Objectives stated that:

"The seriousness of the land degradation problem facing Australia is so great that it is difficult to comprehend but there should be no doubt that if the trend is not reversed it could have serious consequences for the economy and the environment."³

1.4 This view of land degradation as a long recognised and serious but unresolved problem is reflected in the large number of reports in recent years which have all called for the co-ordination of land use policies. The Senate Standing Committee on Science, Technology and the Environment in a report on land use policy in Australia stated that:

"Proposals for the development of a national land use policy, intended to provide an overall framework for land use and resource and environmental management at the national level, and supporting proposals for establishment of a Commonwealth State Co-ordinating Council to plan and implement such a policy, have been made by numerous Committee's of inquiry in recent years but little or no action has been taken."⁴

1.5 An Appendix to the Senate report listed 17 reports between 1944 and 1983 that were all concerned with land conservation issues and which recommended various forms of national action. More recent reports could be added to this list including the Senate Committee's own report, the report on Fiscal Measures and the Achievement of Environmental Objectives as well as numerous reports prepared on the completion of National Soil Conservation Program sponsored research projects and reports prepared for the Australian Soil Conservation Council.

1.6 The Director of the National Farmers' Federation, Mr Rick Farley, repeated the remarks of the Minister when he also told the Committee that the lack of a prominent profile had tended to diminish the political priority given to land degradation and soil erosion. Mr Farley referred to research which had identified statements from the late 1930's through to the present by parliamentarians which described land degradation as a most serious environmental problem facing Australia. Mr Farley did not suggest that the issue was being totally neglected however he was concerned that "...the key to the issue is acceleration of the pace at which things are happening."⁵

3. House of Representatives Standing Committee on Environment and Conservation, 1986, *Fiscal Measures and the Achievement of Environmental Objectives*, AGPS, Canberra.

4. Senate Standing Committee on Science, Technology and the Environment, 1984, *Land Use Policy in Australia*, AGPS, Canberra.

5. Evidence, p 554.

1.7 These remarks are disturbing because they were made towards the end of the inquiry and the Committee had already by that time noticed a substantially quickening pace and it had appeared that significant progress was starting to be made. However, given the enormity and seriousness of the problem the Committee agrees with Mr Farley.

1.8 In the 12 months between the first appearance of the Department of Primary Industries and Energy at a public hearing and its appearance at the final hearing in 1989 the Department put a range of initiatives in place including the launch of the National Soil Conservation Strategy. During this period the Commonwealth developed a broad based strategy to deal with land degradation which involved proposals for an expanded public awareness education program, the co-ordination of policies consistent with soil conservation objectives across government and the expansion and redirection of the National Soil Conservation Program. During this period action was also happening at a state level, for example the South Australian government was undertaking a complete review of its soil conservation legislation and in Western Australia there was an acceleration of the rate of formation of soil conservation districts. The Victorian government developed its Landcare program and a new state soil policy was adopted in New South Wales together with total catchment management. The situation was far from static and progress was being made but it was still not seen as enough.

Land Degradation Issues

1.9 The Committee adopted a broad working concept of land degradation and many specific issues were raised in the submissions presented to the Inquiry. Land degradation was taken as a broad term which encompassed any loss of economic and environmental land values including offsite costs to the community resulting from damage to public utilities, silting of water courses and damages to fences and neighbouring property. The issues raised with the Committee included various forms of erosion and land slip, acidification, irrigation and dry land salinity, soil structure decline and compaction, water logging, water repellence, chemical contamination and pollution, vegetation decline and inappropriate land clearing, weed invasion, damage by feral animals, and the urban development of prime agricultural land. Some problems, such as erosion, are most often recognised as an important contribution to land degradation but, as the Committee discovered, they are not necessarily the most significant in terms of lost production or remedial costs. The level of recognition and understanding of potentially more serious problems was comparatively low. The Committee did not find it necessary to examine in detail the processes involved in each of these types of degradation but there was clearly a need to examine the extent, costs and the level of awareness

associated with each, and to develop an understanding of how these are changing. The Committee found that the information about these aspects was incomplete and that this was hampering the establishment of priorities and the development of remedial programs.

1.10 These diverse problems do not necessarily require totally different approaches, the Committee found it most productive to look at issues such as information requirements, public awareness, education and training, research needs and priorities, administration of government programs, and legislation as applied across a range of problems. All of these issues have common elements relevant to the solution of the various land degradation situations. From this approach the Committee was able to identify problems common to all programs. In consequence, the Committee's findings and conclusions have general application to land degradation although in some cases they relate to particular problems in specific areas.

Current attitudes and the opportunity for progress

1.11 The popularity of land degradation as an issue appears to have increased enormously since the inquiry began and this has occurred in parallel with the increased level of government activity. This may in part reflect the attention given to the problem not only by the Committee but by the Australian Conservation Foundation and the National Farmers' Federation initially acting separately and then in concert as part of the Commonwealth Governments task force on soil conservation, established by the Minister for Resources. The increased popularity may also be a consequence of a number of major press articles and media programs during 1988-89 which may have raised the profile of land degradation as a public issue. There has also been increased activity by community groups in rural areas and by rural producer organisations, perhaps partly sponsored by the National Soil Conservation Program and the activities of state authorities. The Prime Minister in his statement on the environment in July 1989 gave Government endorsement to the concept of 1990 as a Year of Landcare and the period of 1990 to the turn of the century as a Decade of Landcare. This will greatly facilitate awareness, participation and education programs among rural and urban communities. The proposal for a decade of soil conservation activity was first put forward by the National Farmers' Federation and the Australian Conservation Foundation and it reflects the increasing importance of land degradation as a policy issue across a broad spectrum of public opinion.

1.12 The Committee found that the raising of interest and awareness was occurring simultaneously with increasing involvement of rural land owners in individual and group projects aimed at preventing and repairing land degradation. This was not something which suddenly or mysteriously appeared overnight but a

strong change in emphasis was clearly visible. The factors contributing to this probably included the impetus provided by government programs such as the National Soil Conservation Program and the National Tree Program. The States have also been involved in developing and reviewing policies, legislation and programs. Private groups such as Greening Australia, the Australian Conservation Foundation, the National Farmers' Federation and the Queensland Cattleman's Union have also contributed to this increasing acceptance of the need to take action to protect and improve the productivity of the land. The improved economic circumstances of rural communities in recent years may also have contributed by providing opportunities to take action on longer term projects not normally seen as affordable or as essential inputs to the agricultural production process.

1.13 The factors contributing to this heartening shift in attitudes are complex and interrelated and are discussed in more detail below. It is clear to the Committee that this combination of circumstances, however brought about, is contributing to progress and reform in land degradation prevention. It believes that there is now a very considerable scope for governments, communities and land holders to significantly improve existing programs and land use practices.

1.14 The National Farmers' Federation and the Australian Conservation Foundation in their joint submission to the Commonwealth government in 1989 stated:

"the time is now opportune for a major co-operative effort to move towards sustainable land use because:

- . the need for improved land care has been identified and accepted;
- . there is bipartisan political support at Federal and State level;
- . land holders and conservationists wish to co-operate; and
- . the improved season and commodity prices mean farmers are in a better position to undertake expenditure"

1.15 Steps are being taken and the Committee hopes that this report will further facilitate this progress by concentrating on the factors that are likely to hinder developments and by making recommendations about how to overcome these obstacles. Provided the limiting factors can be removed there is every prospect that the Year and the Decade of Landcare can be made one of the most important and beneficial periods of primary production activity in Australia. The prospect for further progress has recently been

enhanced by the Commonwealth's establishment of a private company, called Landcare Australia, to manage a national information and education campaign in support of the Year of Landcare. However, much needs to be done to ensure that the great potential for progress is realised and there is no room for complacency. A cautious note was struck in a booklet that accompanied the launch of the National Soil Conservation Strategy in April 1989:

"While the land degradation situation throughout Australia gives cause for considerable concern, there are many positive aspects of land use which are very encouraging. Many farmers and graziers have already taken steps to use their land within its capability. Among the many other users and planners of land such as mining companies, road and railway authorities and urban and recreation planners, there are many instances of a responsible attitude to land use and management. It is unfortunate that these examples have not yet caused a ground swell of interest in using all of Australia's lands within their capabilities, and also that these land users' own well-managed lands are often adversely affected by the degradation of adjacent lands.⁶

6. R.W. Roberts, *Landcare in Australia: A 200 year Stocktake, Soil and Water Conservation Association of Australia, March 1989, p.16.*

2. THE LAND DEGRADATION SITUATION

2.1 Australian soils are both complex and variable and it is generally recognised that on the whole they have been derived from very ancient landscapes. The condition of our soils prior to the advent of European agricultural systems was the result of a long and uninterrupted period of weathering and leaching. The absence of significant geological soil forming events in recent ages and the lack of glaciation during the last ice age have resulted in essentially impoverished soils with plant nutrients heavily concentrated in the surface soil.¹

2.2 Australian soils are often cited as being among the most deficient in the world, particularly in respect of available phosphate levels, and they compare unfavourably to the soils of the northern hemisphere.² This can be related to low organic matter content associated with generally arid conditions. Large areas of Australian soils are also affected by salt or overlie saline groundwater. They are fragile and susceptible to degradation following land use changes and they cannot be considered to be a renewable resource in any practical sense because the rate of soil formation is very slow.³ Any acceleration of erosion above the natural rate is serious in environmental terms.

2.3 Prior to European settlement the rate of soil loss was very low and the landscapes were basically stable. However after only 200 years of modern land use Australia is now one of the most degraded of developed countries and in some cases the degradation is as serious as that which occurs in some developing nations.⁴

Land Degradation Processes

2.4 The CSIRO identified land use practices associated with farming and other related activities as the major cause of soil degradation in Australia and their view was widely supported in other submissions made to the Committee.⁵ The land use categories and the range of land degradation processes they are associated with, as identified by the CSIRO, are listed in Table 2.1. From this list the CSIRO suggested that the main forms of land degradation are those listed in table 2.2.

-
1. CSIRO Division of Soils, submission p 1.
 2. Gordon Burch, Dean Graetz and Ian Nobel, 1987, Biological and physical phenomena in land degradation, in Anthony Chisholm and Robert Dumsday, eds. *Land Degradation: problems and Policies* Cambridge University, Press, p 28.
 3. Colin Chatres, 1987, Australia's land resources at risk, in, Anthony Chisholm, and Robert Dumsday, p 16.
 4. Richard Eckersley, 1989, *Regreening Australia: the environmental, economic and social benefits of reforestation* CSIRO Occasional Paper No 3, p 1.
 5. Evidence, p 592.

2.5 The major land degradation problems were summarised by the Department of Primary Industries and Energy in its submission as follows.

i Water Erosion

This becomes a degradation problem when sloping land or stream banks lose their protective plant cover. It is the most recognised form of land degradation in Australia, particularly on cropping and grazing land, and is contributing to a decline in productivity. This decline occurs because plant nutrients, seeds and seedlings are lost, rooting depth and consequently water holding capacity is reduced, and seedling survival is reduced by surface sealing on areas stripped of top soil.

TABLE 2.1

ELEMENTS OF A MATRIX FOR RELATING LAND USE AND LAND DEGRADATION

INDUSTRIES AND LAND USE CATEGORIES

DRYLAND EXTENSIVE CROPPING
DRYLAND INTENSIVE CROPPING
ARID GRAZING LANDS
NON-ARID GRAZING LANDS
IRRIGATED PASTURES
PLANTATION AND EXTRACTION FORESTRY
WATER SUPPLY CATCHMENTS
RECREATION AREAS
EXTRACTIVE INDUSTRIES
URBAN/INDUSTRIAL/CORRIDORS

LAND DEGRADATION ISSUES

SHEET AND RILL EROSION
GULLY EROSION
WIND EROSION
DRYLAND SALINITY
IRRIGATION SALINITY
ACIDIFICATION
SOIL STRUCTURE DECLINE
SCALDING
MASS MOVEMENT
WOODY SHRUBS AND PEST PLANTS
TREE DECLINE
PEST ANIMAL INFESTATION
CHEMICAL RESIDUES
OFF-SITE EFFECTS SEDIMENTATION
EUTROPHICATION, WATER SALINISATION
MINE WASTES AND DUMPS

TABLE 2.2

FORMS OF LAND DEGRADATION

DECLINE IN SOIL STRUCTURE
SOIL SALINISATION
SOIL ACIDIFICATION
SOIL EROSION
SOIL NUTRIENT DEPLETION
SOIL POLLUTION
WEED INFESTATION

Water erosion can also result in major sedimentation of waterways, roads and other structures and lower water quality through increased turbidity and nutrient build-up. Any land management system which leaves sloping land bare of vegetative cover will result in accelerated water erosion. Bush fires, vermin and droughts also contribute to the problem. Dramatic erosion problems may also occur during development of urban land and with mining operations.

ii Wind Erosion

This is a major problem in the drier areas of Australia where sandy soil unprotected by plant cover is blown away by the wind. This is a serious form of degradation on the light textured soils of western New South Wales, the Mallee lands of Victoria and the sandy plains of South Australia and southern Western Australia. Both grazing and cropping lands subjected to prolonged dry seasons and droughts with strong prevailing winds are at risk. During these periods, rabbit and kangaroo populations may contribute to the removal of vegetative cover, readily predisposing sandy soils to wind erosion. Kangaroo numbers in some areas have increased as the number of stock watering points have increased.

Beach dunes are also vulnerable to wind erosion and are rapidly eroded if the protective vegetation is removed. Vegetation may also be damaged by wind-blown sand for several kilometres inland of degraded beach dunes.

iii Dryland salinity

This has become a major degradation problem mainly in the southern regions of Australia where past land clearing has disturbed the hydrogeological balance of catchments. Natural salt discharge areas have expanded and new discharge areas have appeared.

Rain-water which was once taken up by trees, percolates down through the soil and rock significantly increasing the volume of groundwater resulting in rising watertables. In regions where the groundwater is saline and it rises close to the soil surface, as it commonly does in the valleys, dryland salting breaks out. Evaporation and capillary action draws the ground water to the surface but leaves the salt behind where it inhibits or kills vegetation or crops and leads to destabilisation of the soil structure. This is a problem which develops slowly and its magnitude can be underestimated. It is a major problem in the wheat lands of south-west Western Australia, the Eyre Peninsula and the south-east of South Australia, and northern Victoria.

iv Irrigation salinity and waterlogging

This has become a serious problem for the major irrigation schemes of the Murray-Darling Basin, particularly the Kerang, Wakool and Shepparton districts. It is caused by leakage of irrigation channels, inadequate land drainage and excessive water use by irrigators as well as the subterranean inflow from non-irrigated areas that have been cleared of deep-rooted vegetation. This raises groundwater levels which in turn brings dissolved salts into the plant root zone. It may have serious off-site effects through the gradual salinisation of watercourses which are also significant water supplies. Irrigation salinity has also become a problem for irrigation schemes at Bundaberg and Emerald in Queensland, and is a potential hazard in the Burdekin Irrigation Scheme.

v Soil structure decline

Good soil structure which permits the entry of air, water and plant roots into the soil may be destroyed by certain agricultural techniques. Soil structural decline may be caused by use of aggressive cultivation equipment such as disc ploughs, excessive cultivation of soil, continued trampling by stock or compression by heavy equipment when soils are moist or wet. As a result crop and pasture yields decrease, runoff is accelerated and water erosion hazards increased. This problem occurs throughout Australia on cropped land and on the more intensively grazed pastures. This form of degradation can be gradually reversed with appropriate management practices but it is presently the most costly form of degradation in Australia in terms of income forgone. It occurs particularly on the duplex soils of the wheatbelt.

vi Vegetation degradation

Loss of native trees and shrubs in Australia is widespread over a range of geographical areas. While trees had to be cleared to allow extensive cultivation to occur, there are situations where vegetation changes are affecting land stability and utility.

In woodland areas, principally on the tablelands, tree dieback is a significant problem which involves a number of causal factors. These primarily stem from clearing many years ago which placed increased pressure on remaining trees from insects and disease, stock damage, altered fertility and water regimes, and dryland salting. Regeneration of young seedlings is prevented by livestock grazing and trampling. These factors have resulted in extensive areas with a degraded, treeless landscape and reduced agricultural productivity.

Woody weed encroachment of semi-arid grasslands in eastern Australia has followed exclusion of fire, and overgrazing of palatable perennial species. This poses a serious threat to the long term grazing capacity of such lands.

vii Mass movement of soil

This is a serious form of degradation on some of the steeply sloping lands of eastern Australia. It occurs where steep slopes are cleared of their vegetation resulting in deep penetration of rain-water into unstable zones of clay which shear when wet, causing landslips. Houses, roads and valuable agricultural land have been damaged by mass movement. The total area effected is small compared to other forms of degradation but it may expand if adequate land use controls are not applied. Areas where this is a common problem include the Tamar Valley in Tasmania, the South Gippsland highlands and the Lockyer Valley in Queensland.

viii Chemical contamination of soil and water

This form of degradation has had recent media publicity as it applies to pesticide contamination of export beef. This example suggests that our knowledge of the extent of this type of degradation problem is inadequate. It has resulted from our continued and in some ways uncritical reliance on fertilisers and pesticides to boost agricultural productivity.

This problem differs from the others in being predominately an off-site effect on underground water supplies, waterways and agricultural products. It makes the land or water unusable and necessitates greater treatment and quality control, leading to greater costs of production.

Nutrients from fertilisers and waste materials are contaminating surface waters and causing loss of oxygen. This is a national problem with waters in every State and Territory being affected. According to the Water Quality Management Committee, eutrophication poses the greatest economic threat to Australian waters and is potentially greater than that of salinity.

vix Soil acidification

The continued use of nitrogen fixing legumes (such as subterranean clover) and acidifying fertilizers (such as sulphate of ammonium) on crops and pastures acidifies the soil. When this happens a decline of up to 50 per cent in productivity may be experienced. This degradation problem has only recently been recognised and its extent and severity are yet to be determined. It is suspected to be a major degradation problem in the sheep-wheat belt of southern Australia where annual rainfall exceeds 500mm. The reduced plant cover resulting from acidification accelerates water erosion. No viable alternative systems of agriculture to control acidification have yet been devised, although liming is known to reverse acidification for up to 10 years. Based on current returns liming is at present considered to be an economic proposition in some situations. However this economic assessment does not take into account the long-term consequences of a depletion of the nation's resource base.

2.6 The CSIRO Division of Soils and the New South Wales Soil Conservation Service highlighted soil fertility decline due to the removal of nutrients in agricultural produce or through stubble burning as another potential form of land degradation. It becomes a problem where the nutrients are not replaced through the appropriate application of fertilisers or through proper rotational practices. The CSIRO Division of Soils estimated that \$200 million worth of nitrogen and \$70 million worth of phosphorous were exported annually from Australia in wheat grain alone.⁶ The Division considered that the need to maintain the nutrient store was reasonably well understood although loss of nitrogen from soil organic matter was misunderstood and could become a problem of disastrous proportions in premium wheat country in northern New South Wales and Queensland.

6. CSIRO Division of Soils, submission p 2.

The Extent and Cost of Land Degradation

2.7 A paper to a recent workshop on land degradation problems and policies referred to:

"...the paradox (in Australia) of having a detailed understanding of the processes whereby our renewable resources are being destroyed or degraded but lacking a rigorous quantitative assessment of how much has been degraded and how severely, or whether this degradation is accelerating or stable. Nor are the costs known. We understand the detail clearly but have no overview. Unfortunately, it is the latter that is required for instigating changes in management to curb land degradation."⁷

2.8 Attempts have been made to get better estimates of the extent and costs of land degradation including a national effort co-ordinated by the Australian Soil Conservation Council. These efforts have been hampered by the lack of an agreed methodology. A submission from Dr E W Radoslovich, a scientist at the CSIRO Division of Soils, referred to a 1987 survey of soil science experts that confirmed methods did not exist which could adequately measure the existing levels of land degradation and the rates of change of such levels.

2.9 Representatives of the Western Australian government told the Committee that in the absence of an agreed methodology the various estimates of the extent of land degradation which have been made have to be regarded as very much open to personal interpretation.⁸ The problem has two aspects - it has been difficult to identify a methodology which provides reliable and easily obtained results and there has been a need to get several different administration agencies to come to agreement.

2.10 One of the most commonly quoted studies of the cost of land degradation is the report of the Commonwealth - State Collaborative Soil Conservation Study published in 1978. That study estimated that on a national basis 51 per cent of rural land used for agriculture required treatment for erosion or vegetation degradation.⁹ Improved land management was all that was required for just under half of this land but structural works such as waterways and contour banks were required on the remainder. The cost of these works would now be approximately \$2 000 million. In considering the significance of this figure it must be realised that the study did not take into account all land degradation processes. More recent work has shown that processes such as acidification and soil structure decline, which

7. Gordon Burch, Dean Graetz, and Ian Noble, 1987, p.27.

8. Evidence, p 433.

9. Department of Environment, Housing and Community Development, 1978, *A basis for soil conservation policy in Australia, Commonwealth and State government Collaborative Soil Conservation Study, 1975-77*, AGPS, Canberra.

were not covered in the study, may be much more significant than erosion and salinity and will also be costly problems to overcome.

2.11 The figures from the 1978 study might now be considered as out of date and not representative of the current situation. Evidence before the Committee and the discussions it held with land managers around the country leads it to believe that the situation has not improved since the 1978 report. In 1986 the then Department Arts, Heritage and the Environment stated in its report on the State of the Environment in Australia that only 2 per cent of the agricultural and pastoral land identified as being in need of soil conservation measures had been treated.¹⁰ The Australian Society of Soil Science in its submission stated that the general picture was one of limited progress and the Tropical Grassland Society of Australia submitted that the rate of land degradation associated with the pastoral industry has accelerated since the 1960's. This has occurred in the arid sheeplands and, more importantly, in the better beef producing regions.¹¹ It appears that little has changed over the last decade and the 1978 figures can be taken as an indicator of the minimum magnitude of remedial costs.

2.12 A booklet prepared by an officer of the New South Wales Soil Conservation Service and launched in April 1989 in support of the National Soil Conservation Strategy stated that since the publication in 1978 of the findings of the collaborative study the Commonwealth, State and Territory governments have continued to pursue soil conservation programs but it is unlikely that the situation has improved.¹² The reasons for this lack of improvement included the 1979-83 drought, the worsening of both dryland and irrigation salinity due to the delayed consequences of previous management and the extension of cropping into marginal lands.

2.13 When asked if the situation had worsened or improved since 1978 representatives of the Department of Primary Industries and Energy were unable to provide a clear answer other than to say that the factors contributing to land degradation had diminished with the increased adoption of conservation farming.¹³ The Department's difficulty in answering the Committee reflected the lack of data on this matter. The Department stated that a national study of the cost of land degradation, in terms of lost annual production, suggested that the figure could be in the order of \$600 million. The Committee subsequently noted other references to this figure and it is now being widely quoted.

2.14 The Committee received some other figures which can be used to indicate the magnitude of the problem. The CSIRO referred to reports which state that the value of lost production in the Murray - Darling Basin was \$217 million a year. Over half the

10. Department of Arts, Heritage and the Environment, 1986, *State of the environment in Australia; Source book*, AGPS Canberra.

11. Tropical Grassland Society of Australia, submission p 1.

12. R.W. Roberts, 1989, p.14.

13. Evidence, p 40.

losses were attributable to soil structure decline with irrigation induced salinity and acidification also causing major losses.

2.15 The South Australian government advised the Committee that the value of lost production in that state was in the order of \$80 million a year.¹⁴ The Australian Society of Soil Science submitted a report which showed that soil degradation resulted in a loss of 25 per cent of crop production in northern and north-eastern Victoria which, in 1980 figures, was worth \$20 million a year.¹⁵ This was due to a number of causes which may sometimes have combined effects including acidity, soil structure decline, water logging and inadequate rotation practice.

2.16 The Western Australian government presented detailed figures of the cost associated with various forms of land degradation which show that in that state alone annual losses exceed \$700 million.¹⁶ The government's representatives acknowledged that their most recent figures suggested that the situation was probably worse than indicated by other estimates but believed that their figures were conservative. Their figures are summarised in Table 2.3.

TABLE 2.3

LAND DEGRADATION COSTS - WESTERN AUSTRALIA
VALUE OF LOST PRODUCTION

Cause	Costs (\$ Million/Year)
a) Rangeland Areas	
wind erosion	}
water erosion	} 44.2
vegetation decline	}
b) Agricultural Areas	
salinity	44.2
waterlogging	187.3
water erosion	21.3
wind erosion	10.0
soil structure decline	70.0
subsoil compaction	153.0
water repellence	150.0
acidification	5.0

2.17 The Western Australian figures are different from those generally reported for other parts of the country in that they include a significant allowance for losses due to water repellent soils.

14. South Australian government, submission p 5.

15. Australian Society of Soil Science, submission, attachment 4.

16. Evidence, p 434.

2.18 The results of a recent survey by the New South Wales Soil Conservation Service show that the impacts of all forms of land degradation had increased over the preceding 12 years although changes in sampling methodology meant that the results were not directly comparable. The main problems identified in New South Wales, in terms of area affected, were severe soil structure decline, wind erosion, acidification, water erosion and woody shrub invasion. The cost in New South Wales has been reported at more than \$200 million in lost production.¹⁷

2.19 The relative significance of the different forms of land degradation is not reflected in the level of public and official attention that the various causes have received. The Institute of Foresters of Australia pointed out that although community perceptions of land degradation have tended in recent times to focus on the economic significance of erosion and salting, there is no real basis for this. The general view emerging in scientific circles is that for every dollar that dryland salinity costs the community, water and wind erosion cost five, soil acidification cost twenty five, soil structural decline cost one hundred and twenty five, and soil nutrient degradation costs six hundred and twenty five.¹⁸

2.20 All of the above figures need to be used with some caution given that we lack a reliable national survey of the extent and costs of all forms of land degradation. Even if the available figures are discontinuous in their national coverage and are only indicative of the magnitude they still suggest that land degradation is one of the most serious economic problems facing Australia as well as being environmentally serious. The recent paper on the "Regreening of Australia" by Dr Eckersley of the CSIRO points out that the real costs are much greater when the treatment of degraded land, nutrient loss, research needs and off-site costs such as silting and pollution of waterways are considered.¹⁹ Dr Eckersley suggests a figure of \$2,000 million a year.

2.21 The costs to the community are further compounded if offsite effects of land degradation are considered. These effects are experienced away from the source of degradation and may also become apparent at some much later time after the initiating action occurs. They are more difficult to identify, to evaluate and to take effective action against. A range of offsite costs were identified by officers of the then Department of Arts, Heritage and Environment including:

- . loss of water storage capacity caused by sedimentation;
- . increased turbidity of waterways or eutrophication of lakes leading to losses in recreation and tourism;
- . soil-polluted air or water leading to reduced life and increased costs for machinery and appliances;

17. Sydney Morning Herald, 28 February, 1989, p 1.

18. Institute of Foresters of Australia, Supplementary submission p 10.

19. Eckersley, R., 1989, Number 3.

- . damage to roads resulting in higher repair and maintenance costs; and
- . loss of native vegetation and wildlife.²⁰

2.22 While some of the direct and offsite damage can be repaired, if we are prepared to pay the cost, there are also areas that have been lost to agriculture or are now permanently less productive than in the past. It has been reported that in some parts of New South Wales several million hectares of prime farming and grazing lands will be unproductive within 50 years.²¹ In a recent paper two scientists from the CSIRO Division of Soils suggested that eroded soil materials cannot be replaced at individual sites or over landscapes, even within hundreds of human generations. Meanwhile, our soil assets are being steadily diminished by continuing erosion. It is the view of these researchers that if modern agriculture is to survive into the future, management practices must be developed in the knowledge that there is no prospect of re-constituting a soil from its erosional remnants at a rate that will maintain it indefinitely as a productive system. Complacency with current agricultural malpractices and indifference to the severity of the soil erosion problem have already led to the widespread degradation or destruction of substantial amounts of our fundamental soil resources.²² The Committee strongly believes that it is not an exaggeration to suggest that land degradation is already costing Australia dearly but the long term may be much more serious, resulting in the slow collapse of our agricultural industries.

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- 20. Garrett Upstill and Timoty Yapp, 1987 Offsite costs of land degradation in Anthony Chisholm and Robert Dumsday, p 101.
 - 21. Sydney Morning Herald, 28 February, 1989, p 9.
 - 22. Beckman, G., and Coventry, R., 1987, Soil erosion losses: Squandered withdrawals from a diminishing account *Search* 18. (No 1), p 21.



3. WHY WE HAVE A PROBLEM

Factors underlying Land Degradation

3.1 Most land degradation is the result of inappropriate land use practices associated with agriculture including grazing. The CSIRO told the Committee that the primary causes of soil erosion are land clearance and ill advised land use, such as cropping on unstable soils and in highly drought-prone areas, or over-grazing. Similarly, soil salinisation was described as the result of land clearing while acidification was the result of agricultural practices.

3.2 The CSIRO point out that European settlers made major mistakes in land use and management practices, some which were historical and some which are still being made. The mistakes included:

- . lack of awareness of the likely impact of introducing animals that subsequently became feral (e.g. rabbits, foxes, buffalo, horses);
- . lack of knowledge and awareness of the potential of introduced plants to become dangerous weeds (e.g. prickly pear);
- . lack of knowledge of the consequences of unrestricted timber clearing (salinisation, erosion);
- . lack of knowledge - and failure to utilise existing knowledge - about the effects of unrestricted irrigation in poorly drained areas (rising water tables, salinisation);
- . lack of knowledge - and failure to utilise existing knowledge - about the susceptibility of bare soils to water and wind erosion;
- . misjudgements about the risks and consequences of flood and wild fires, as well as the consequences, in some areas, of eliminating fire; and
- . lack of knowledge about the effects on soil acidity of improved pastures based on annual legumes.¹

3.3 CSIRO's view was summarised by Dr Smiles, the Chief of the Division of Soils, in a submission where he said that farming is the most important cause of soil degradation because it was associated with loss of nutrients in products, with loss of topsoil and organic matter, with salinity, with acidification and with the accumulation of noxious or toxic agricultural chemical residues. The loss of topsoil follows exposure of the soil surface to action of water and wind caused by excess cultivation and overgrazing.

1. CSIRO, submission p.5.

3.4 Dr Smiles also considered that salinity, while it has always been present in Australia, is exacerbated when management results in raised saline water tables. Principal causes are profligate irrigation practice and leakage from canals and by extensive clearing of trees. He also stated that acidification was an "unforeseen" consequence of good practice associated with superphosphate and use of subterranean clover to enhance the nitrogen status of soils. The widespread heavy use of nitrogen fertilisers inevitably increased the process. Dr Smiles also referred to locally severe degradation associated with land disposal of urban and industrial wastes, and with mining.²

3.5 Although farming can be identified as the main cause of land degradation this does not mean that farmers can be blamed or expected to carry the burden of the cost of preventing degradation and repairing the land particularly where the problems are the result of the application of generally accepted management practices over several generations. A number of submissions discussed the role that governments and society in general have played in contributing to the circumstances that result in land degradation. The view of the Australian Society of Soil Science suggested that there were several factors that limited progress in overcoming land degradation in Australia including inadequate resources, the economic problems of primary producers, limited public awareness, insufficient co-ordination and, in many cases, insufficient knowledge of the local or regional detail of problems, even though the broad problem and its solutions were fairly well understood.

3.6 The United Farmers and Stockowners of South Australia, for example, considered that Commonwealth and State government policies have had major impacts on land use even though those policies were not intended to relate to land use.³ They referred to the recent trend towards shorter crop rotations and suggested that this has come about not because farmers wanted to use their land more intensively but was caused by factors which affected farm income. These were beyond the control of farmers and included factors such as tariffs on farm inputs and taxation procedures. The United Farmers and Stockowners suggested that governments were forcing farmers to adopt soil use techniques which may not have been in the best interests of long term soil conservation. As an example they referred to an increase in meat inspection charges levied on producers which was likely to result in increased stocking rates.

3.7 The Tasmanian Government also discussed the impact of general economic conditions on the choice of farming systems. In its submission the Government stated that the effects of cultivation on Tasmanian soil resources had been compounded by economic conditions in vegetable production where growers were forced to increase the proportion of land under crop on their farms, as well as increasing the rotational intensity of cropping.⁴ Farms which had previously been cropped within their capability were being exploited beyond that limit. The narrowing

2. CSIRO Division of Soils, submission p.2.

3. United Farmers and Stockowners of S.A. Inc., submission p.1.

4. Tasmanian Government, submission p.3.

of the margin between costs and prices intensified the search for maximum yield. It forced growers to make intensive use of herbicides in crops such as onions, leaving the soil bare for prolonged periods and open to the erosion from which it was once better protected. The pressures for greater productivity also led to increased fertiliser use which in some instances has caused imbalances of certain mineral nutrients in soils.

3.8 The Tasmanian Government also submitted that the cost/price squeeze has created pressure to use larger and heavier cultivating and harvesting machinery. This exacerbated the damaging effect of traffic on the soil, leading to structural breakdown and erosion. Economic pressure to undertake tillage, harvesting and other cultural operations in less than ideal soil moisture conditions to meet market or contractual requirements had a similar effect. The same forces put greater pressure on vegetable processing companies to make maximum use of capital equipment and to achieve high rates of throughput. This placed stringent demands on the supply of farm products and dictated the timing of cultural and harvesting operations, irrespective of the impact which this activity may have had on the soil. The clearing of land to meet greater economic demands for productivity was also seen to have increased the potential for soil degradation through the development of offsite salinity and water table changes as well as through water and wind erosion.

3.9 The Tropical Grassland Society of Australia described a process of degradation caused by an increase in the number of cattle and the introduction of more productive breeds which consumed more pasture.⁵ Improved husbandry techniques, also contributed to increased exploitation of native grasses and consequent degradation. This all occurred against a background of increasing financial stringencies where pastoralists were forced to maximise their outputs. The result was that profitability was retained in the short term but there was a gradual decline in pasture productivity with considerable erosion resulting from reduced grass cover.

3.10 The National Farmers' Federation also stressed the significance of economic factors and stated in evidence that:

"In approaching the issues of land care and land degradation, we really need to be aware of the total environment in which farmers are operating. As prices fall, as farmers themselves come under more pressure to keep up the payments on loans and to meet their debt commitments, then the tendency is for them to try to increase the productivity of their country and that, of course, can result in environmental pressure... it is important for us to consider the whole climate in which producers are operating. That takes into account, for instance, the level of commodity

5. Tropical Grassland Society of Australia, submission p.1.

prices, the level of interest rates, the economic climate in general, as well as seasonal factors, management techniques, and so on... the more we look at this question the more we find that economic pressure equals environmental pressure.⁶

3.11 Economic factors are important because they make it more likely that farmers will use agricultural systems which will yield higher returns in the short term without giving due attention to the long term cost that might result from any subsequent land degradation. The New South Wales Soil Conservation Service submitted that there is a tendency for farmers to work more land to counteract low yields or returns resulting from adverse economic or climatic conditions. The Committee observed a similar tendency in Western Australia where the solution to some emerging land degradation problems was to open up new areas for development rather than incur the costs of repairing the land. Adverse economic conditions also made it less likely that landowners would undertake capital expenditure on soil conservation projects and works that might have resulted in some long term benefit.

3.12 Past policies and practices were also criticised with hindsight as contributing to land degradation even though they were accepted at the time. The Queensland Land Administration Commission recognised that small or unviable properties contributed to land degradation in the pastoral areas through overstocking.⁷ These properties were the result of the early administration of the leasehold system which served the State well at that time and enabled an orderly move to closer settlement. Present administration policy is one of recognition that land settlement and development as it was known in the past is no longer appropriate. Another example of a government policy that would now be considered inappropriate was raised by representatives of the United Farmers and Stockowners of South Australia who referred to the requirement that some pastoral leases had to be cleared down to 10 per cent of the leased area at risk of forfeiture of the lease.⁸

3.13 Governments have also given advice or encouragement that has eventually contributed to land degradation. For example representatives of the Western Australian government stated:

"...Inappropriate land use is very easy to define in hindsight. So it is very easy to say that overgrazing on the south coast is not an appropriate land use ...The sort of agricultural system that we developed on the south coast is proving to be an inappropriate land use, yet it was categorically stated in a government commission report before that land was opened, that there was no risk of salinity in that south coast sand plain."⁹

6. Evidence, p.551.

7. Land Administration Commission, submission p.2.

8. Evidence, p.303.

9. Evidence, p.439.

3.14 The Victoria River Downs Conservation Association submitted that the moderate to severe land degradation which had been found in the Victoria River catchment was, in the most severely affected area, the result of the lack of control of cattle numbers and distribution in the early pastoral use of the area. The potential for erosion still existed and there was a need to consider land use and animal husbandry practices but the Association believed that the present generation of graziers have inherited the results of the actions of earlier generations.

3.15 The Central Australian Conservation Council agreed that for the arid zone generally substantial degradation did take place early in the settlement phase but the Council considers that degradation continues to occur due to overgrazing.¹⁰ This occurs for reasons of economic pressure, inappropriate regulation or ignorance on the part of pastoralists. In informal discussions the Northern Territory Cattleman's Union told the Committee that overstocking had occurred and they also suggested that this was at least partly due to out dated lease covenants that might now be considered inappropriate.

3.16 The relevance of non-farm factors to land degradation was recognised by both major Commonwealth government agencies that gave evidence to the Committee. The Department of the Arts, Sport, the Environment, Tourism and Territories and the Department of Primary Industries and Energy both identified socio-economic factors which work in addition to physical factors. The Department of the Arts, Sport, the Environment, Tourism and Territories referred to three broad factors;

- . failure by landholders to look after their own self interest;
- . failure by landholders to take account of the negative impacts of their actions in the wider community; and
- . government policies directed at other elements of the public interest which indirectly influence land degradation.

3.17 Landholders could fail to take account of their own self interest because early signs of land degradation are not easy to detect or quantify and are masked by management activities, land use changes or seasonal conditions. Research into farmer perceptions of the impact of erosion on productivity suggests that the problem lies not so much in convincing farmers that soil conservation is important as in convincing them that their own land is being degraded. Unless landholders can see that land degradation affects their own properties it is unlikely that they will either voluntarily undertake preventive management of their land or support development and implementation of performance standards, or coercive government regulation.

10. Central Australian Conservation Council, submission p.5.

3.18 Other reasons referred to by the Department for landholders failing to take action in their own self interest to prevent or contain land degradation included:

- . the perception that degradation is a long term process, so action can be put off to future years;
- . the limited capital available to landholders tends to be applied to short term income producing activities rather than long term income protecting action;
- . insufficient information is available to individual landholders on the impacts of land degradation or the techniques available for dealing with it;
- . resistance to changing traditional practices of land management, particularly where new practices have not been locally demonstrated; and
- . some landholders are more concerned with the social and life-style advantages of rural living than with its financial returns and their decision making is not bound by economic rationalism.

3.19 The Department suggested that wider community impacts are often not taken into account by Australian landholders because they are not reflected in the costs which have to be considered by individual landholders or the returns available to them. Thus a landholder who clears vegetation does not bear the costs of resulting dryland salinity in neighbouring properties, or the additional treatment costs for potable water supplies. Were these costs, or potential costs, charged to the landholder, they would be taken into account in rational decision making. As matters stand, only the altruistic landholder would take them into account, and in doing so might incur reduced income compared to neighbouring landholders who make decisions based on their own economic interests.

3.20 Government policies directed to other ends can significantly distort decision making of landholders and indirectly influence the rate of land degradation. Examples of government policies with unintended impacts on land degradation suggested by the the Department included:

- . drought assistance which favours landholders whose management does not take full account of the impacts of drought;
- . transfer pricing policies which favour rural areas and thus encourage extension into marginal areas;
- . under-pricing of inputs such as irrigation water and subsidised fertiliser, leading to greater use than if full cost pricing were applied (however, recent OECD

studies have found Australia to have the lowest level of farm subsidies among OECD nations, and subsidies to other areas of the economy, particularly through tariffs and quotas, adversely affect farm economics);

- . tax provisions designed to promote development, such as the deductibility of capital expenditure on clearing allowed until 1983;
- . short term land tenures which lead to "mining" of the land in the final years of occupancy; and
- . lease conditions designed to force development of land, for example by requiring development of infrastructure or specifying minimum stocking rates.

3.21 The social causes of land degradation identified in other submission included;

- . lack of knowledge of soil properties and the impact that various land use practices will have;
- . lack of availability or lack of awareness of more appropriate land management systems;
- . failure to recognise that land and soil resources are not renewable but finite and there is a need to use these resources within sustainable limits;
- . the attitude that private ownership of land implies a right to exploit that land without regard to long term consequences;
- . failure to bridge the gap between the findings of research agencies and the land use practices of primary producers; and
- . failure of land owners and governments to heed the warnings given by scientists that accepted land management practices were exploiting the finite stock of fertile soils.

3.22 Governments at all levels can contribute directly to land degradation through their activities as land holders. The Commonwealth and particularly the State governments can make significant additions to land degradation through their management practices in publicly owned land such as forests, national parks and reserves. For example one submission to the Committee alleged that it is evident, particularly in New South Wales, that the greatest area of affected land lies within the control of various government departments at all levels.¹¹ The land referred to included vacant crown lands, state forests, stock routes, roadsides, land under lease from governments, wilderness and national parks. The Committee does not consider

11. Ms B Moore, submission p.1.

that there is evidence to suggest that the extent of degradation on public land is as widespread as suggested in this submission or that it is as serious as, for example, soil structure decline due to farming on private land but the Committee believes that role of governments as land managers must be taken into consideration.

3.23 The Department of Primary Industries and Energy made a submission which considered the role of local government. It concluded that the actions of local and semi-government authorities probably make only a minor contribution to land degradation as they would tend to be concentrated in small areas. The impacts of local government activities included the consequences of poorly designed and located roads and erosion from construction sites. Local government was identified as also indirectly responsible for water erosion by allowing inappropriately designed subdivision to take place.

Sustainable agriculture as a goal

3.24 The Committee considers that society can rightly require land holders to manage their land in a sustainable way regardless of the form of tenure that the land is held under. This is a requirement that cannot be introduced overnight because there are many complex and interrelated factors contributing to land degradation.

3.25 Land owners cannot now be expected to set right the mistakes of previous generations or suddenly modify practices that until now were widely accepted as the norm and encouraged by governments. On the other hand, as more information on the causes, extent and costs of land degradation comes to hand it is increasingly difficult for land owners to justify unsustainable land uses or for governments to create circumstances which encourage or allow such practices to continue. The Community may also have to bear some of the cost if it requires land holders to undertake conservation practices which may be unviable under prevailing economic circumstances .

3.26 Just as the causes of land degradation are multi-faceted and involve landowners and the community generally so it can also be expected that the solutions will also be complex and require action on the part of individuals and governments. However the problem can be simply represented as a failure to use land and soil resources in a sustainable way. The solution stated in equally simple terms is to ensure that, in the future, all land is used within its capability.

3.27 The Australian Conservation Foundation's submission to the Committee was based on the goal of achieving sustainable use for all land by the year 2000.¹² This goal was subsequently restated in the joint submission that the Foundation and the National Farmers' Federation made to the Commonwealth Government in their proposal for a National Land Management Program. The Foundation and the Federation stated that the aim of their joint submission was to

12. Australian Conservation Foundation, submission p 3.

"...work together towards ensuring that Australia's agricultural and pastoral lands are used within their capability by the year 2000 and that there is sustainable use of lands from that time on."

3.28 The principles put forward in the National Soil Conservation Strategy are also based on the recognition that the nation's lands must be used within their capability. The Strategy does not suggest a target date for the implementation of sustainable land use and the Committee considers that it is unlikely that this goal can be achieved in just another decade, as proposed by the Australian Conservation Foundation and the National Farmers' Federation, without a major and unprecedented effort by all levels of government acting in concert with land owners. However the Committee strongly endorses the position taken by the Foundation and the Federation and agrees that the achievement of sustainable land use is essential. A clear objective, such as a target date, will facilitate this aim even though it seems optimistic and the slogan "... SUSTAINABLE LAND USE BY 2000 ..." should be the basis for all government action and should be emphasised in community education and awareness programs. The government has already gone part of the way in its major statement on the environment in July 1989 when it announced that the last decade of the century will be a decade of soil conservation. The Committee recommends:

that the Commonwealth government should take up the concept of "sustainable land use by 2000", as proposed by the Australian Conservation Foundation and the National Farmers' Federation, and use it as the theme of the proposed Decade of Landcare and as the basis for all its policies and programs.

Constraints to Sustainable Agriculture

3.29 Progress with the introduction of sustainable and more appropriate land use has not been restricted by a lack of willingness to respond. The National Farmers' Federation referred to information that showed that measures had been taken, their representative stated:

"...farmers have had a history of involvement in land care projects for at least the last 30 years. There have been some very extensive programs undertaken in various States. For instance, in Western Australia over 90 soil conservation districts have been formed.

According to statistics supplied to us by the Western Australian Government, farmers planted more than 12 million trees in 1987; 70 per cent of Western Australian farmers surveyed in 1988 employed soil conservation and land care measures. In South Australia there are 10 soil conservation boards; four million trees are planted by farmers annually; about 50,000 hectares of native vegetation have been placed under heritage agreement. In Victoria there are 35 land care projects involving 1,500 land-holders covering 400,000 hectares, and a further 35 projects are likely by 1990. In New South Wales in 1986-87 farmers themselves put up over \$7m or 2,037 kilometres of graded banks; 282 kilometres of gully fill; almost 2,000 dams, gully erosion control studies, and so on..."¹³

3.30 The question that needs to be addressed is why is it that despite the awareness that already exist and the efforts that have been made land degradation remains an ongoing and serious problem? The Committee found that there were a number of factors limiting the introduction of sustainable agriculture. In many respects these constraints are the continuation of the factors which have contributed to land degradation in the past. The factors identified by the Committee are summarised in Table 3.1 and discussed below.

3.31 The Department of Primary Industries and Energy suggested that farmers were interested in changing their land use practices to control degradation and believed that the reasons why farmers did not actually adopt new measures were many and varied but could be grouped into the following three categories.

1. Landholders may be keen to change and control land degradation but there are no alternative management strategies or systems of land use developed to replace the current ones which result in degradation. Conservation techniques developed so far may not be applicable to the existing system of agriculture.
2. There are landholders who remain unconvinced of the need and value of land degradation control measures. These individuals may be close to retirement, may consider conservation management too complex, may be fearful of the use of herbicides, may not have been given sufficient information by the advisory services or as is sometimes the case, may have made a genuine and competent judgement on what is being promoted by conservation officers.

13. Evidence, p 551.

3. Landholders may wish to change to less damaging practices but are prevented from doing so. Financial constraints would be the commonest constraint where short-term cash-flow problems dominate their thinking and decision making. Where conservation practices are more costly than existing operations, a struggling landholder cannot consider a change in the short-term.¹⁴

TABLE 3.1

CONSTRAINTS TO SUSTAINABLE AGRICULTURE

- . LACK OF AWARENESS OF LAND DEGRADATION AS A PROBLEM
 - . LACK OF UNDERSTANDING OF SOIL PROCESSES
 - . UNCRITICAL APPLICATION OF INAPPROPRIATE LAND USE PRACTICES
 - . LAND TENURE THAT ENCOURAGES NON-SUSTAINABLE LAND USE OR INHIBITS CHANGE
 - . ECONOMIC FACTORS INCLUDING LACK OF INCENTIVES
 - . DEFICIENCIES IN EXTENSION SERVICES
 - . LACK OF INFORMATION SOURCES AND DATA BASES
 - . INADEQUATE TRAINING AND EDUCATION OF LAND MANAGERS
 - . INDIRECT CONSEQUENCES OF GOVERNMENT POLICIES
 - . LACK OF A NATIONAL APPROACH TO A FORWARD STRATEGY
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3.32 The National Farmers' Federation also identified several factors that have inhibited action:

- . land degradation has had a low public profile and hence a low political profile;
- . there has been a lack of co-ordination between the Commonwealth and the States;
- . there has been jealousy between various government departments at the Commonwealth and State levels;
- . a lack of co-ordination of data and transfer of research into usable, accessible information.¹⁵

3.33 The Conservation Farming Information Centre stated that one of the reasons why a more sustainable form of agriculture known as conservation tillage was not more widely adopted was that farmers recognised erosion as a problem but not on their own farms. From other submissions it is apparent that a lack of awareness of the full extent of the problem and the cost involved was limiting moves to more sustainable agriculture. There is also a wide spread lack of understanding of the nature and properties of soils.

14. Department of Primary Industries and Energy, submission p 6.
15. Evidence, p.554.

3.34 In relation to the introduction of sustainable agriculture the New South Wales Department of Agriculture provided information about a 1986 survey of conservation tillage in north western New South Wales. The aim was to determine the social, financial and physical characteristics of farms and farmers which influence the adoption or non-adoption of conservation tillage techniques. The main reasons for non-adoption were found to be:

- . lack of information, research and application of conservation tillage to the red hardsetting soils;
- . concern regarding the long term effects of the continual herbicide use that is involved in most conservation tillage operations;
- . belief that conservation farming was irrelevant to grazing properties and unsuitable for mixed farming enterprises;
- . concern regarding the expense of moving into conservation farming, especially the cost of herbicide chemicals and machinery;
- . lack of adequate financial information regarding conservation farming in the longer term; and
- . unwillingness to change existing operations perceived to be successful.¹⁶

3.35 Many farmers do not have a full appreciation of the limits of their soils or the consequences of some of their land use practices. This inadequate knowledge of land systems was identified by Professor Ferguson of the Melbourne University School of Agriculture and Forestry as a major constraint.¹⁷ He stated that in many areas we lack basic information and that where this information was available, it was not well applied and integrated with land use practices.

3.36 The land tenure system itself is also a factor which can limit moves towards sustainable agriculture. This can be the case especially where freehold ownership encourages the view that ownership implies a right to exploit the land without regard to its long term productivity or the offsite impacts of degradation such as salinity and silting. The lack of a general "land ethic" in Australia compounds the resistance to change that results from the tenure system.

3.37 The economic circumstances which contribute to land degradation can, if they persist, act as a long term constraint to adoption of sustainable agriculture. This persistence can occur even if economic circumstances change. In many cases this may be the result of ingrained attitudes such as the view that

16. New South Wales Department of Agriculture, submission p.3.

17. Prof. I.S. Ferguson, submission p 5.

conservation necessarily conflicts with profitable production or it may be the result of lack of information about the real economic benefits of conservation farming to individual land owners and the community at large.

3.38 Even where governments and advisory agencies were able to demonstrate alternative farming systems which would increase profitability and help protect land resources farmers may not have been able to find the funds to make the change. The Conservation Farming Information Centre, which has shown in a practical way that conservation farming is profitable, has found that the extra costs which may be required for machinery or for herbicides and the extra management in-put required for conservation tillage programs restricted farmers even when they had access to good information.¹⁸

3.39 The importance of adequate resources was highlighted by a representative of the Victorian government who said:

"...one of the major constraints is in the land-holder's resources, because if one is going to effect a change in the land degradation condition, the only avenue is through the land manager. You are dependent on the land manager's resources and whilst the State recognises this need and makes provision for incentives to land-holders for land degradation control, there seems to be a matter of principle in the Commonwealth mind which disallows this avenue of approach so it will provide substantial funds for encouraging land degradation control, for facilitating community action on it through the community facilitators, and for organising community groups to get together, but in the end point what you are looking at is some action on the ground by the land manager. This is where there is a major lack of resources in the process."¹⁹

3.40 If the economic circumstances and awareness improve farmers would still be limited in terms of what they could do because they have so many other priorities and because the problem is so large. They may also be reluctant to act given that the problem is, at least in part, not of their own making. Many of the submission made to the Committee suggested that the incentives for farmers to adopt better land management techniques were inadequate.

3.41 In addition to economic incentives farmers will also need information to assist them in identifying problems and developing solutions. Many of the solutions that could be adopted are complex and there is a need for good quality extension services to be available to all land managers. All the State soil

18. Conservation Farming Information Centre, submission p 2.

19. Evidence, p.373.

conservation and rural land management agencies give some attention to their extension services but the evidence available to the Committee suggests that unless these services are expanded and improved, a lack of information will be a further constraint to the adoption of sustainable agriculture. There is a need to develop the information sources and data bases which extension officers and farmers can draw on. There is also a need to ensure that the results of research are made accessible and relevant to practitioners.

3.42 According to the CSIRO Division of Soils there has been a difficulty in educating land managers in relation to the options and opportunities that are available to them.²⁰ The Bureau of Rural Science submitted that the factors which have limited the effectiveness of efforts to control land degradation included a lack of technical knowledge and the failure to apply existing knowledge.²¹ Many other submission referred to the need for improved education of the farming community and for better information dissemination through extension services and public awareness campaigns. This does not mean that all the information we might need is available but only needs to be made accessible. There is still a need for research into alternative farming and land use systems which will contribute to the protection of the soil resources while still forming the basis for a profitable agricultural industry.

3.43 The final constraint raised in some of the evidence is the lack of a national policy or forward strategy. The Victorian Government in its submission stated that:

" It is not seen that the Commonwealth can improve (as distinct from increase) its land protection effort without the establishment of an adequate forward strategy ... That forward strategy should be the joint concern... and the joint product, of the responsible Councils of Soil Conservation, Water Resources, Agriculture and Environment."²²

3.44 The question of the need for a national land use policy is one that has been taken up in numerous reports in the last two decades and the Committee does not propose to go over the old arguments other than to say that this constraint identified by the Victorian Government may be the result of the lack of such a national policy. The need for increased co-ordination and co-operation in determining forward programs is essential, if difficult to achieve under Australia's federal system, and the call by the Victorian Government is timely and welcome.

3.45 Programs and measures to overcome these constraints and to move Australia towards the goal of sustainable land use by the turn of the century are discussed in the following chapters.

20. CSIRO Division of Soils, submission p 2.

21. Bureau of Rural Science, submission p 1.

22. Victorian Government, submission p 11.

4. INFORMATION AND RESEARCH - PREREQUISITES FOR PROGRAM EVALUATION AND DEVELOPMENT

4.1 Land degradation problems and the failure to resolve them has in part been due to past mistakes in decisions of land use and management. These mistakes have largely resulted from a lack of information or failure to utilise the knowledge available at the time. As discussed in the preceding chapter a lack of knowledge about soils and land degradation processes has been a factor underlying the spread of land degradation and the continuing failure to provide information and increase awareness is a major constraint limiting the success of programs to prevent and repair degradation.

4.2 Managers now realise and accept that, in order to develop effective policies and programs to address land degradation problems, they must make full use of all scientific knowledge and information available. The Committee encountered instances where land managers were being held back in their search for solutions to land degradation problems by the lack of easily understandable information relevant to their situation. In some cases the information was inaccessible or unavailable rather than non-existent.

National Surveys and Inventories

4.3 There was a strong consensus among State Governments and Commonwealth Departments, that made submissions to the inquiry, about the urgent need for an inventory of land resources and degradation to serve as a basis for evaluation of needs and trends and the allocation of priorities.¹ It was suggested that information was required in two areas - an assessment of land degradation and an assessment of land capability and that there was a need for an inventory of land resources.

a) Assessment of Land Degradation

4.4 The lack of an overview of the problem of land degradation in Australia as discussed in Chapter 2 and evidenced by the absence of a quantitative assessment of how much land has been degraded or how severely, has restricted policy and program development. Such information is essential to enable informed resource decisions to be made and allow priorities to be objectively set. The Department of Primary Industries and Energy admitted that:

"In the absence of suitable information on land degradation, decisions on priorities for research and extension have been difficult to

1. Victorian Government, Submission, p.740.

make. While not necessarily unreliable, the decision making process has depended on subjective assessment".²

4.5 The problem of insufficient data on the location and extent of land degradation is recognised by the Commonwealth Government, and was addressed by the Prime Minister in his statement on the environment released in July 1989. In the statement it was announced that a national assessment of land degradation will be undertaken to allow priorities to be objectively developed and specific targets set. Although some States have undertaken their own studies of land degradation, the lack of uniform methodology has prevented the comparative assessment needed for national policy and decision making. In addition, information collated in many areas has not been at the level of detail required for meaningful assessment.³

4.6 One of the problems discussed in Chapter Two was the difficulty experienced in developing an agreed methodology for land degradation assessment. To assist the collection of uniform national data, the Victorian government suggested that an immediate priority should be to develop a practical and repeatable methodology for assessing the extent and severity of land degradation, capable of being used by all States and Territories.⁴ In the past individual States have devised their own inventory process which has resulted in much duplication of effort. To prevent this from occurring, the Victorian Government suggested that the Commonwealth take an active role in developing or confirming an appropriate inventory process, and encouraging its adoption by all States and Territories. The Department of Primary Industries and Energy advised that the Australian Soil Conservation Council has initiated the development of a uniform system of assessing land degradation. However, agreement has yet to be reached between States on the system to be adopted.⁵ The National Farmers' Federation and the Australian Conservation Foundation submitted to the Commonwealth that the Australian Soil Conservation Council survey needs to be accelerated and the priority should be given to identifying the problems and regions that most need attention.⁶

4.7 The CSIRO urged the Committee to recommend the formulation of a generally acceptable definition of land degradation as a first step. This was seen as necessary to serve as a basis for quantitative evaluation and analysis of the problem, whatever form it takes, allowing it to be expressed in terms of biological productivity, which in turn can be converted into economic terms.⁷

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2. Department of Primary Industries and Energy, Submission, p.308.
 3. Department of Primary Industries and Energy, Submission, p.307.
 4. Victorian government, Submission p.740.
 5. Department of Primary Industries and Energy, Submission p.308.
 6. National Farmers Federation and Australian Conservation Foundation, submission p.8.
 7. CSIRO, submission p.7.

4.8 Requirements for a system to support a quantitative assessment of land degradation condition and trends were outlined by the then Bureau of Rural Science which stated that:

"To undertake such an assessment, a system needs to be established to provide an inventory of land condition, and to monitor changes in the physical, biological, economic and social phenomena affecting land degradation. This system needs to document the spatial scale over which land degradation processes are operating, the magnitude and frequency of operation of the processes and the historical record of changes in the land resource. This information, together with an adequate understanding of the physics, chemistry and biology of the land degradation processes operating, and the social and economic factors affecting changes in land use and land values, will enable identification of the risks and hazards of land degradation to the environment.⁸

4.9 There was not universal support for further efforts to assess land degradation. The representation of the Western Australian government raised this question when they stated that:

"...the technical committee of the Soil Conservation Committee that supports the scheme has been arguing for some years on the ways of properly estimating the need for soil conservation, the amount of land degradation, across Australia, and non-one has agreed on a methodology. ...but it is widely agreed that this is an area that should be pursued. The Standing Committee on Soil Conservation has as a top priority for discussion the effort that should go into quantifying land degradation. Everybody recognises it is unsatisfactory at the moment. It is a question of whether you should go out measuring it in a better way or spend most of your effort doing something about it."⁹

4.10 This question was addressed by the Western Australian Farmers Federation which stated that further quantification is not necessary either from the point of view of the land holder or the wider community which must be properly informed of the situation. It was felt that public awareness was at a high level and the time had been reached where the problem had to be tackled, rather than 'sold'. Future use of "LANDSAT" and other detailed photographic comparisons was seen as allowing monitoring and comparisons with little expensive 'on the ground' input needed. So strongly did the Federation hold this view that it

8. Bureau of Rural Science, submission p.2.

9. Evidence, p.433.

submitted that further resources outlaid in this direction would be counter-productive, and at the expense of the urgent requirement to rectify the situation.¹⁰ The New South Wales Farmers Federation put a similar argument that as adequate research into land degradation had already been carried out in New South Wales, largely by the Soil Conservation Service, any duplication of this work should be avoided.¹¹

4.11 The Australian Soil Conservation Council discussed the question of a national assessment of land degradation at its meeting in July 1989. The Department of Primary Industries and Energy advised the Committee that a sub-committee of Commonwealth and State officers appointed by the Council reached agreement on methodology and proposed a survey which would cost \$4 million to complete.¹² The Department's preliminary advice about the outcome of the Council's meeting indicated that the Council expressed concern at the cost and considered that:

- . the method of measuring the parameters was too broad to quantify trends over time;
- . the assessment could not be used by itself to monitor progress of the Decade of Landcare;
- . the political imperative for a national assessment of the type envisaged was no longer relevant;
- . there was still an imperative to report on both the condition of the land resource, its trend and on the progress of National and State programs; and
- . an adequate knowledge of land capability was essential to defining and preventing land degradation hazards across the nation.

4.12 The Council agreed not to proceed with the national land degradation assessment and agreed instead to the following.

- . A National Land Capability Assessment to be implemented by the States and Commonwealth with a target for completion of 1996.
- . Establishment of a National Monitoring Network to monitor change and progress in land degradation. The first element to be established by January 1990 will be a salinity monitoring system to integrate, and where necessary, expand existing States' salinity monitoring systems. The Council's Standing Committee has been directed to complete by April 1990 a report on a comprehensive framework for monitoring all other land degradation processes for consideration by the Council at next meeting.

10. Western Australian Farmers Federation, submission p.1.

11. New South Wales Farmers Federation, submission p.4.

12. Letter from the Department of Primary Industries and Energy 12/10/89
36.

- . The fourth National Soil Conservation Report being devoted to 'The State of Australia's Lands.

4.13 The Committee is surprised by the decision of the Australian Soil Conservation Council, given that the evidence received by the Committee from the State and Commonwealth authorities generally supported a national assessment. Such an assessment still appears to be necessary if policies and programs are to be developed on a knowledgeable basis and the Committee supports the Prime Minister's announcement of a national assessment of land degradation, and acknowledges the Commonwealth Government's efforts to establish a co-operative and uniform inventory system. The Committee is concerned that the difficulty in developing a practical agreed methodology remains but it agrees with that part of Council's decision which refers to the need for land capability assessment. The Committee considers that both the land degradation survey and the land capability assessment are essential and if necessary the Commonwealth should provide additional funds to overcome the objections the States might have to the cost of the land degradation survey. This does not necessarily mean that the Commonwealth should do nothing more than uncritically fund the entire land capability assessment program in each State.

4.14 The Assistant Director of the Department of Primary Industries and Energy's Bureau of Rural Resources told the Committee that the Bureau could assist in co-ordination and facilitation of large scale reviews and monitoring activities although that has not yet been its major function nor does it have the resources.¹³ The Committee recommends that:

- . the Commonwealth take responsibility for developing definitions, methodologies and programs to establish the extent and costs of land degradation in consultation with the States and Territories; and
- . that the co-ordination of this program should be allocated as a priority task for the Bureau of Rural Resources which should be provided with the necessary additional resources.

b) Inventory of land resources and land capability assessments

4.15 Many witnesses to the inquiry called for an ongoing program of land resource appraisal, land capability assessment and continued monitoring to provide the essential base data for analysis and land use planning and decision making. Resource evaluation is a priority action of the National Soil Conservation Strategy which requires the documentation, mapping and monitoring

13. Evidence, p.665.

of the nations soils and land systems. Information requirements include the nature and distribution of soils, rocks, groundwater, waterways, topography, vegetation, climate and land use.¹⁴

4.16 Arguments in favour of continued efforts to properly identify the extent and costs of land degradation and the establishment of a basis for monitoring trends were put forward by both the Victorian and South Australian governments. The Victorian government stated in its submission:

"To be able to overview the situation, it is essential that the Commonwealth has at its disposal an effective means of overview; that is, it must have a sound system of inventory and assessment. It must also have the capacity to reliably repeat the inventory and assessment process in order to be able to detect change. From the vantage point of systematic inventory (once established), the Commonwealth should be in a position to identify common problems, common causes and interactive solutions. The Commonwealth could then influence the development, adoption and implementation of solutions of general applicability by the strategic allocation of funds ... If the Commonwealth is to have a credible role in land protection, it requires an adequate, practical and repeatable inventory process to identify problems and changes therein to serve as a basis for the evaluation of needs and trends and the allocation of priorities. Essentially the inventory method adopted by the Commonwealth should also be capable of interaction with all States and Territories, with the Commonwealth having the capacity to aggregate and interpret the data. There has been much duplication of effort between States and in devising inventory processes it is imperative that Commonwealth should -

- a) through it scientific staff devise (or confirm) the appropriate inventory process and establish guidelines for standardising collection and storage of information.
- b) encourage States and Territories to follow a standard process of co-operative inventory and monitoring, probably through preferential allocation of resources."¹⁵

14. Department of Primary Industries and Energy, Submission, p.307.

15. Victorian Government, Submission, p.12.

4.17 The South Australian government stated that a national study undertaken jointly by the States using a common approach and data base funded by the Commonwealth would be a good initiative.¹⁶ The Government also proposed a national project to fund States to develop the resource base for land capability mapping. They pointed out that a national approach would ensure systems would be compatible and could be integrated when information at a national level is required.

4.18 According to the Australian Conservation Foundation the most serious problem was the lack of land capability information at a national level.¹⁷ A representative of the Foundation stated:

"...we would like it to be a national format so that people across different States could compare the land capability of different situations in different States and make really well informed assessments of where the land was being used within its capability and whether other forms of production would be better, or in fact whether it should be withdrawn from production... the work that would need to be done on land capability assessment could be done within 12 months. The relevant units at ANU and CSIRO, we believe, should be asked to co-ordinate their computer based geographic information systems in order to use the available topographical drainage, climatic, and lithographic information which is already available to combine that and put it into their computer system. In this way land capability assessment can occur using the basic resource material which is already available. If you could get a land capability map on the current situation of land degradation with an analysis of the economic costs and benefits of current land use, then you get a really good picture of where we are at the moment and where we should be heading towards the next century ... land capability work can ... and should be done quickly."¹⁸

4.19 The Committee is aware that a great deal of environmental data has already been collected by State and Commonwealth authorities, tertiary institutions and the private sector. This data is available from a variety of sources but on a largely uncoordinated basis, creating substantial problems with accessibility. Several submissions to the inquiry supported the establishment of a national land data base to integrate existing information, making it readily accessible to environmental administrators, policy makers and researchers.

16. South Australian Government, Submission, p.30.

17. Evidence, p.391.

18. Evidence, p.391.

4.20 The CSIRO suggested that monitoring projects and databases should be set up to provide the information needed for analysis and decision making. These should include such matters as land clearance and erosion mapping, land salinisation, water salinity levels and silt loads. The National Farmers' Federation also called for a centralised data bank:

"there has been a lack of co-ordination of data into a central data bank; not necessarily central in the sense of being in one place, but centrally accessible. CSIRO has got information, DPIE has got information, ABARE has got information, as have various universities and State Departments but the work has never been centralised and made accessible to farmers."¹⁹

4.21 A national land data base would initially integrate environmental data held by all State and Commonwealth bodies, but could be extended to include research organisations, institutions and academic bodies. The Commonwealth should play a key role in being the central administration agency, ensuring co-ordination and ease of management. The Committee agrees that the development of a national data base would promote a co-ordinated approach to collection of environmental data, and would assist in identifying gaps and avoiding duplication in information collection. This would result in better co-ordination of research efforts and improved direction and management of field surveys.²⁰

4.22 The Bureau of Rural Science proposed that the land inventory system should preferably be established as a computerised database, nationally co-ordinated and networked to enable ready access and manipulation of the data. The Bureau suggested that to establish such a database some further development of existing remote sensing techniques to assess the extent of land degradation will be required, and an improved knowledge of some of the processes involved, particularly in wind erosion, soil acidification and soil structure decline, will be necessary to improve the prediction of likely trends. It was suggested that the database should be used to supply the information needed as a basis for legislation and planning procedures, to assist in the allocation of resources to research and for preventive and remedial works, and to examine the potential effects of the introduction of new policies and measures on land degradation.

4.23 The availability of comprehensive resource information would also enable an assessment of land capability, which would be of great value in land use planning to highlight areas where land use and intensity of utilisation may not be in accord with

19. Evidence, p.555.

20. Department of Home Affairs and the Environment, Environment Survey of Australia, AGPS, Canberra, 1985.

the capability of the land. In its submission to the inquiry the South Australian Government suggested that:

"A national project to fund states to develop rapidly the resource base for land capability mapping in Australia would provide a sound basis for planning for sustainable use of the land in the future. A national approach would ensure systems were compatible and could be integrated when information at a national level is required."²¹

4.24 The Committee considers that there is an urgent need for evaluation and documentation of land resources including land capability. It considers that initial emphasis should be given to improving the availability and use of existing information and that a national data base should also be developed. After the aggregation of existing environmental information, attention should then be focused on areas about which there is insufficient or inadequate information. Accordingly, the Committee recommends that:

- . the Commonwealth should allocate resources to help establish and maintain a national data base;
- . this data base be used to integrate existing land resource and land management information and present it in a usable and accessible form; and
- . land capability assessment projects should receive priority funding and the Commonwealth should work with the States to develop a National Land Capability Assessment and Mapping Program.

Increased Research and/or Extension ?

4.25 A considerable amount of research into land degradation has already been carried out by CSIRO, State government departments and instrumentalities, higher education institutions, private sector organisations, and research bureaux affiliated with the Commonwealth Department of Primary Industries and Energy. This research has contributed greatly to our understanding of land degradation and has led to the development of policies, management practices and technology that promotes the rehabilitation and sustainable utilisation of the nation's soil and land resources.

21. South Australian Government, Submission, p.791.

4.26 Many of the submissions received by the Committee considered that sufficient knowledge already existed to allow governments and professionals to understand and develop solutions for land degradation problems. This view is shared by the CSIRO, which stated in its evidence to the inquiry that:

"... in almost all cases we understand enough to make recommendations which would certainly improve matters ... We will never understand fully, ... but we know enough to solve the problem in the main if we apply what we already know".²²

4.27 This raised the question as to whether the problem of land degradation would be more effectively addressed by focusing government resources more towards the application of existing research findings than continuing research efforts. It is generally considered that research has received priority in the past but a shift in priority may now be warranted. For example a retired South Australian soil conservation officer with experience in research told the Committee that although there is value of research into ongoing efforts to combat land degradation, the current state of the art is such that a target of 80 per cent achievement is realistic providing current knowledge is put into practice.²³

4.28 Existing extension programs have been of great value in applying research findings in an effort to combat land degradation. The National Soil Conservation Program has been responsible for significant accomplishments in this area, through the provision of financial support to help establish and maintain State operated extension activities.²⁴ However, many submissions received by the Committee expressed concern that not enough time, effort or resources was spent on extension and that the transfer of knowledge to users has suffered as a result.

4.29 Several witnesses before the inquiry suggested that most, if not all, State extension agencies suffer from insufficient resources to be able to adequately carry out their demanding task. The lack of resources is evidenced by significant understaffing and recruitment problems, which obviously impacts on the level of service provided. Evidence given by the Western Australian Soil Conservation Advisory Committee highlighted the magnitude of the problem facing individual States in that:

"While the research resources currently in place are adequate..., the extension resources are deficient when faced with the task of contacting the 16,000 land users with land degradation problems in Western Australia".²⁵

22. Evidence, p.75.

23. W.E. Matheson, Submission p.4.

24. Western Australian Soil Conservation Advisory Committee, Submission p.474.

25. *ibid*, p.474.

4.30 This state of affairs was reflected in the view held by the National Farmers' Federation that "there has been a tendency to concentrate on research without necessarily focusing as much on how to make that information available to farmers" and that this has been one of the factors that has obstructed progress towards improving efforts to combat land degradation.²⁶ The importance of extension services to land holders was stressed by the South Australian United Farmers and Stockowners who stated that:

"...farmers should be given the right advice - this is where our State departments come in very much - they need to have that advice available, to have the technology and the research done so that when questions are asked the farmer can go ahead and do it... the farmers have taken a very conscientious approach right throughout, but more education, more technology and more research needs to be done so that we can do it more economically and we can do it better, as we go through the years. ...there has to be a combination of more research work, more funding for education, extension and structural works..."²⁷

4.31 Professor Ferguson from the Melbourne University Department of Agriculture and Forestry advised the Committee that:

"...advances stemming from the necessary and over-increasing specialisation in research have often left the farmers behind because a well-balanced and up-to-date integration of desirable land use practices has not been available. Under-staffed extension and advisory services are unable to keep up with the task of providing advice on whole farm planning and land management as well as the more specific problems of animals or plants."²⁸

4.32 The Department of Primary Industries and Energy pointed out that many landholders remain unconvinced of the need to change their system of land use to control degradation. The Department referred to a study of farmer attitudes which found that 90 per cent of farmers believed that soil erosion was not a problem on their farms, yet 88 per cent thought it was a problem for the region. The majority of farmers in this study saw erosion as a major problem but didn't believe it applied to their property. This suggested that extension agencies required greater resources. There was a lack of trained extension personnel and in many regions, the demand for farm plans far exceeded the ability of extension agencies to service them. One New South Wales

26. Evidence, p.555.

27. Evidence, p.288.

28. Professor I.S. Ferguson, Submission p.5.

country office has a six-year waiting list. Not only are agencies understaffed but personnel in some cases were discouraged by a lack of career structure. The problem of turnover of extension service staff was raised several times with the Committee.

4.33 According to the the Department one of the most effective instruments for change within the armoury of conservation agencies was the use of demonstration sites and equipment showing the results of effective degradation control measures. The number of demonstrations had increased in recent years and they were found to be an effective aid for extension, education and community awareness. The Committee visited several Potter Farm Plan demonstration farms in Western Victoria and agrees that such demonstrations are an effective and very powerful medium for getting practical information to landholders.

4.34 The Western Australian Farmers Federation in its submission saw the need to increase both research and extension but considered extension programs a high priority, arguing that:

"...all the education and research in the world is wasted if the results cannot be directed to those who need to have the knowledge. Extension has to increase at a similar pace to research and matched funding needs to be employed."²⁹

4.35 Many of the submissions supported these views and called for increased funding to improve and expand extension programs so that they become more efficient and effective at disseminating our current knowledge and new research findings. Central to these proposals is the need for increased financial support for training and employment of appropriate professional staff. Without adequate numbers of trained personnel, extension agencies will not be able to service the increasing number of landholders and land care groups seeking advice and assistance.

4.36 It should be noted that submissions from landholders and their representative associations have not supported extension services exclusively, as they also see a role for relevant research. However, some submissions to the inquiry raised concerns that recent research has focused too much on experimental and theoretical studies that do not necessarily have much applicability on a practical scale. Consequently, the value of research is often not recognised and may be seen to be non-productive and costly.

4.37 Given that land degradation is a problem of land use and the management system being applied, it was argued that more emphasis is required on applied research that involves a task-oriented and multi-disciplinary approach. This concurs with

29. Western Australian Farmers Federation, Submission p.374.

a submission made by the Bureau of Rural Science that suggested that:

"...management-oriented research, which encompasses economic, social, political and biophysical factors is required ... It is likely that the major research inputs need to be at an applied local level. This will require a shift from the present focus of research at the theoretical and general scale to more specific problems".³⁰

4.38 In evidence given by the CSIRO Division of Soils it was agreed that there is certainly a need to apply existing knowledge, but there are some real difficulties with implementation that maintains the need to continue properly focused research.³¹ CSIRO expressed concern that incorrect assertions have been made that land degradation problems would all be resolved if we were to apply existing knowledge.³² They noted that problems would still exist due to the difficulty in maintaining sustainable and profitable land management practices. Problems also occur when innovative solutions designed to combat land degradation have unexpected and unfortunate outcomes. For instance, herbicide use and possible soil pollution, and root diseases associated with crop residue retention and minimum tillage.³³ CSIRO argued that such problems require continued commitment to research. The Western Australian government, the Department of Primary Industries and the Soil and Water Conservation Association of Australia also referred to specific problems where research is required to provide reliable information that can be incorporated into extension services. As discussed in Chapter Three the lack of knowledge of land systems and soil processes is a factor which has hindered progress with conservation programs.

4.39 The Department of Primary Industries and Energy referred to two problems affecting research. The Department suggested that it has been difficult to find funding for cross commodity and broad based, multi-disciplinary research. They also stated that there was a lack of co-ordination and objective priority setting.

4.40 Professor Ferguson also noted the same problem in obtaining funds for multi-disciplinary research into farm planning, land management and agroforestry.³⁴ He stated that because the research in these areas is generally multi-disciplinary and multi-product in character, many of the Rural Industry Research Councils tend to reject applications because the research projects do not lie solely within their own domain. The Australian Special Research Grant Council does not suffer that limitation but normally requires matching funds from industry. This has been difficult to achieve particularly in the

30. Bureau of Rural Science, Submission p.230.

31. Evidence, p.603.

32. Evidence, p.596.

33. Evidence, p.596.

34. Professor I.S. Ferguson, Submission, p.4.

case of agroforestry given the infant status of this area of research and sometimes non-commercial aspects of the use of the species that might be involved. There is no research council for forestry to take on this role and although the National Soil Conservation Program and the National Afforestation Program may offer avenues for funding in the future, to date these programs seem to have been preoccupied with site works or discipline-specific research in the former case and commercial forestry in the latter. The situation is more acute in the case of agroforestry where unfavourable attitudes seem more entrenched and the potential sources of funding fewer. The problems in funding agroforestry research were brought into focus when it was revealed that the CSIRO Division of Forestry and Forest Products had decided to discontinue an agroforestry study in Queensland.³⁵

4.41 A potential solution to these problems would be to bring together funding into a single land degradation research funding authority. The Committee considers that closing down all the existing avenues of research funding in favour of one centralised agency might result in an overall reduction in funding levels. The Committee discussed this issue with representatives of the Western Australian government and agrees with their view that "...a special rural research fund would be quite overwhelmed if it were to carry responsibility for such research." However the need to co-ordinate research and to ensure the funds are directed to multi-disciplinary, multi-product research remains.

4.42 The identification of a specific research component in the National Soil Conservation Program as announced in the most recent changes to the Program will help improve the situation but the success of this element of the Program will have to be assessed in the light of more experience. The Soil Conservation Advisory Committee is best placed to conduct any future assessment of the adequacy of the research program.

4.43 There will also be a need to cater specifically for research that is relevant across State borders. The Victorian government's representatives, for example, suggested that there was a need for a process:

"...whereby there is an occasional review of those types of research problems which are pretty complex in nature, the benefit of which may apply to a number of States. Those are in the category of problems which would fall very much into a CSIRO basket. But often one sees situations where State governments are pursuing a fairly complex problem - the result of which would be of general benefit - with less than adequate resources ... if there were some sort of review process between the States which could isolate those complex problems,

35. The Weekend Australian, 21-22 October 1989, p.9.

with general benefit and saying that that is where CSIRO should be operative, I think, could work more systematically and effectively than it currently does..."³⁶

4.44 The Committee concludes that there is a clear need for greater extension efforts to improve the application of existing knowledge, as well as a need for related research to continue to develop and improve solutions to land degradation problems. The Committee notes that there is a good deal of knowledge about most land degradation processes but considers that further research is essential particularly in relation to more recently recognised problems but this research must be focused more towards integrated, applied studies. The Committee recommends that:

- . additional funding be provided through the National Soil Conservation Program for extension and related research to improve the preparation and delivery of information to land managers;
- . the Soil Conservation Advisory Committee conduct an open review of the Research Component of the National Soil Conservation Program and other land degradation funding programs in consultation with the States, research agencies and professional associations, with a view to ensuring that research is co-ordinated, integrated, relevant to land degradation priorities and that multi-disciplinary research is being adequately funded; and
- . that the role of the CSIRO in land degradation research be included in the review by the Soil Conservation Advisory Committee.

Research Priorities

4.45 It is clear to the Committee that the level of research funding is going to be inadequate to meet all research needs. To ensure that we get the most benefit from the funds that are allocated the research program needs to be relevant to the priority areas. A number of priority research tasks were proposed to the Committee. The Soil and Water Conservation Association of Australia for example suggested that in addition to furthering our knowledge of traditional land use problems, there is a need for "greater knowledge of types of land degradation other than soil erosion; of land degradation and required control measures in non-rural land uses; and of soil and water conservation economics."³⁷

36. Evidence, p.377.

37. Soil and Water Conservation Association, Submission p.367.

4.46 Many submissions supported the Association's view that:

"While some research has been carried out into ... salinity, soil structure decline, soil acidity, vegetation degradation and pollution of water bodies, there is still limited knowledge of these problems and the requirements to overcome them."³⁸

It was considered that these areas are in particular need of greater research effort.

4.47 The characteristic environmental conditions, land uses and major causes of land degradation in the Northern Territory are reflected in the Northern Territory Government's call for priority research into the development of control methods for feral animal populations and exotic weeds, and improved rangeland grazing management systems.³⁹ The Western Australian Farmers Federation saw a need for greater research efforts into all aspects of land degradation, noting that:

"The movements of water above and below ground, the effects of clearing and of planting various species, the effects to soil structure of various agricultural practices all need to be addressed".⁴⁰

4.48 There has been a lack of broad based research programs incorporating multi-disciplinary teams, and this has resulted in limited understanding of the interaction of the physical, biological, social, economic and institutional factors affecting land degradation. The Committee agrees that the complexity of agricultural systems are such that a single disciplinary approach cannot be adopted as any prescribed actions need to fit in with all other aspects of a land holder's activity.

4.49 The Bureau of Rural Science considered that the lack of an integrated approach to research is one of a number of factors that have limited the effectiveness of efforts to control land degradation in Australia. Other factors cited by the Bureau included insufficient technical knowledge and solutions, and a lack of appreciation of the real costs of land degradation.⁴¹

4.50 Given the importance of economic criteria in government policy and decision making, there has been a surprising lack of research into the economic costs of land degradation. A number of submissions to the inquiry called for a detailed examination of the economic significance of land degradation, including an analysis of both off-site and on-site costs. A thorough assessment of this type would help decide appropriate levels of expenditure on control of degradation, and show the relative

38. *ibid*, p.368.

39. Northern Territory Government, Submission p.697.

40. Western Australian Farmers Federation, Submission p.374.

41. Bureau of Rural Science, Submission p.227.

significance of land degradation as a regional or national problem.⁴² It would also be of particular use in showing elected representatives and decision makers the real costs of failing to address the ongoing problem of land degradation.

4.51 It is acknowledged that overclearing of native vegetation is a major cause of land degradation, and that revegetation can play a key role in resolving the problem. The Institute of Foresters considered that tree replacement will be essential if we are to re-develop the fertility of many of our degraded soils and maintain sustainable systems of agriculture.⁴³ Although much research has been carried out into the use of trees to prevent, repair or control land degradation problems, it was suggested that there is insufficient knowledge on how to use trees to their greatest effect. It was noted that it is not possible to predict accurately and precisely the effects specific ameliorative techniques will have on particular sites.⁴⁴ This was due partly to the lack of detailed knowledge on how trees and shrubs interact with the soil and groundwater.⁴⁵

4.52 In order to maximise the potential use of trees to combat land degradation, it has been argued that a greater research effort is needed to understand what regions would benefit most from revegetation, which tree should be placed where, and for what desired effect.⁴⁶ This approach is supported by the South Australian Department of Agriculture which feels that more research is required into developing revegetation techniques to ensure that if landholders undertake a revegetation program they are reasonably assured of success.⁴⁷

4.53 The Institute of Foresters believes that research is needed at the basic or fundamental level into matters such as the role of trees in soil formation and fertility maintenance, and the effects of different species on the chemistry and water status of soils.⁴⁸ They also considered that more applied studies are needed into such factors as species selection and planting technology, and the potential contribution of trees to farm incomes.

4.54 There has been widespread support from government bodies, researchers and landholders for increased research into alternative, economically sustainable systems of farming that promote conservation of land resources. It has been suggested that more information be developed on the techniques and the costs and benefits of different conservation farming measures. In

42. Upstil, G. and Yapp, T. Offsite Costs of Land Degradation. In. Chisholm, A., and Dumsday, R., 1987. Land Degradation, Cambridge University Press, Cambridge.

43. Institute of Foresters, Submission p.812.

44. John Field, 1988. Research on trees as an agent for soil and land conservation. Soil and Water Conservation Association of Australia Newsletter 10.

45. Richard Ekersley, 1989. Regreening Australia: The environmental, economic and social benefits of reforestation, CSIRO Occasional Paper No 3, p.3.

46. *ibid.*

47. Evidence, p.250.

48. Institute of Foresters, Submission p.822.

particular, there have been many calls for improved understanding of conservation tillage farming systems, which involve maintaining a protective layer of stubble or crop residue on the soil surface to conserve soil and water. Conservation tillage methods minimise soil disturbance and maximise soil cover, and are promoted as an effective means of reducing soil erosion and increasing farm productivity. Decisions on the appropriate farming system to adopt will need to be based on benefit/cost analyses of not only the new techniques, but also the traditional management practices currently in place.

4.55 The extent of land degradation in Australia is such that if anything is to be accomplished then it will be necessary to focus government attention and the use of scarce resources in some practical way. The Committee considers that this can be achieved by establishing a mechanism to monitor and review research efforts and to recommend national research priorities. The process would need to be an ongoing activity which would follow the review of research funding that the Committee has proposed should be undertaken by the Soil Conservation Advisory Committee.

4.56 This initiative would require the establishment of a new advisory body or the expansion of an existing structure, with a membership that incorporates a broad range of expertise relevant to land degradation research. The Committee believes that one possible body to undertake the task would be the Soil Conservation Advisory Committee, provided its membership, functions and resources are made compatible with the proposed new responsibilities. The Committee notes that Australian Soil Conservation Council has a role to play in setting and reviewing broad principles and ensuring that national principles are reflected in State programs, however this role needs to be supplemented by the type of ongoing activity that the Committee proposes should be undertaken by a group of experts and practitioners.

4.57 The importance of focusing research effort is such that the Committee considers a mechanism to identify national research priorities is essential. Accordingly, the Committee recommends that:

the Commonwealth Government develop a forum such as an expanded Soil Conservation Advisory Committee comprising representatives of Commonwealth and State Governments, researchers, industry and land holders' associations to:

- . develop national land degradation research priorities and promote related research programs; and
- . monitor the adequacy of research in relation to the priorities.

4.58 Even within the general directions given by national research priorities there will be a need to further focus efforts in some way to ensure the efficient and effective use of resources in funding and implementing solutions to land degradation. Dr Smiles, Chief of the CSIRO Division of Soils, identified two collaborative approaches that would provide such a focus for efforts to resolve land degradation:

- . a product or commodity approach where collaborative effort between CSIRO, the States, researchers and industry-specific landholders is directed at the land degradation problems associated with a particular commodity, such as cotton or wheat; and
- . a regional approach where an integrated effort between CSIRO, State Government authorities, researchers and landholders in general are focused in a particular geographic area - this approach addresses land degradation problems that affect different industries in the same region.⁴⁹

4.59 The commodity approach involves a close analysis of all steps involved in the production of the commodity, enabling efforts to be focused on those areas which are the cause of identified problems. Both approaches provide an effective method of ensuring that the research and its application are integrated. This is preferred to having research undertaken in isolation from the land use which is generating the problem. The Committee considers that the integration of effort would ensure the quick transfer and use of knowledge gained through research. Without such collaboration research and extension efforts will continue to be fragmented.

Administration of Research Funding

4.60 The principal sources of funding for research relevant to land degradation have been the Commonwealth and State governments, and to a much lesser extent rural industry levies. At the Commonwealth level, in addition to the direct funding of CSIRO, the main funding of land degradation research is provided from elements of the National Soil Conservation Program.⁵⁰ Research support is also provided by other Commonwealth programs, such as the National Water Research Program, and several of the Rural Industry Research Trust Funds.

4.61 The National Soil Conservation Program and the National Water Research Program are administered by the Department of Primary Industries and Energy. Research priorities for funding under these programs are determined by the Minister for Resources on the advice of the Soil Conservation Advisory Council and the Australian Water Research Advisory Council, respectively. Rural Industry Research Trust Funds disperse research moneys collected from industry levies and Commonwealth appropriations. Such funds

49. Evidence, p.70.

50. John Kerin, Minister for Primary Industries and Energy, Statement on Research, Innovation and Competitiveness, May 1989, AGPS.

have been established for a number of industries, and are each administered by a statutory council, for example the Wheat Research Council and the Cotton Research Council. Support for research associated with new or smaller industries not covered by their own funds is available through the Australian Special Rural Research Fund.

4.62 The Department of Primary Industries and Energy has acknowledged that research efforts into land degradation suffered from inadequate funding because it was a cross-commodity issue.⁵¹ The current research funding arrangements involving several separate programs, each concerned with different aspects of natural resource management, do not recognise the important inter-relationships that exist between research activities in the areas of soil conservation, water resources and some parts of forestry. The Department has noted that:

"While these programs have each been successful in encouraging research and development in their respective areas, the Government believes that their organisational and administrative arrangements can be improved..."⁵²

4.63 The problems with funding administration are expected to be resolved by new initiatives announced in May 1989 in the Commonwealth's statement on 'Research, Innovation and Competitiveness'. The Commonwealth announced that a new organisation - the National Resources Research and Development Corporation - is to be established to provide integrated administration for research into the environmental aspects of forestry management, soil conservation and water quality. The Commonwealth indicated that the new Corporation will provide a more flexible administrative system than was possible under either departmental or statutory council administration.⁵³ The role that the proposed corporation will have in land degradation research has not been determined and will be strongly influenced by the Board of Directors who will be appointed to manage the Corporation. The Committee considers that this area of research should be a priority for the Corporation and the Commonwealth should appoint Directors with an interest or background in land degradation.

4.64 The Director-General of the Western Australian Department of Agriculture expressed some concern about the Commonwealth Government's moves towards corporatisation of research administration, specifically in regard to its effects on research into land management, soil conservation and land resource maintenance. According to the Director-General, existing research and development corporations have increasingly focused

51. Department of Primary Industries and Energy, Submission p.309.

52. John Kerin, Minister for Department of Primary Industries and Energy, Statement on Research, Innovation and Competitiveness, May 1989, AGPS.

53. *ibid.*

their attention towards marketing, which has meant that "the nearer the research benefits are to the end product, the more likely they are to be funded".⁵⁴ He stated that this trend toward market research is exemplified by:

"the Australian Meat and Livestock Research and Development Corporation, (which) has changed its emphasis from 50 per cent production research to 30 per cent production research and 70 per cent marketing research."⁵⁵

4.65 Given the Commonwealth's intention to administer more of its research funds through research and development corporations, such a trend could have serious consequences for the future funding of soil and water conservation research. The Committee believes that the operations of the proposed corporations will require ongoing monitoring and evaluation to ensure that research relevant to land degradation receives the resources it deserves. The Department of Primary Industries and Energy has acknowledged that the greater autonomy which the Research and Development Corporations have in administering research funds "may be seen as a disadvantage for research that is primarily of a public good".⁵⁶ However, it believes that adequate control and accountability mechanisms will be in place that will enable the government to influence the priority given to resource management research, including that concerned with land degradation.

Research funding levels

4.66 During the inquiry, concern was expressed in submissions and evidence about the inadequacy of, and cut backs to, Commonwealth funding for research relevant to the problems of land degradation. It is widely felt that funding levels were not commensurate with the seriousness of land degradation in Australia and should be substantially increased to ensure the problem receives appropriate consideration. It is difficult to assess the overall level of research funding attributable to land degradation because of the wide range and complexity of funding schemes, and the inadequate categorisation or detail contained in published expenditure reports. However, it is generally accepted that funding for research into natural resource management and conservation has declined in real terms in recent years. This trend is demonstrated by the reduction in Commonwealth Government expenditure on 'Environment' and 'Agriculture' research and development, categories of most relevance to land degradation problems. The Government's 'Science and Technology Statement' released in May 1988 indicates that for the period 1978-79 to 1987-88 average expenditure on 'Environment' and 'Agriculture' research and development declined by 6.8 per cent and 3.4 per cent, respectively.⁵⁷

54. Evidence, p.441.

55. *ibid.*, p.441.

56. John Kerin, Minister for Department of Primary Industries and Energy, Statement on Research, Innovation and Competitiveness, May 1989, AGPS.

57. Department of Industry, Technology and Commerce. 1988. Science and Technology Statement 1987-88, AGPS.

4.67 The reduction in Commonwealth Government expenditure on research has had a significant effect on the CSIRO, which receives the bulk of its funding from direct Budget appropriations. Financial cuts to the main CSIRO Divisions that undertake much of the research relevant to land degradation has resulted in reduction of staff numbers and the cancellation or restriction of current and proposed research programs. The Chief of the Division of Soils stated that:

"In the past six years we have lost more than 30 per cent of our Treasury funds in real terms, and closed one of the four research laboratories of the division. In the process, there has been a net loss of more than 20 professional staff through retrenchment and retirement."⁵⁸

4.68 This trend has caused considerable concern that research into important issues of national interest, such as land degradation, will not receive the attention they require and deserve. The decline in direct Commonwealth appropriation to CSIRO is a result of:

"deliberate policy changes to seek a higher proportion of CSIRO's funding from external (non-government) sources and to seek a larger proportion of government funds competitively through general research and development funding schemes (other government sources)".⁵⁹

This policy shift towards increased reliance on industry funding is likely to disadvantage research into land degradation as it is primarily a public good and not an attractive area for private sector investment.

4.69 The CSIRO Division of Soils made a submission to the Committee proposing that a specially funded erosion research initiative should be developed involving the States and the CSIRO. It was proposed that a soil erosion research group be re-established in Canberra to underpin the Division's field studies and to be interactive with States and other research agencies. The submission stated that because of the significance of water erosion the Division of Soils developed, in Canberra in the 1970's, a raintower-flume laboratory to provide basic understanding of erosion processes. This unique facility became the centre of collaborative research between CSIRO and State authorities, and attracted researchers from overseas. In the 1980's, however, budget cuts saw the withdrawal of CSIRO and the States from this area of erosion research, and the Division of Soils has effectively "mothballed" the central facility to maintain the field studies. These now require the more basic insights that could be generated by the central facility.

58. Evidence, p.597.

59. Budget Related Paper No.10. Science and Technology Statement 1989-90.

4.70 The Committee believes that if the government is serious in its commitment to resolving land degradation problems it should consider implementing special provisions to ensure that those Divisions of CSIRO that are engaged in work specifically directed at land degradation are adequately resourced. The Committee considers that this could be achieved by making a special subvention to those Divisions to maintain their level of funding equal in real terms with that existing in 1982. The Committee recommends that:

- . the Commonwealth recognise the special importance of land degradation research carried out by the CSIRO and the difficulties involved in attracting external funding for this research;
- . the Commonwealth make a special allocation of funds to at least restore the resources of the CSIRO Division of Soils to 1982 levels; and
- . the CSIRO establish a consultation and co-ordination panel to facilitate co-operation with the States and to integrate activities within CSIRO.

4.71 Although co-operation exists between CSIRO Divisions located in different Institutes, the Committee considers that the above mentioned consultative panel proposed would require more formal co-ordination mechanisms to ensure proper identification of priorities and allocation of resources. The Committee suggests that a management Committee including the relevant Institute and Division heads would be one possible means of contributing to more effective co-ordination.

Training and Education

4.72 If the results of research and surveys are to be translated into improved land management practices there needs to be effective awareness campaigns and education processes in addition to extension services. The attitudes of land managers and their capacity to deal with the information they receive from extension services is of one of the keys to redirecting Australian agriculture towards sustainable land use. The Committee found that the need for awareness campaigns and general information distribution was well understood by the Commonwealth and State authorities. There was ample evidence of effective programs with good material being made available to rural land managers and the community in general through a variety of mediums. This effort has extended to the preparation of materials for schools however the capacity of teachers to utilise this material may be limited. The Department of Primary Industries and

Energy stated that some educators have felt insufficiently informed on land degradation and soil conservation matters to be able to provide suitable course material. This lack of confidence by teachers may be reducing the effective utilisation of educational material provided to schools.⁶⁰

4.73 The South Australian government submitted that in South Australia, the Department of Education and the Department of Agriculture have co-operated in including the topic in the geography syllabus. However there was some doubt that the secondary education process was effectively teaching the basic concepts of conservation strategies, principally that of sustained resource use. It was suggested that current school curricula and teaching resource materials be reviewed by educators and resource managers with a view to ensuring that the facts are presented in the most constructive way. A nationally funded State program was proposed - one approach identified would be to organise Commonwealth sponsored national workshops in each State.⁶¹ The Victorian government proposed that the Commonwealth should help to ensure a more systematic and interactive process between the States in education support.⁶²

4.74 The South Australian government proposed a range of Commonwealth assisted initiatives aimed at using the limited materials available at secondary and tertiary level in more efficient ways:

- . the development and sharing of education program throughout Australia;
- . development of a national data base of educational resources related to resource management;
- . the resources should be 'packaged' to permit competent, experienced resource managers to teach;
- . a network of influential people throughout the nation could be developed to promote improvement of resource management;
- . greater use of improved technology in communication systems for teaching purposes;
- . improvement in the information base upon which the course education material is based; and
- . financial support of voluntary community groups where they are providing a demonstrably useful service addressing the needs.

4.75 The Committee agrees that a range of initiatives along the lines proposed by South Australia would be worthwhile, particularly to help overcome deficiencies at the secondary level however it appears that, in terms of general public awareness

60. Department of Primary Industries and Energy, Submission, p.18.

61. South Australian government, Submission, p.32.

62. Victorian government, Submission, p.14.

that much is already being achieved by the State governments with existing programs. Any involvement by the Commonwealth in this area should be subsidiary to the State's efforts. The onus should be on the State governments to develop courses within the state education systems, with the Commonwealth providing funds and co-ordination particularly at the tertiary level. For example representatives of the New South Wales government told the Committee that:

"... educating the people is a State responsibility through the school system. I think the Commonwealth can play a role in tertiary or higher education ... academic institutions can often give the theory but when we are dealing with a lot of these issues that are evolving then often we have to be involved in that training process. We have short courses of three days in our particular technology and the same will apply in other things where we would like to have the university or an academic institution presenting the theoretical part and we would present the practical part. I think there is a function for the Department of Agriculture to be involved in this as well as the academic institutions.⁶³

4.76 The South Australian government raised problems in relation to another aspect of the education and awareness problem:

"However, there also needs to be an improvement in the knowledge of the general community about land degradation. A survey, undertaken by the Commonwealth Government in June 1988 showed that within the South Australian sample population, 93% had heard about land degradation in general terms, but only between 6% and 30% could be specific about the types of land degradation (water, wind etc.). Level of education had little effect on the results."

4.77 The national results of this survey showed that controlling soil damage was ranked fourth overall in response to the question of what was the most important issue for the government to concentrate upon. This ranking was ahead of that achieved by other popular environmental issues such as forest preservation and protecting rare plants and animals.

4.78 The view of the apparently low level of public knowledge about land degradation may be somewhat pessimistic and although the level of technical understanding may be low it appears that there is an acceptance of land conservation problems in the

63. Evidence, p.169.

community. The Department of Primary Industries and Energy referred to an earlier survey that found there was strong general community support for soil conservation, much more than is generally presumed. In a survey of 1105 households in New South Wales, more Australians appear concerned about conserving the soil than about saving rainforest or preserving rare kangaroos. Further, there appeared to be widespread support for a relative increase in public expenditure to prevent soil erosion. This high level of support was found in all income classes of Sydney including two ethnically-oriented test suburbs. In this survey, most conservationists also rated land degradation as a major issue above rainforest conservation and energy conservation.

4.79 A more serious problem identified by the Committee was the deficiencies in tertiary programs and the serious shortage of professionally trained soil scientists for field work and research. Dr Smiles told the Committee that increased funding associated with a National Conservation Strategy can only lead to immediate increased national benefit if well trained people are available to implement it. Australia, at the moment, does not have sufficient knowledge about its soils, nor the supply of trained people to effectively service the various community projects so vitally important for the success of the scheme. This assessment of the current situation was supported by the Department of Primary Industries and Energy whose representatives stated:

"... in Victoria I believe about two or three facilitators or co-ordinators are operating. The number of groups in Victoria total about 49 at the moment. They estimate that in a year's time about 150 groups will be operating. The facilitators at the moment cannot keep pace with the demands. How ... are they going to keep pace in 12 months' time when you triple the number of groups that are going to be seeking assistance. It is a very serious problem."⁶⁴

4.80 This problem also has serious repercussions for research program. Dr Smiles stated

"The Division of Soils' problems in relation to trained people, apply more to the research end of the spectrum ... Only 6 of the 19 young scientists I have been able to appoint in the past eight years, however, have been Australian, and the continuing decline in numbers offering, and their quality, are issues that must be of great concern to Australia. The problem is not restricted to the research and teaching area. Australia has about 1,000 trained soils people at present. If we assume a working life of (say) 35 years

64. Evidence, p.650.

we need to replace them at the rate of about 30 each year. In fact the age structure suggests that the rate should be closer to 50 each year for the next ten years just to "maintain the line". A quick count indicates that we are producing about 30 well trained people annually."

4.81 An example of the difficulties being encountered Dr Smiles referred to the situation at the University of Sydney where there was two senior vacancies for a Soil Chemist and a Soil Physicist, and a great difficulty was being experienced in finding a suitable Professor of Soil Science. The lack of soil scientists reflects the low number of students entering tertiary level agriculture courses. Professor Ferguson stated that the number of applications has been declining quite seriously and he believed that this reflected negative perception of agriculture in the community at large.⁶⁵

4.82 The problem of the low number of graduates from tertiary agriculture course was considered by representatives of the Victorian government to be not so significant in the face of the very limited number of recruitment opportunities over a long period.⁶⁶ This situation appears likely to change in the near future and the Victorians pointed out that they recently have undertaken extensive recruiting from the agriculture faculties. They suggested however:

"the other point to make in relation to this area is that you do not have an individual on an issue; you do have multi-disciplinary teams in all these things; and you do have the need to integrate disciplines and specialists in a number of different areas so that you get good material in the form of the people within the service and within that activity. Experience is what gets those people into the area where they can follow the interactions which are being discussed. I do not think you will ever get a person trained in all these things in one spot because it is just not possible in the student training program to develop that kind of understanding of the need for interaction."⁶⁷

4.83 This leads on to the suggestion that there is a need to provide continuing education and development opportunities for professional staff in land management authorities in addition to increasing undergraduate training programs. A sub-committee established by the Australian Soil Conservation Council to review tertiary education related to soil conservation found that there were not many courses available and the number could not be

65. Evidence, p.414.

66. Evidence, p.374.

67. Evidence, p.375.

increased due to the lack of funds. An officer of the New South Wales Department of Agriculture told the Committee that the sub-committee concluded that:

"the sort of course that we were trying to run should be run at a college of advanced education type of institute. In fact, the two that were looking the most suitable were the Riverina Murray Institute and the Canberra College. That was based on staff they had available. It was based on the fact that they were in the country and therefore could run country based courses with field work which was an essential component of the work. They were flexible enough to be able to do it, whereas the universities are generally not very flexible in taking on those sorts of courses. It was a short three-month course we had in mind. It was a training course where people would go and get a diploma and they would live in for a three-month period"⁶⁸

4.84 Another institution that is well placed to present such courses is the Roseworthy Agricultural College in South Australia. The College which has been designated as a key centre for teaching and research in agriculture offers five undergraduate courses and two post-graduate course, each having the common theme of management of rain-fed land systems for maintenance of long-term productivity of food and fibre, natural ecosystems and aesthetic values. The Committee visited the College and met with its staff to discuss the college's role in teaching and research.

4.85 Roseworthy sees itself as an applied teaching and research institute and course development centre. It is the only designated 'key centre' concerned with agriculture and land management. The College sees scope for the endowment of special professorships to take advantage of the situation where they have agriculture and natural resource management at one institution. It is also working on computer based information systems that could be used by land managers including farmers.

4.86 The College has had discussions with the CSIRO Division of Soils with the aim of utilising National Soil Conservation Program funds to jointly develop programs which will upgrade the skills and knowledge of practising soil extension officers and researchers. Roseworthy only has one person working in this area but has the capacity to develop courses while CSIRO has the professional expertise and staff.

4.87 Professor Ferguson expressed a preference for shorter courses for practising professionals and referred to postgraduate programs of course work to build on existing skills and experiences. His submission referred to proposals being considered by the Department of Agriculture and Forestry at Melbourne University for an innovative form of postgraduate diploma course work in agricultural extension, based on a block

68. Evidence, p.170.

release system. While the primary intent of the program is to service the requests for training of staff in extension work and agribusiness generally, it would also offer an important vehicle for introducing further training in relation to whole farm planning and more appropriate forms of land management. Earlier applications for financial support from the Australian Special Research Grants Council were unsuccessful; the Council preferring to adhere strictly to the funding of research, not training programs.

4.88 Dr Smiles proposed a number of measures to help overcome the problems at the tertiary education level. He submitted that:

"there needs to be a public reappraisal of attitudes to land management and rural industries, in particular, there is a poor perception of their technical and managerial sophistication and hence of their decision support needs in relation to profitability and sustainability. And there are social as well as economic pressures that tend to result in the less able and innovative remaining on the land. These perceptions are, to a large extent, responsible for the quality of technical support and trained people now being produced.

There should be enhanced support for training at all levels. For example, in the 1950's and 1960's there were up to 14 scholarships awarded each year in the University of Sydney to train agriculturalists. They were discontinued in the early 1970's. They should be re-established as the universities accept that they have an obligation to meet real community needs.

This Division is developing land management courses with the University of Adelaide, and with James Cook University of North Queensland. We cannot sustain those actions, however, without support, and without overcoming deep suspicion from the universities of our motives.

There is also a need to train research professionals. We are directly funding four PH.D. students within the Division as a contribution to the situation, and supervising, for Universities, a dozen more. Now even this source is drying up, and we are

in the process of returning to the National Soil Conservation Program, funds allocated to support a PH.D. studentship to work in soil acidification research because we were, after advertising twice nationally, unable to attract a suitably trained Australian graduate."

4.89 The Queensland Agricultural College submitted that the qualifications of professionals working in the land degradation area must be multi-disciplinary science based, with a sound background in economic, social and political analysis. An integration of these facets of planning is essential to rational decision making in land degradation problems. In particular these professionals need to be qualified in the agricultural (plants and animals) fields.

4.90 The College suggested that academic courses in the management of land degradation were technology based and that there were special requirements that needed attention. The multi-disciplinary and integrative nature of such courses dictated that they were intellectually more taxing. This had two ramifications. Firstly, class size needed to be smaller to maximise academic interaction. Secondly, related to this interaction, staff input need to be significantly higher. The implication was, that if a 'quality product' was to be developed by a professional course in land degradation control, there was a significant increase in cost per student. The College also pointed out that the specialist nature of such courses required specialist equipment. There was a need to expose students to a wide variety of equipment to increase graduate effectiveness in the field. This caused an increased initial capital cost in establishing courses. It also saw an essential requirement for students to have work experience within the courses. Hence there was a need for employer groups to be co-operative and use these students in real work situations.

4.91 The College proposed a number of measures to assist the tertiary training of land degradation specialists. They suggested that, due to the large cost in running land degradation specialist training, additional funding assistance to the educational institutions was needed for each student that embarked upon such a program and that special capital grants were required to purchase equipment and develop facilities to educate these students.

4.92 The Committee is concerned that the capacity to deal with land degradation problems is at serious risk from the lack of suitably trained soil conservation professionals and the apparent inability of tertiary institutions to produce significant numbers of graduates with appropriate qualifications.

This problem needs urgent consideration and the Commonwealth will need to take the lead in finding solutions to this national problem - although the implementation of these solutions will depend on the States. The Committee recommends that:

the Minister for Primary Industries and Energy and the Minister for Employment, Education and Training establish a joint departmental working party to urgently:

- . identify tertiary education and continuing education requirements in the land conservation area;
- . develop programs to promote the courses that are available, and identify measures to attract more students; and
- . identify assistance measures required to support key institutions.

4.93 The Committee further recommends that:

the inter-departmental tertiary education working party operate in close consultation with the States, through the relevant ministerial councils and with CSIRO.

