Drawing new lines in the landscape

Fragmentation of native vegetation and wildlife habitat in Australia's extensive areas of cleared agricultural land is one of the greatest threats to biodiversity.

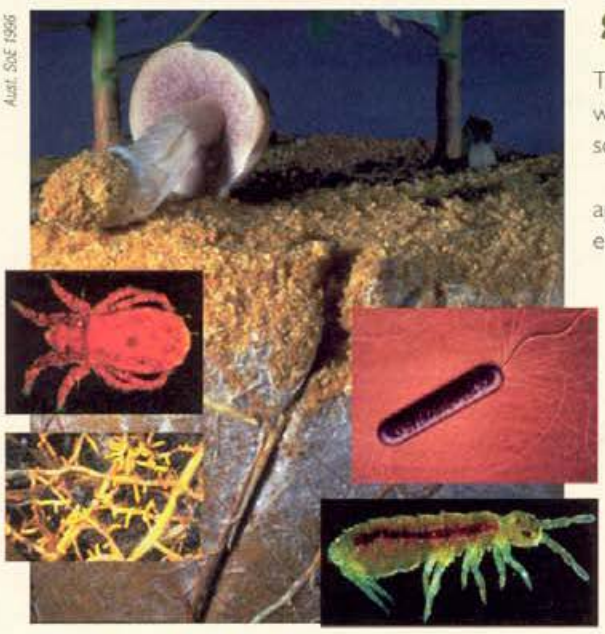
In the shire of Kellerberrin, in the central wheatbelt of Western Australia, clearing of native vegetation for agricultural development has caused salinity; soil erosion; rainfall and nutrient run-off to watercourses; and extensive declines in bird and mammal species. Kellerberrin's story is summarised in Chapter 4 of *Australia: State of the Environment 1996* to illustrate the effects on Australia's biodiversity of vegetation clearance and fragmentation.

The reference group that prepared the Biodiversity chapter was chaired by Dr Denis Saunders from CSIRO's Division of Wildlife and Ecology. Saunders and his colleagues from the Division in Western Australia have spent more than 10 years studying the Kellerberrin region: documenting the effects of land degradation on biodiversity, and working with farmers to address its decline. He says the ecological sustainability of this and other extensively-cleared agricultural areas in Australia will depend on whether land managers can successfully integrate nature conservation with commercial production.

Saunders sees the removal and fragmentation of native vegetation and wildlife habitat in Australia's extensive areas of cleared agricultural land as the greatest and most immediate threat to Australia's biodiversity. 'As a community, we tend to be putting a lot of conservation effort into saving our forests, but while many forest areas are intact, our agricultural areas have experienced massive extinctions, yet we are not devoting the conservation effort they need' he says.

'At the moment in virtually all the production systems we see, we are losing species. To address these declines we need to equip land managers with a vision of what these production landscapes should look like in the long term with production and nature conservation being integrated.

'If you looked at the Australian landscape, you'd think that nature grows in straight lines. We need to replace artificial management structures with ones that reflect natural landscape processes. We also must understand that the soil itself is a living entity that drives the production systems on which we live. Soil formation processes in turn are driven by elements of biodiversity which must be maintained.'



Aust. SoE 1996

Sustaining soils

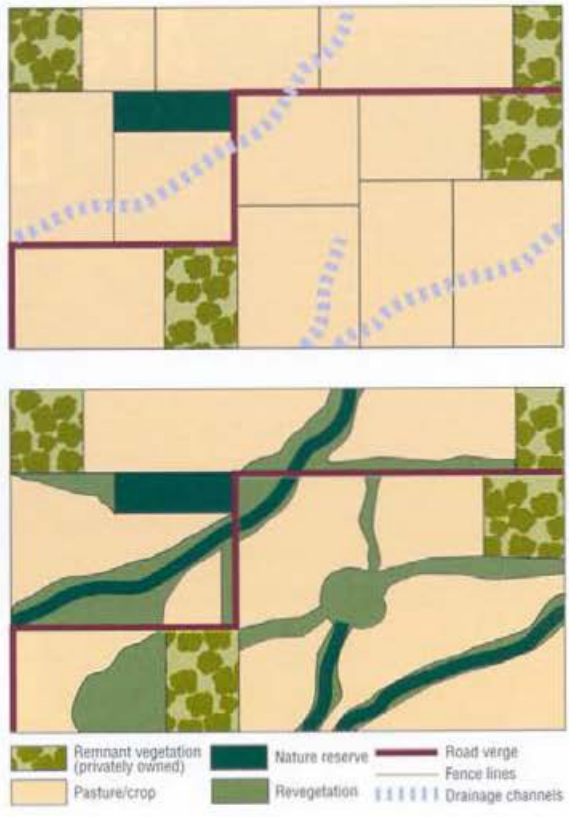
THE health and fertility of soil is maintained by a diverse range of organisms whose activities cycle carbon, nitrogen, sulfur and phosophorus, and maintain soil structure.

Human activities (such as cultivation, irrigation and fertiliser and pesticide application) alter both the chemical and physical characteristics of the soil. The effects of these practices on soil biodiversity are poorly understood, but it appears that soil acidification in many parts of Australia is adversely affecting nitrogen-fixing bacteria which aid the growth of many crop and native plants.

Loss of the soil's biodiversity, as a consequence of cultivation, is associated with loss of its structure, making it subject to erosion. The destruction of mycorrhizal fungi, which forms a symbiotic association withe many plants, can adversely affect the prospects of plant recolonisation.

While most soil biodiversity is yet to be discovered, it is clear that species of soil biota are tightly linked functionally to above-ground biota. The preservation of familiar plant and animal biodiversity is therefore dependent on soil biota.

Bill van Aken, CSIRO Water Resources



Landscape linkages. The top diagram shows a section of an agricultural landscape showing remnant vegetation, reserves, roads, paddocks and drainage lines.

The lower diagram depicts a revegetation plan that provides linkages along road verges and drainage line to connect remnant vegetation. (Souce: Aust. SoE 1996, after Hobbs *et al* 1993)

The *Australia: State of the Environment 1996* report warns that while enthusiasm for tree planting has generated community-based projects such as Save the Bush and One Billion Trees, this activity has not been planned on an ecological basis. Many plantings have had a single purpose (such as control of soil erosion and salinisation) and have centred on individual properties. It is better to ensure that tree-planting has potential multiple benefits (for example plantings for soil erosion can be designed to provide habitat) and is placed within a broader planning framework, the report says.

Saunders and his colleagues advocate the establishment of landscape linkages through planning and planting in line with landscape features. This approach, applied on a regional scale, offers opportunities to enhance the benefits from tree planting at a property/local level. The benefits of extensive networks of vegetation for the protection of water and soils and for the maintenance of biodiversity have wide recognition. It is generally accepted that corridors (see diagram) serve to ameliorate the process and consequences of fragmentation.

Farmers, rather than developing isolated management plans that begin and end at boundary fences, need to work with neighbours to implement nature conservation measures across entire regions, Saunders says. They must ensure that their actions are building on the actions of others across the landscape.

'The potential of Landcare as a mechanism for achieving these goals is not being realised,' he says. 'The concept of people joining to manage the land on an ecological basis is marvellous. It is time for them to appreciate that revegetation must be done with nature conservation in mind as well as production objectives: that means conserving biota in production landscapes. This is starting to happen in some areas, but greater research and financial support is needed.'

In addition to changes in farm management, the structure of government authorities requires realignment, Saunders says. 'At the moment it is difficult for resource managers to work together, because there's a mismatch of management scales. Agricultural regions don't tally with nature conservation or water catchment regions. We need a hierarchy of scales that enables integration between all relevant parties.'

The need for 'bioregional management' is a recurring message in *Australia: State of the Environment 1996*. The report warns that although the requirements of bioregional management are partially recognised, enormous efforts are still required to fully develop and implement them. For example, more needs to be learned about Australia's biodiversity before strategies can be developed for achieving sustainable production.

In all, Australia is home to more than one million species, but less than 15% have been described. 'We need to know much more than we know now,' Saunders says. 'We need to learn more about soil formation processes, the hydrological balance, and how to integrate conservation into production systems. We have a goal of ecologically sustainable development, but we really don't know how to go about it.'

Greening Australia Victoria

When planned on a regional scale, tree-planting can have multiple benefits such as providing habitat as well as protecting soils and water.