

## Towards sustainable agriculture

Sheep and cattle roam over 768 million ha of Australia —that's more than 60% of the total land area. But just 3.6% of the country supports more than 40% of the grazing animals. This is the land that has been 'improved' by the sowing of exotic pasture species and the use of fertiliser.

Pasture improvement began in Australia just 70 years ago, and has produced vast increases in productivity. Various worrying developments are threatening those gains though; these include the acidification of soils over large areas and changes in the botanical composition of the pastures. If Australia is to achieve 'ecological sustainability' in its agriculture, these problems must be overcome.

Most of the sown pasture is in temperate areas of eastern and south-eastern Australia and in country enjoying a Mediterranean climate in the west and south of the continent. This productive land is the focus of the latest initiative in CSIRO's \$2.2-million-a-year Land and Water Care Program.

The Program, which got under way in early 1990 — the beginning of the Decade of Land Care — seeks to develop practical land use systems that will prevent further land degradation, restore areas already damaged and maintain long-term productivity. Research teams from CSIRO are collaborating with Land Care groups, agriculture and conservation departments and a variety of interested organisations and individuals across Australia in the work.

Armidale, on the New South Wales Northern Tablelands, is base for the temperate pasture work in the new project. According to Dr Keith Hutchinson, a long-time student of grazing and its effects on pasture at the CSIRO Division of Animal Production research station there, land managers will need to apply an 'ecosystem perspective' if they are to meet the challenges of ecological sustainability. 'Management traditionally favours the grazer rather than the grazed', he says. 'We have neglected the regenerative needs of the grazed plant, which is often grazed year-long and selectively.' He says even less attention has been given to the soil and to the organisms

in it that have the essential role of recycling plant nutrients.

The research at Armidale will attempt to define the major causes of undesirable changes in the temperate pastures' botanical composition and of decline in their productivity. An important source of information will be the vast quantities of data accumulated during a 28-year experiment, now in its final stages, to determine the long-term effects of different stocking and fertilisation regimes on pastures. The researchers will also be evaluating ways — involving spelling, cultivation, reseeding, various grazing management options and the use of herbicides — to restore and sustain the pastures.

So that change can be monitored effectively, the researchers are developing remote-sensing methods to assess growth, botanical composition and soil organic matter status. Other work focuses on methods for better matching of pasture species with farm and regional environments, and

assessment of the impact of agrochemicals on pastures. One study will investigate what effect, if any, one of the most potent drugs used against sheep and cattle worms, ivermectin, has on nutrient cycling in the soil. The concern is that traces of the drug in the animals' dung may decrease the activity of soil animals and micro-organisms.

In Mediterranean environments, a worrying element of pasture decline is the gradual reduction in clover content, partly as a result of increasing soil acidity. Scientists from the Divisions of Animal Production and Entomology based in Perth hope to develop better ways to manage the acidity problem. In seeking ways to improve clover seedling survival they will also investigate how grazing, pests and competition from other plants affect the clover. Their general goal is to develop management techniques that will maintain stable and resilient pasture systems.

While this research on sustainable pastures is just starting, other parts of the Land and Water Care Program are reporting progress. For example, an efficient way to identify areas of a farm susceptible to salinity or waterlogging has been developed, and a new method for handling remote-sensing data is providing better assessments of land degradation. At Townsville, Qld, researchers working on prediction of the risk of soil salinisation after tree-clearing in northern Australia's semi-arid woodlands have devised a way to combine satellite imagery dating back as far as 1975 with the much more sophisticated imagery available now to track the progress of clearing.

The Land and Water Care Program aims at developing ways to conserve soil and control salinity, to sustain production and restore degraded areas in rangelands and cropping land, to maintain livestock and pasture productivity and to re-establish trees on land that is eroded, waterlogged or saline. Researchers estimate that about half of Australia's agricultural land is already degraded in some way and that the lost production costs some \$1.2 billion per year. Achieving an ecologically sustainable future for Australian agriculture is clearly a major challenge.

