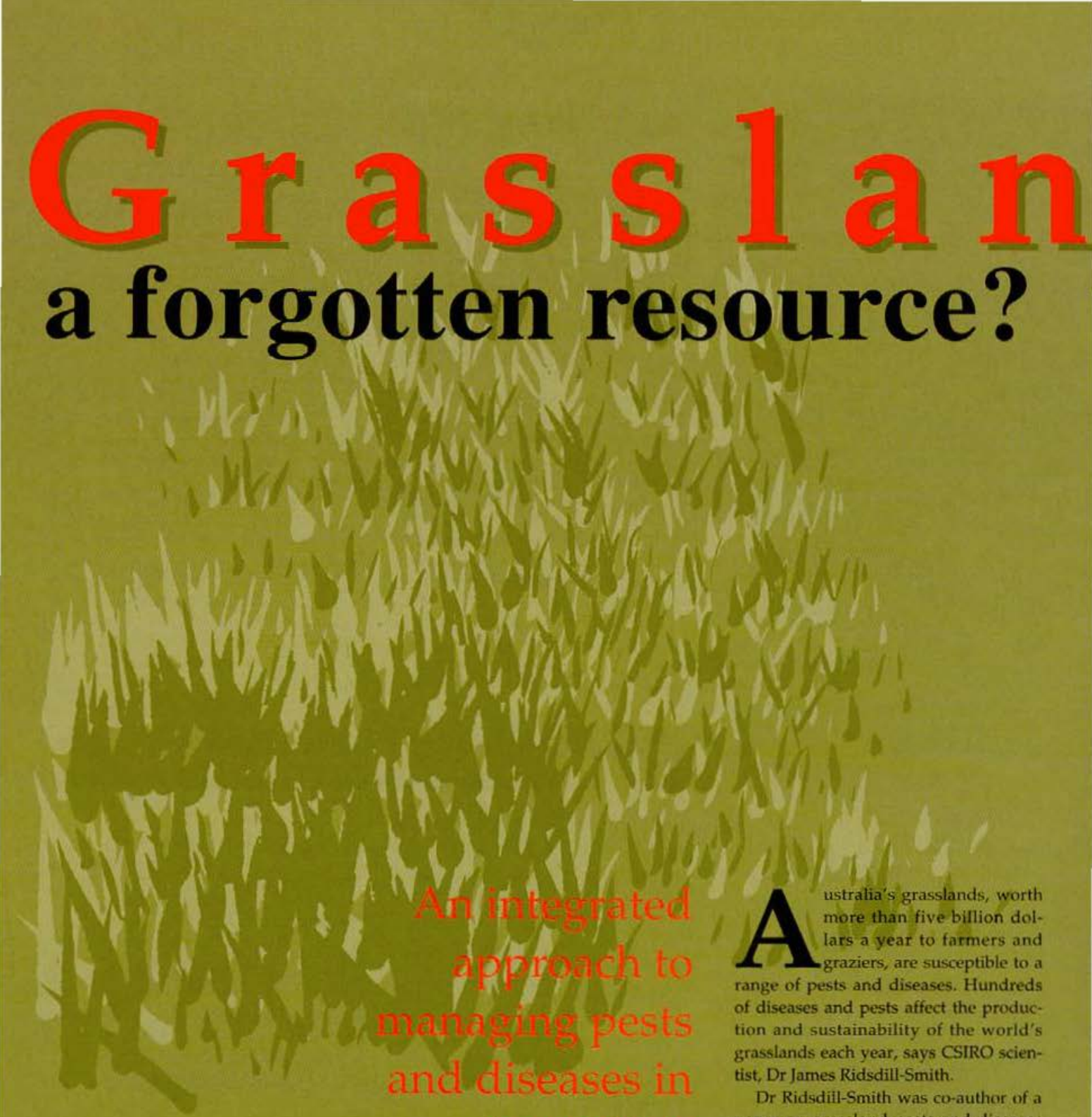
Grasslan
a forgotten resource?



An integrated approach to managing pests and diseases in Australia's grasslands is vital to ensure their survival.

Jenni Metcalfe

Australia's grasslands, worth more than five billion dollars a year to farmers and graziers, are susceptible to a range of pests and diseases. Hundreds of diseases and pests affect the production and sustainability of the world's grasslands each year, says CSIRO scientist, Dr James Ridsdill-Smith.

Dr Ridsdill-Smith was co-author of a paper on grassland pests and diseases presented at the International Grassland Congress, held in New Zealand and Rockhampton earlier this year.

'Grasslands are a forgotten resource,' Dr Ridsdill-Smith said.

'Yet, they are more important to Australia's economy and environment than rainforests, wet lands or coral reefs.'

Delegates at the International Grassland Congress have called for a decade of grassland care across the world to ensure the long-term survival of these areas.

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Dr Ridsdill-Smith said the long-term survival of grasslands depended on better pest and disease control, but barriers had to be overcome if research and new technology was to be developed and accepted by farmers and environmentalists.

Unfortunately, environmentalists often see agriculture as a major threat to natural environments. This puts plant production scientists under suspicion so that they are not accepted as credible authorities on environmental impact issues.

'This credibility gap needs to be overcome,' Dr Ridsdill-Smith said.

'Agricultural scientists have a significant and valuable role in helping to develop environmentally sound control mechanisms for pests and diseases of fragile grassland environments in dry and wet zones, deserts and hill lands.'

Dr Ridsdill-Smith also said most farmers probably underestimated the full impact of pests and diseases on their pasture and animal production.

'Lack of understanding about pest problems is not only a failing of farmers and their consultants,' he said.

'It is also a problem with politicians and science administrators preoccupied with short-term problems and current budgets.'

A study by the Australian Wool Corporation has indicated that pests and diseases contribute to losses of up to 10-20% of animal production from Australia's grasslands.

'This translates into big money,' Dr Ridsdill-Smith said.

Every grassland region in the world was represented at the International Grassland Congress held in February in New Zealand and at Rockhampton, Queensland.

More than 1300 scientists from about 100 countries discussed ways of cooperating on research of international significance. The articles on these pages are based on papers presented at the congress.

Congress organiser, Dr Barry Walker, says grasslands cover 50% of the world's land area and are a vital resource for the world's people, supplying most of their food and much of their clothing. He says the importance of grasslands has been long underestimated by the world's economists and politicians.

Issues addressed at the congress included the impact of deforestation; the preservation of biodiversity; the use of pastures in mixed cropping systems; sustainable pasture management; pest and disease control; climate change and the value of tropical legumes.

'And it doesn't take into account the more insidious, ongoing damage from pests and diseases which affects things such as feed quality.

'We estimate that pests and diseases could cost up to one billion dollars in lost production each year in Australian grasslands.'

Dr Ridsdill-Smith also warned that pests and diseases affected the sustainability of grasslands.

'Severe pasture run-down due to pests or diseases can lead to loss of desirable pasture species and to erosion problems,' he said.

'Current control mechanisms may also reduce the survival of beneficial natural enemies or lead to contamination of soil and water.'

Pests and diseases appear to cause more damage in the Southern Hemisphere than the Northern Hemisphere. This is because many of the sown pasture grasses and legumes came from the Northern Hemisphere. Pests and diseases have therefore developed in the absence of adapted natural enemies and controls. Australia's high climatic variability increases the impact of the damage.

Dr Ridsdill-Smith said a long term view was needed in focussing research on the problems of pests and diseases.

Integrated pest management

There is a pressing need for effective, integrated pest management programs, particlularly in light of the recent withdrawal of DDT and the desire of both farmers and the community to reduce the use of chemicals on pastures.

'The most urgent research need is to design integrated pest management systems that are based on a better under-

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1. **The whirlygig mite *(Anystis wallacei)*, an introduced predator of the redlegged earth mite.**
2. **Redlegged earth mite *(Halotydeus destructor).***
3. **Blue-green aphid *(Acrythosiphon kondoi).***

standing of the biology and ecology of the pests,' Dr Ridsdill-Smith said.

'Current integrated pest management programs in Australia are spasmodic and fragmented.

'Where chemicals are required, they should be specific to the pest targeted and applied at the right time for that pest.'

Dr Ridsdill-Smith said that while chemicals would always have a role to play in pest control, especially with unexpected outbreaks or establishing pastures, they needed to be used more effectively and less indiscriminately.

'Many farmers are spending big dollars on pest control that may not be necessary,' he said.

'About half a dozen pests cause the majority of the problems and a better understanding of their biology will help us plan better management systems.

'Most farmers don't react to pest or disease infestation until extensive pasture damage is obvious. Then it is too late and they use chemicals when it could have been avoided if better control techniques had been used at an earlier stage.

'Farmers, consultants and advisers need to appreciate the complex life-histories of pests and diseases and the need to recognise problems early on.'

Dr Ridsdill-Smith said better information was needed to plan more effective control of pests and diseases. The information needed includes:

- simple methods for assessing the populations of pests and diseases;
- accurate estimates of the direct impacts of pests on pasture production under different seasons, soils, pastures, climates and farming systems;
- the exact costs of controlling pests and diseases;
- a description of the distribution of pests over time as well as space;
- measurements of the indirect impacts of pests, such as effects on soil erosion and soil fertility;
- better knowledge about the natural controls of pests;
- better understanding of the key interactions between beneficial organisms and pests and diseases; and
- the social impact of repeated pest attacks on farmer attitudes.

'Research needs to be integrated and organised better across organisations,' Dr Ridsdill-Smith said.

The current research program into the redlegged earth mite is an example of cooperation headed in the right direction. This pest causes production losses worth $200 million a year to southern Australia's legume pastures.

Research is being carried out in all southern states on ways to combat this pest. One group in Western Australia is

Global change: good or bad

Grasslands are almost as important as forests in cycling greenhouse gases, and soil under grasslands stores as much carbon as soil under forests.

Today, however, many of the world's grassland economies are affected by tough economic, ecological and political conditions.

Rangelands, which cover more than half of Australia's grazing lands and include most of its native grasslands, are particularly threatened by harsh seasonal conditions, poor market prices and the environmental dangers of soil erosion and weed invasion.

CSIRO scientist Dr Mark Stafford Smith says that the issues facing Australia's rangelands are similar to those facing other grassland regions.

'Productivity is relatively low, the climate unreliable, and there are often complex land use issues,' he says.

'There are also strong environmental concerns about the damage being done in some areas by high stocking rates or poor management.'

Dr Stafford Smith believes that the survival of Australia's rangelands relies on adopting the economic theory behind innovative industries in variable business environments.

'These industries develop clear long-term goals, focus on product quality, avoid high debt levels, deal constructively with errors, and maintain a high level of innovation in order to keep ahead of society's environmental expectations,' he says.

'Australia's commercial livestock industry needs to take on a product approach to identify a distinctive high quality rangelands product. Something like free range chemical-free beef that can also meet the highest possible environmental standards.'

Stafford Smith's colleague, Dr Barney Foran, agrees with the need for high-quality products from grasslands in developed countries.

'The key to our future management of grassland areas lies in producing high quality products,' Foran says.

'Instead of flooding world markets with food products that poor countries can't afford, we should be developing the highest quality livestock products.

'The real challenge for grassland scientists, after developing a product image and specifications, is to design the grassland system which might achieve it, and then to chart the multiple pathways by which a farmer might attain the product goal, without going bankrupt in the process.'

Global change

A range of longer-term issues are also of concern to grassland farmers. Predictions of future changes in the global environment are uncertain, yet scenarios of climate change could have large impacts on the world's grassland economies.

Global change and its interaction with grasslands was one of the key themes of the International Grassland Congress earlier this year which brought over 1300 grassland scientists from more than 100 countries together in New Zealand and Australia.

Global change encompasses much more than climate change. It includes changes to the concentration of atmospheric gases such as carbon dioxide and other greenhouse gases. It also includes changes in land use, as driven by economic, population, technological and social pressures.

Stafford Smith says that global changes are already happening all around us.

'However, our understanding of their causes and our ability to adapt to predict their consequences is limited,' he says.

Much has been made in recent years of atmospheric climate change and the 'greenhouse effect', but there has been limited research or discussion about the likely effects of global change on land areas, like grasslands.

That is one reason why the United Nations-endorsed International Geosphere-Biosphere Programme (IGBP) has established a core project on Global Change and Terrestrial Ecosystems.

This project, with headquarters at the CSIRO Division of Wildlife and Ecology in Australia, but also involving many other organisations around the world, aims to predict the effects of change in climate, atmospheric composition, and land use on land-based systems such as agricultural and forest production systems.

Scientists predict that global warming, and climate change linked to this, could bring advantages to the mid to higher latitude regions of the

looking at developing resistant subclover varieties while another group is trying to learn more about the biology of the mite, including its sexual behaviour.

CSIRO is collaborating with the Western Australia Department of Agriculture, the University of Western Australia and the Cooperative Research Centre for Legumes in Mediterranean Agriculture in an effort to develop pasture legumes resistant to this mite.

'The best thing about this research program, supported also by the Wool Research and Development Corporation, is that all scientists involved in the program are communicating with each other, no matter which organisation they belong to,' Dr Ridsdill-Smith said.

'Which means we should be able to solve the problem of this costly mite much sooner.'

Dr Ridsdill-Smith said research held many opportunities for solving pest problems, especially with the new technologies available such as molecular plant biology. For example, using advanced genetic engineering techniques, a variety of chemicals could be put into pasture plants to make them less susceptible to pests.

'However, control will still depend largely on more traditional approaches such as the use of management systems, classical plant breeding techniques and biological control,' Dr Ridsdill-Smith said.

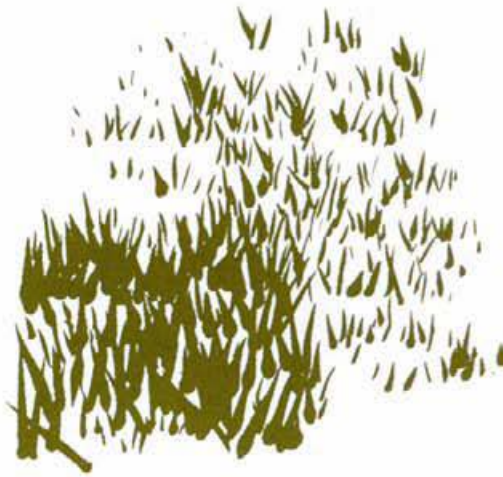
'These approaches need to be based on a thorough understanding of the pests' biology and ecology.

'It is seldom that a simple method can be developed quickly to solve important pest and disease problems.

'We have the research skills in Australia, but we need basic support to do biological studies and then integrate the strategies developed by different workers.

'Pests and diseases, and their effects of grasslands, need to be given higher priority.

'A longer term vision is needed to protect our valuable grasslands for future generations of farmers.'



news for grassland economies?

world such as southern Australia, Canada, northern Europe, Russia, north America, South Africa and China. Conversely, these changes could also disadvantage lower latitude regions such as northern Australia, south east Asia and northern Africa.

The advantage for grasslands from predicted global changes arises from increased carbon dioxide being available for plant growth. At low latitudes, however, plants are being grown near the limits of temperature tolerances and global warming may add to their stress. On the other hand, plants grown in mid to high latitudes are likely to benefit from warmer temperatures and longer growing seasons.

United Kingdom scientist Dr Martin Parry from the University of Oxford has combined climate change scenarios with crop yield models. The results have been further incorporated into a world food trade model to predict changes to world food trade by the year 2060.

Parry argues that what happens to the cropping industries with global changes will also ultimately affect grassland economies. For example, if there are decreases in crop production as a result of climate change then we might expect food crop prices to rise. In turn, crop production may expand into current grassland areas.

On the other hand, increases in food production may lead to reduced food prices and an increased status for grasslands. At the same time, it is reasonable to expect that if crop yields are improved then grassland yields and carrying capacity will also be improved.

Parry's analysis suggested a possible world crop production decrease of between 1-5% might occur as a result of climate change. Estimates of increases in cereal prices resulting from such a reduced production vary from 25 to 150%. Most of the decreases would be felt by developing countries where more pressure would be put on grassland areas.

Parry also predicts that the number of people at risk from hunger will increase with climate change, unless there is full trade liberalisation by 2020. With a full trade liberalisation in agriculture there would be more efficient resource use, leading to a 3.2% higher value added in agriculture globally and a 5.2% higher agricultural GDP in developing countries (excluding China). This means 20% fewer people at risk from hunger.

Of course, as Parry says, these results are not a forecast of the future. The conclusions are very uncertain due to a lack of information on possible regional climate change, the effects of technological change on agriculture, and trends in demands and population growth. But only a complete sceptic could ignore the direction change might take.

Dr Barney Foran, who summed up the issues of the International Grassland Congress for developed countries, says we must plan for the anticipated competition between grasslands and crop plants and for likely-land use conflict.

'The key lies in developing flexible and adaptable options for managing grasslands,' he says.

'These options must be both economic and environmentally friendly in the long term.'

An early step toward reaching this goal for the world's rangelands was the formation of a Global Rangelands Modelling Network at the International Grassland Congress. This network, part of the Global Change and Terrestrial Ecosystems project, is being coordinated by Stafford Smith.

'The aim of the network is to get scientists from around the world working together to look at the effects of global change on the world's rangelands and how these can be managed,' Stafford Smith says.

'We will use a modelling approach to try and integrate as many factors as possible to look at the effects of global change on human activity in rangelands.

'Our ultimate objective is to be able to provide options to managers of rangelands that will work to keep their business profitable and the rangeland environment protected.'

The results will also have important implications for political systems at the local, national and international level.

The key to the survival of the grasslands seems to lie in coping with the present crisis while keeping an eye on likely long-term changes.

'In the face of global change, droughts and tough economic times, grassland managers and scientists need to develop economic strategies and quality products,' Stafford Smith says.