Australian Government
Land & Water Australia

ISSUE 5 • September 2007

ThinkingBush

Science for managing native vegetation in Australian landscapes

Branching Out

NATIVE VEGETATION AND BIODIVERSITY R&D PROGRAM

CONTENTS

Compiled by Nadeem Samnakay, Land & Water Australia

Layout by ZOO Design , Printed by Pirion

Published by Land & Water Australia © 2007

Product number: PN071324 SEPTEMBER 2007

Disclaimer

The information contained in this publication is intended for general use, to assist public knowledge and discussion and to help improve the sustainable management of land, water and vegetation. It includes general statements based on scientific research. Readers are advised and need to be aware that this information may be incomplete or unsuitable for use in specific situations. Before taking any action or decision based on the information in this publication, readers should seek expert professional, scientific and technical advice.

To the extent permitted by law, the Commonwealth of Australia, Land & Water Australia (including its employees and consultants), and the authors do not assume liability of any kind whatsoever resulting from any person's use or reliance upon the content of this publication.

Foreword

John Childs

Issue five of *Thinking Bush* heralds a new direction for this occasional magazine. When Thinking Bush was first published, it came at a time when research into native vegetation management was in its infancy and there were relatively few organisations working in this field.

There are now a host of national, state and regional organisations, both government and non-government, investing in the generation and application of knowledge to better manage our rural landscapes. Many of the organisations with a national interest in native vegetation are represented in this edition – which is why this issue is titled Branching Out.

Previous editions of Thinking Bush have tended to focus on research funded by Land & Water Australia. However, it is now appropriate and timely for Thinking Bush to 'branch out' and publicise important work that is being done around the country by a range of organisations.

This issue of Thinking Bush provides you with a sample of the many issues being addressed by organisations such as the Australian Government Department of Agriculture, Fisheries and Forestry, the Bureau of Rural Sciences, CSIRO and Greening Australia. Together, these organisations form part of the 'Partners in Vegetation Management' group, a bunch of national organisations which are collaborating to improve the delivery of information to NRM practitioners.

As in the past, there is also news from projects supported by Land & Water Australia. In this issue we cover three projects that are building upon the knowledge base developed from earlier projects, and we also provide you with some exciting research outcomes that will influence how we manage native vegetation at the landscape scale.

We always seek and appreciate feedback on the value of this publication and its general content. How can it be improved? Is it clear where to seek additional information? Contact details for Land & Water Australia staff are provided on the back cover.

We hope this edition of *Thinking Bush* helps you as you continue to create healthy natural landscapes.

LandWater&Wool
Shaping the future

Land, Water & Wool: Managing for sustainable profit

Jann Williams

The Australian wool industry is one of our largest land users, with nearly 12 per cent of the landscape, or 85 million hectares, currently utilised for wool production nationally.

The industry recognises that by integrating improved natural resource management into the day-to-day activities of woolgrowers, the resulting improved profitability, productivity and sustainability gains to be made will continue to enhance the environmental credentials of Australia's 37,000 wool producers.

The now completed Land, Water & Wool program was the most comprehensive natural resource management research and development program ever undertaken by the wool industry – a $40 million collaboration between Australian Wool Innovation Limited, Land & Water Australia and numerous other investors that ran from 2002 – 2007.

Woolgrowers play a big role in managing natural resources for the benefit of the whole community; this has significant implications for policy and support programs where landscape-level change is the goal.

Importantly, and uniquely, Land, Water & Wool has also given natural resource management practitioners and researchers the chance to appreciate the challenges from a woolgrower's viewpoint. Land, Water & Wool's collaborative approach to research has generated new ways of exchanging knowledge and experience – often changing the perspectives of researchers and giving them better insights into how the environment works and the role of sheep in it.

A major component of Land, Water & Wool was its investment in the Native Vegetation and Biodiversity Sub-program, which successfully demonstrated through a number of projects that biodiversity has a range of values, can add wealth to a business and can be managed as part of a productive and profitable commercial wool enterprise.

By profiling in detail the economic and environmental characteristics of wool producing enterprises across Australia, the research teams and woolgrowing families involved in Land, Water & Wool have established a legacy of new knowledge, management tools, peer networks and invaluable scientific evidence all pointing to the positive contribution that the wool industry can make in improving our natural resources.

Features in this publication of *Thinking Bush* provide an overview of some of the key findings from the Land, Water & Wool Native Vegetation and Biodiversity Sub-program. For further information, visit our website **www.landwaterwool.gov.au** where you can order the final report Land, Water & Wool: Managing for Sustainable Profit and access many more information resources and research papers.

Sustainable Wool Advisory Group Chair and Tasmanian woolgrower Tom Dunbabin (left) inspects sustainably-produced wool at 'Connewarren', in the Western District of Victoria with Ian Rogan, Wool Production General Manager, Australian Wool Innovation Ltd (right). Land, Water & Wool has given natural resource management practitioners and researchers the chance to appreciate the challenges of environmental management from a woolgrower's viewpoint. (Currie Communications)

Are our agricultural landscapes biologically debt-free?

Jim Radford

"Time heals all wounds" or so the old adage goes. But will time heal or inflame the wound that is the perilous state of our native plants and animals? In agricultural regions of southern Australia, extensive clearing of native vegetation and degradation of the remaining natural habitat has resulted in the local extinction of many native species and significant declines in the abundance of many others. For example, recent research in north-central Victoria has shown that when the landscape-level tree cover falls below 10%, there is a dramatic crash in the number of woodland birds present. Even more alarming is that the population size of many birds begins to decrease well before this threshold is reached, with many species showing population declines when tree cover drops below 30-40% of the landscape.

An important question for landscape managers is whether there will be further loss of native species in modified landscapes, even if there is no further loss of habitat. Ecologists have long suspected that some species can 'hang on' in landscapes for some time following habitat loss but in ever-decreasing numbers before eventually disappearing. That is, landscapes carry an 'extinction debt' made up of species that are still present but destined for local extinction. If this is true, the threshold in species richness described above may shift to higher levels of habitat cover with time.

We expect that the rate of population declines (and therefore species loss) will be faster in more extensively cleared landscapes, and in landscapes with less connected habitat. However, most of our knowledge about how the amount and arrangement of native vegetation affects animal populations is based on one-off or short-term surveys – they are 'snapshots' in time. In order to assess time-lags and changes over time, we need repeated, long-term monitoring in agricultural landscapes.

A new Land & Water Australia funded project (DUV 11: Improving landscape design guidelines by considering temporal trends in species richness and population sizes) will begin to address this gap by re-surveying 24 landscapes first surveyed in 2002/03 under a previous LWA funded project (DUV6: Landscape level thresholds for conservation of biodiversity in rural environments). This will allow us to examine landscape-level changes in the bird community between the two time periods, and ask questions such as:

- Have bird populations stabilized in these landscapes or are they still declining?
- Are species more likely to be lost from low, medium or high cover landscapes?
- Are rates of population decline and species loss associated with the degree of fragmentation of native vegetation?

We anticipate that outcomes from this research will improve our understanding of time lags in avifaunal responses to landscape change in agricultural environments. This will complement other landscape-level research at Deakin University aimed at identifying the benefits of revegetation and restoration for biodiversity in rural landscapes (partnership with Glenelg Hopkins Catchment Management Authority), quantifying the extent and consequences of bird movement in fragmented landscapes using genetic markers (ARC Linkage project in collaboration with Molecular Ecology Research Group, Monash University and six industry partners), and developing a framework for predicting the conservation significance of rural landscapes (ARC Linkage project in partnership with Victorian Government, see **http://www.dpi.vic.gov.au/lfa**). Together, these projects will greatly increase the capacity of natural resource managers to assess the long-term risks

Remnant grassy woodland in northern Victoria. Will the number of woodland bird species in this patch decline over time? It may depend on the amount and connectivity of remnant vegetation in the surrounding landscape. (Kelli Fox)

and consequences for native fauna from landscape change and to prioritise actions for landscape restoration.

What did we learn from our initial research?

Many benefits flow from managing rural landscapes in an ecologically sensitive way. Not only will retention and restoration of native vegetation help to sustain resilient populations of native fauna, it will also promote landscapes that are more robust to environmental shocks (e.g. low rainfall, floods, fire), buffer degrading processes (e.g. salinity, soil acidity and erosion, weed invasion), enhance sustainable agricultural production, and contribute to the emotional and spiritual well-being of people.

We have a choice about the types of rural landscapes we want in the future. Our research shows that the woodland bird community collapses below 10% cover – we must aim higher than this. In mosaics with 10-20% cover, many species are in decline but this is enough habitat to support sustainable populations of some species. However, to support most species present in woodland regions in southern Australia, an average of 30-35% native vegetation cover is necessary. It is not practical to have uniform cover of 30-35% on all farms and landscapes, but we need to ensure that areas with high vegetation cover are regularly interspersed among those where native vegetation has been heavily cleared.

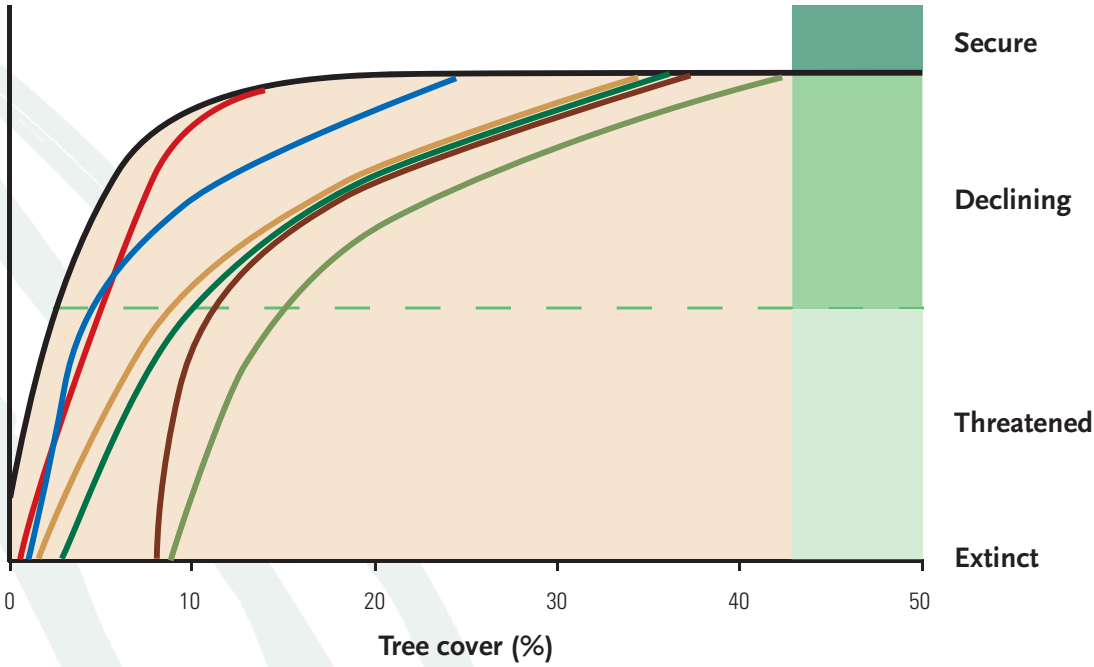
Effective actions to protect and conserve Australia's distinctive wildlife can be undertaken at many levels – for single blocks of bushland, the farm property, the landscape scale and across entire regions. Every property contributes to the land mosaic on which native flora and fauna depend for survival. It is the actions of many individual land managers that together determine the shape of present landscapes and the pattern they will take in the future.

Individual actions do make a difference in rural landscapes:

- Protecting patches of native vegetation, especially key parts of the landscape such as streamside vegetation, scarce vegetation types and large blocks of habitat.
- Tying together the landscape by maintaining natural vegetation along creeks and streams, protecting remnant 'corridors' and 'stepping stones' of bushland, and building on to existing blocks of bush.
- Increasing the total amount of habitat for wildlife by natural regeneration and strategic revegetation.

The author demonstrates a new bird survey technique! (Kelli Fox)

Warby Ranges: Agricultural landscapes can support a diverse array of native animals, depending on the extent and quality of remnant native vegetation. But for how much longer? Have we crossed a tipping-point that will inevitably lead to the disappearance of more species, or are current populations resilient and relatively stable? (Kelli Fox)



This figure illustrates how species richness (black line) may remain unchanged even though many species (coloured lines) are declining. It is only when species become locally extinct that species richness falls. If we react only to a decline in species richness (e.g. at 10% cover in this instance), many species will have already declined to dangerously low levels.

GREY SHRIKE THRUSH

CRESTED SHRIKE-TIT

RUFOUS WHISTLER

DUSKY WOODSWALLOW

WHITE-BROWED BABBLER

EASTERN YELLOW ROBIN

For more information *on DUV6 and DUV11, contact Jim Radford on jradford@deakin.edu.au or (03) 5430 4357 at the School of Life and Environmental Sciences, Deakin University, or visit the research pages on* **www.lwa.gov.au/nativevegetation.** *Project DUV6 has an informative brochure titled "How much habitat is enough?' and the final report detailing research outcomes.*

national vegetation knowledge service

Exchange Incentive Fund adding value to NRM projects

Workshops on wetlands, study tours for farmers and knowledge exchange forums for catchment managers. These are just some of the value adding initiatives supported by the Exchange Incentive Fund (EIF); a small grants program operated by Greening Australia in collaboration with Land & Water Australia and supported by the Australian Government's Natural Heritage Trust.

This flexible funding program contributes around $5000 per approved project. It encourages applications that extend or add value to existing NRM projects and has a firm emphasis on putting research into practice.

As Dave Carr, Greening Australia's National Technical Capacity Manager explains, "Exchange funding can provide the icing on the cake for NRM projects – the extra funding that stretches the value of the original investment through a range of stakeholder engagement initiatives including workshops, forums, field days and extension materials."

Across Australia, NRM practitioners have enthusiastically embraced the EIF and the value adding opportunities it provides. Recent initiatives funded by the EIF include:

- A workshop and field demonstration for 80 stakeholders conducted by partners in the Tree Decline Management Toolbox project, Tasmania.
- A forum of 300-plus NRM practitioners to share their knowledge and experience of Ecological Vegetation Class restoration in Victoria.
- Four workshops on wetland assessment techniques for NRM practitioners in the northern rivers region of NSW.
- A study tour of native pasture management in the NSW Tablelands for South Australian farmers.
- Funding of travel costs for a Queensland expert on Mitchell Grass management to share the latest research in a hands on field based paddock session for pastoralists from the Pilbara region of Western Australia.
- A knowledge exchange forum attended by representatives from all NRM regions along the Murray River to foster discussion about different approaches to incentive delivery and capacity building.

Can the EIF help you?

Contact the Exchange Team for further information about the EIF (1300 886 589; exchange@greeningaustralia.org.au).

The Team offers advice to potential applicants and can assist funding recipients with project planning and delivery.

Queensland Bluegrass (Dichanthium sericeum) seed production trial in Katherine

Australian Government
Department of Agriculture, Fisheries and Forestry

Native grass seeds an emerging industry

It's not easy to find anything positive about a prolonged drought, but in the Northern Territory the success of native grass seed production trials might provide a long term benefit to pastoralists. The grasses, which go by such evocative names as Cockatoo, Forest Blue and Curly Blue are not only drought-resistant and high in nutritional values, they also require less fertiliser than introduced grass species.

Through the support of the Australian Government's National Landcare Programme (NLP) for the Harvesting Native Grass Seed program in the Northern Territory, awareness is growing of the value of native grass as a sustainable natural resource.

This NLP initiative will assist the harvesting and storage of native grass seeds and developing seed production systems. A database of native grasses is being set up, detailing germination information, and providing graziers with comparative assessments of different species.

According to Sam Crowder, Greening Australia's Rangeland Co-ordinator in Katherine, the potential for a native seed industry is quickly emerging.

'We're basically trying to build an industry from scratch', acknowledges Crowder, 'and we're aiming to focus not only on education but also on developing machinery from harvesting to processing, to help potential producers.'

One of the most important aspects of the Australian Government funded plan is the sustainability of grass seed production. In the 'Healthy Pastures' project the Greening Australia team has been working with local landholders to identify and collect native grass seeds and also to set up intensive field trials.

The NLP funding is crucial because as Crowder notes 'the project is about educating people regarding sowing, harvesting, storage and management of native grasses'. He sees his work as 'educating the market' about the potential of native grass as a valuable resource.

'The goal is to cement the native grass industry in northern Australia, so there's greater awareness about the skills needed to collect and grow the seeds. The drought has definitely been a spur to greater interest from pastoralists, but knowledge is the key. '

Crowder acknowledges that some expectations are probably too high. 'A lot of people want 'super grass' that'll grow on rocks and reach this high and do this and that. So our challenge is to provide detailed information on every species. It'll be baseline information that allows the industry to compare and assess different seeds.'

One of the trials is underway on Barry Fletcher's property 'Shalom' near Katherine. Fletcher is the first to admit he is not an expert in native grasses, but quickly adds he's very impressed with the results so far.

'Just like any grass you sow, I simply prepared a bed and then scattered the seed and rolled it in.'

Initially not much happened, but then about September or October, after brief rainfalls of around 10mm, Barry Fletcher witnessed something happening.

'I noticed all these green shoots coming up, and my son realised it was the native Cockatoo grass. I think this grass is going to be really good. There was no more rain, yet there was this one patch of green – that was the Cockatoo grass – and it was easy to pick out, you could see it really clearly from the boundary', enthused Fletcher.

For Sam Crowder, the aim is to get the native grass seed industry on a secure footing by showing pastoralists the various benefits of the highly sustainable and nutritious grass. To date, the main use for native grass has been mining and infrastructure re-vegetation, but the pastoral industry is a more significant objective.

It's a challenging goal. As Crowder outlines, not only is there community education and on-farm trials, specific machinery has been developed. 'The majority of harvesting is mechanical and we use a small brush harvester. It's a rotating nylon brush, a bit like a street sweeping brush, that's towed behind a quad bike.'

The seeds collected not only provide the basis for further trials, there's also the little known niche market for bird seed. 'You can get good prices for the seeds that people want to feed Gouldian finches and the like. And as for grazing, when the grass is about 2 feet (60cm) high, it makes beautiful feed.'

The end result could well be a better understanding of a natural resource that holds great promise for the pastoral industry in northern Australia.

That's what Sam Crowder is targeting: 'What we'd like to see is native grasses being more appreciated and better understood by graziers—ideally in-depth knowledge about seed collection, sowing and harvesting. That sort of understanding is our goal. Of course, we're not shying away from mining companies and re-vegetation work, that's a fundamental, but mining only covers a small area compared to pastoral activity, and helping graziers realise a valuable asset is very important.'

For more information contact
Sam Crowder, 0427 052 807.

Wild Harvest of Queensland Bluegrass in the Roper River area

Putting it all together: Better Knowledge, Better Bush project moves from research to practice

Summary

Synthesis of key findings from the Better Knowledge, Better Bush project has commenced as the major collaborative research project enters its final phase. Over the coming year, key findings from the project's four research themes will be integrated to address knowledge gaps in vegetation management and assist catchment managers, vegetation practitioners, researchers and landowners in the planning and delivery of biodiversity and native vegetation management programs.

Better Knowledge, Better Bush

The Better Knowledge, Better Bush (BKBB) project is a multi partner research project funded by the NSW government through its Environment Trust to improve the science to underpinning landscape restoration initiatives. The two-year project commenced in 2005 as a collaboration between research organizations (CSIRO, Charles Sturt University, RMIT University) state agencies (NSW Department of Environment and Climate Change) and organizations that implement biodiversity and native vegetation management programs (Greening Australia and Southern Rivers Catchment Management Authority).

The research is organized under four themes: improving knowledge of assets, understanding ecological function, principles and guidelines for restoration and principles and guidelines for managing threatening processes. Twelve sub projects address specific questions related to remnant vegetation, revegetation and native pastures in south eastern Australia. A brief description of the individual sub projects is available from the project website (www.betterbush.org.au).

Better Knowledge, Better Bush research has been conducted at sites across five southern NSW catchments: Central West, Lachlan, Murrumbidgee, Murray and Southern Rivers catchments. The integrated research findings will be directly relevant to these CMAs and will have further application throughout NSW and other states and territories.

Making the links

The Better Knowledge, Better Bush project started with its sights firmly set on integration. A frequent criticism of past research efforts has been that research projects only deal with one facet of a problem and hence the outputs are difficult to translate into

Environmental TRUST

CSIRO

action. This project commenced with a broad conceptual framework that has continued to evolve over time to link together outputs from the individual sub projects and overarching themes to address the broader questions that managers and landowners have in relation to vegetation management and restoration.

A series of multi-purpose workshops were held throughout the project's two-year duration. These workshops were designed to identify links between research projects, further develop conceptual frameworks for integrating results and maximise the exchange of information between researchers.

As well as building the internal links between different researchers and organization, the projects Knowledge Broker, Paul Ryan works between the researchers and the external stakeholders including Catchment Management Authorities and other agencies, vegetation service providers, land owners and other researchers to ensure the project outputs are well targeted towards key knowledge gaps. As the project has evolved, the emphasis of knowledge exchange has been on building relationships, recognizing the most effective interactions occur at one to one level where there can be genuine two way knowledge sharing and exchange.

The next steps

The research phase of Better Knowledge, Better Bush has recently wrapped up with the sub projects delivering final reports, key findings summaries and publications. The project team is now focusing on synthesizing these outputs to provide stakeholders such as policy makers, regional staff and landowners with sets of linked key messages and guidelines about managing native vegetation.

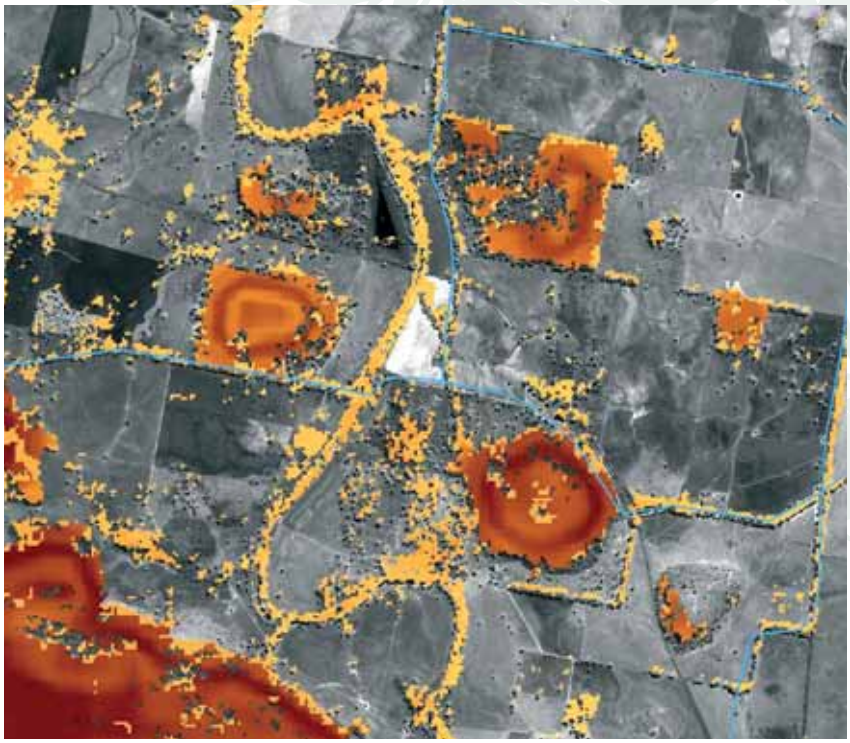
The project team is working closely with representatives from the various target audiences to identify suitable communication pathways and mediums to ensure that outputs from the project are delivered in the right format to the right people. While traditional pathways such as publications, seminars and workshops are playing an important role, the project team is exploring innovative communication methods that utilize the social networks that underpin natural resource management to increase the transfer of knowledge.

For further information:

Paul Ryan,
Knowledge Broker,
Better Knowledge, Better Bush
CSIRO Sustainable Ecosystems
Phone 02 6242 1602
Email Paul.Ryan@csiro.au
www.betterbush.org.au

BELOW LEFT: Researcher Jacqui Stol (CSIRO Sustainable Ecosystems) explains a tree health assessment procedure to participants at a field day looking at ecosystem services. Photo: Michael Bell Photography

BELOW: The BKBB project has explored new methods for linking vegetation assessment at the site scale with remotely sensed data for monitoring changes in vegetation condition over time: Image: Space Imaging LLC, distributed by Raytheon Australia



Integrating production and conservation goals

Jann Williams

Grazing management is a powerful tool available to woolgrowers to integrate production and conservation goals. Both grazing trials and modelling have demonstrated that sheep grazing and the conservation of native plant and animal species can be compatible. In Tasmania for example, some of the best examples of native grassy vegetation have been used for wool production for almost two centuries.

Regardless of what sort of production system woolgrowers, or for that matter any farmers have, it is possible to make a worthwhile contribution to nature conservation. To achieve this, managers need to be informed about the natural values of their property and willing to manage parts of their property for conservation or in a conservation-compatible way. They also need to be aware of the many options that have been identified that show that NRM and 'this environmental stuff' is 'doable' on-farm and not necessarily an expense to production. These management options cover five main areas on-farm: grazing, pastures, woody vegetation, water bodies (both farm dams and streams) and livestock. Taking a whole-farm approach to these issues was considered instrumental in improving environmental management on many farms, with good management skills also being a critical component of integrating conservation and production goals.

A project centred around Armidale in northern New South Wales identified 41 management practices to enhance on-farm biodiversity and, more often than not, wool profits. Examples include selling or beginning feeding stock early going into a dry spell, aiming for 100% ground cover, varying grazing management of native pastures, retaining native timber and fencing farm dams to exclude livestock and reticulate clean water to troughs. This project also investigated important scientific relationships between biodiversity and wool production at a whole farm scale. By doing so, they were able to address questions such as 'do native pastures sustain a greater diversity of plants than in sown pastures?' In the New England region, the answer to this question was 'no' for pastures on basalt soil. While the total number of species was not statistically different, overall there were more native species in native pastures, and trends towards more herbaceous species in native pastures. Overall, this project found that diverse flora and fauna underpinned the stability, resilience and productivity of local wool properties.

Set stocking, where sheep are left in the same paddock for long periods of time, has been a traditional way to graze sheep. More recently however, methods such as rotational or cell grazing, where large mobs of sheep are only kept in paddocks for short periods, are increasingly being trialled at certain times of the year. In the Mid-North of South Australia, a six year grazing trial found that on balance, high-density short-duration grazing gave the best production/ conservation outcomes as it enabled considerably higher stocking rates on degraded native pastures while protecting and gradually enhancing grassland function. In Tasmania, preliminary results from a grazing trial found that changing from set stocking to cell grazing was unlikely to result in local extinction of native plant species in the long-grazed native pastures that were being studied. However, some caution about changing current management practices was given, with suggestions that a longer period was needed to demonstrate the impacts of cell grazing on native plant species in these environments.

Low rates of fertiliser application are conducive to integrating conservation and production. Fertilising native pastures can increase productivity, but will reduce the diversity of native plant species. Any application of fertiliser in native pastures needs to be carefully managed, as the system can tip over to one dominated by annual introduced grasses and clovers. Higher stocking rates are necessary to make use of the extra feed after sites are fertilised, but these must be flexible to avoid overgrazing. Nutrient levels should be monitored in any grazing system, as balanced nutrient budgets are a core principle of sustainable farming systems.

Woody vegetation has a number of benefits for production systems, as well as providing essential habitat for a range of native birds, bats, mammals and insects. The production benefits include the provision of shade and shelter, which reduces the energy requirements and in extreme environments the mortality rates of sheep. In northern NSW, wooded native pastures on farms generated 8–9 kg wool/ha and ran 4–5 DSE/ha, about half the contribution of naturalised pastures. This project also found that beneficial insect-eating bird species – including a number of woodland species that are declining elsewhere – are returning to replanted areas that were affected by dieback or over cleared in the past, providing a natural pest control service on farms. Another important finding was that in some regions properties can have 30% tree cover without sacrificing carrying capacity, which is good news for meeting both production and conservation goals. However in Victoria anything more than 15% tree cover was found to negatively impact on production

Increasing ground cover can also result in both production and conservation benefits. Across a wide range of farms and soil types in northern NSW, infiltration rate increased significantly with increasing litter cover, and the abundance of macro-invertebrates increased significantly with increasing pasture cover. Ants, earthworms, spiders, scarab larvae and adult beetles all increased with increasing pasture cover. Conversely, invertebrate numbers decreased with increasing amounts of bare ground. In other words, more litter means greater infiltration of rain and better water use efficiency. More pasture cover and less bare ground means more soil macro-invertebrates. The South Australian project also found increased water filtration in sites where ground cover had increased.

The upshot of all this is that there is no one 'right' way to integrate production and conservation goals. Many options are available to woolgrowers, whether they have 5% or 90% native vegetation on their properties. The approach they take will depend on their management goals, the enterprise they run, their financial situation, the incentives available and a range of other external factors.

Victorian woolgrowers Skye (left) and Jenny Weatherly inspect a rare stand of Ptilotus (Pussy Cat Tail) thriving on their property. Land, Water & Wool has found diverse flora and fauna underpins the stability, resilience and productivity of wool properties. (Currie Communications)

Monitoring biodiversity 'health' in northern Australian rangelands

Alaric Fisher & Alex Kutt

Most pastoral land managers understand the importance of keeping their grazing land in good condition, in order to maintain production levels in the long-term. Experienced managers can assess "land condition" visually, by looking at key indicators such as the amount of bare soil, the makeup of dominant pasture species and the frequency of desired "3P" species (palatable, productive and perennial grasses). In northern Australia, the concept of land condition has been formalised in the simple A,B,C,D framework used in Grazing Land Management (GLM; one of the EDGEnetwork training workshops) extension manuals (where A is ideal condition and D is almost irretrievably degraded), and the condition of a whole property can be assessed in types of the proportion of each pasture type in each condition class. Government agencies responsible for administering pastoral lands also have well-established procedures for assessing "land condition" across the pastoral estate , including the periodic assessment of fixed ground plots, and the use of satellite imagery to track changes in ground cover.

A more complete view of rangeland 'health' would also consider the status or condition of the biodiversity of the rangelands – the native plants and animals that inhabit them, the variety of ecosystems they contain, and all the ecological processes that go on there. Indeed, there is an increasing expectation that Australian rangelands will be managed in an ecologically sustainable fashion; and increasing requirements to report on trends in biodiversity at national, regional scales and local scales. However, the task of monitoring such a complex concept as 'biodiversity' is a daunting one, and outside the experience and expertise of most land managers.

Monitoring biodiversity in rangelands would be a relatively simple task if there was a strong relationship between pastoral "land condition" and the condition or "health" of biodiversity in these areas. In fact, such a relationship is sometimes assumed but this assumption has never been rigorously tested. In this project, we examined whether pastoral land condition was a good surrogate for biodiversity health in two important pastoral regions in northern Australia – the Burdekin Rangelands in Queensland and the Victoria River District in the Northern Territory. To do this, we selected a large number of sites in 5 different landtypes across the two regions. Within each landtype, we chose sites that were in good, fair or poor pastoral land condition (corresponding to the A, B & C states of the GLM framework). At each site, we sampled a broad range of biota including plants,

1. Short-tailed Mouse (Leggadina lakedownensis). The richness and abundance of native small mammals was lower in poorer condition sites in some landtypes, but not all. (Photo: Eric Vanderduys)

Straight-browed Ctenotus (Ctenotus spaldingi). This large skink was a consistent "decreaser" species – it was more abundant in good condition sites than poor ones. (Photo: Eric Vanderduys)

ants, birds, mammals and reptiles; and then compared biodiversity attributes between sites in different condition classes.

We found that there was some relationship between pastoral land condition and biodiversity, particularly for those groups whose ecology is closely linked to characteristics of the ground surface and the density of ground layer vegetation (such as ants). However, the response of most plant and animal groups to land condition was generally weak, complex and highly variable between taxa, landtypes and locations. We concluded that land condition is, by itself, too blunt an instrument to adequately monitor biodiversity health in savanna rangelands. Rather, comprehensive biodiversity monitoring programs must include the direct assessment of selected biota and this will inevitably require investment to ensure that adequate information and expertise is available to land managers.

This is not to say that good pastoral management is not very important in maintaining the high biodiversity values that persist in much of our savanna rangelands, and improvements in land condition across rangeland landscapes are likely to have positive biodiversity consequences. As part of the project we also developed a set of guidelines (Table 1) for biodiversity-friendly land management, which would ideally be applied in concert with appropriate biodiversity monitoring in an adaptive management framework .

New R&D in the pastoral areas of northern Queensland and southern Queensland is seeking to develop a broad but informative assessment tool for biodiversity that can be summarised in a report card fashion similar to that of the 'ABCD' grazing land framework. For more information contact Alex Kutt, CSIRO or Teresa Eyre, Qld EPA.

TABLE 1: MANAGEMENT GUIDELINES FOR RETENTION OF BIODIVERSITY IN TROPICAL SAVANNA RANGELANDS.

These guidelines are primarily aimed at management at an enterprise scale, and complement biodiversity management actions at regional (as defined in regional Natural Resource Management Plans) and State scales (eg. Northern Territory Parks and Conservation Masterplan).

1. Maintain cover and diversity of native perennial grasses

- this will help guarantee the survival of many native plant and animal species
- this is already a goal of good pastoral management, and ways to achieve it are described in Grazing Land Management manuals (noting that the use of exotic species is counter-productive)
- management strategies may include conservative and/or variable stocking rates, wet-season spelling, rotational grazing, and the maintenance of appropriate fire regimes

2. Where possible, use grazing strategies that rest large areas of country

- this will assist in the seeding and recruitment of native plant species, improve breeding success in some native animals, and reduce predation on some species
- may be achieved by wet-season spelling or rotational grazing systems
- particularly important where there are high stocking rates

3. Protect special areas, by fencing out stock if necessary

- special areas include key habitat for threatened species; important breeding areas for animals (such as waterbirds); vegetation types that are very sensitive to grazing; and remote or unwatered country (see below)

4. Where possible, retain and protect natural waterholes

- waterholes and creeklines are usually rich in plant and animal species; contain species that are not found elsewhere in the region; and often have special species or breeding areas
- these areas are also vulnerable to damage by concentration of stock
- where possible, fence off waterholes and major creeklines and pipe water outside the fences (although not into previously ungrazed areas)

5. Retain some areas on the property (of each habitat) with little or no grazing pressure

- this will help maintain populations of all species on the property, particularly the ones most sensitive to grazing
- ideally, the non-grazed areas would be 5-10% of the area of each land type on the property
- ideally, these areas would be in a few large blocks rather than tiny, scattered areas
- having little or no grazing pressure may be achieved by controlling

the spread of waterpoints and/or by fencing "refuge areas"

- this principle becomes more important as pastoral use is intensified

6. Try to maintain a variety of burning regimes

- different plant and animal species require different fire regimes – so a variety of burning practices will benefit most species
- avoid either no fire, or very frequent fire, over large areas of country
- avoid burning large areas of country in most years
- a patchy pattern of burning is ideal, with some areas that are not burnt for a long time. This can be achieved through cool winter burns, or storm burning
- the period areas are best left unburnt will vary from region to region, and local information should be sought as to appropriate periods

7. Maintain structural and micro-habitat diversity

- leaf litter, fallen logs, standing dead trees, large trees with hollows and termite mounds are all important habitat for some species
- a diverse midstorey with trees and shrubs of a variety of ages and sizes contributes to habitat diversity
- avoid grazing and fire regimes that reduce this diversity over substantial areas

8. Control problem weeds and restrict further spread

- this is a standard management practice on most properties
- identify and target weed species that threaten special areas or special species (eg. taking over areas used by breeding waterbirds)
- exotic pasture species can be considered as weeds to native wildlife. Ideally all introduced species should be avoided, but if exotic pastures occur, prevent these species becoming dominant over large areas

9. Control feral grazing animals

- this is a standard management practice on most properties, and reduces total grazing pressure
- concentrations of feral animals may damage special habitats, even in areas set aside for conservation

10. If possible, reduce numbers of feral predators

- cats (and in some areas, foxes) kill large numbers of native animals, but are very difficult to control
- dingos may help keep cat and fox numbers down. Dingos can also help control feral pig numbers (which damage wetlands and riparian areas), and reduce the numbers of large macropods (which contribute to total grazing pressure).

An example of a box woodland site in the Burdekin Rangelands, in the intermediate "land condition" class. (Photo: Alex Kutt)

11. If possible, avoid clearing native vegetation

- clearing, especially over large areas, dramatically affects many native plants and animals
- if clearing is considered essential, restrict clearing to less than 30% of each land type (habitat) on each property, and create mosaics of cleared and uncleared vegetation, rather than extensive clearings
- retain substantial buffers of native vegetation around watercourses and wetlands, and retain connecting strips of native vegetation within cleared areas
- the trade-off for clearing should be lower stocking rates and/or improved spelling in other parts of the property
- in certain cases, it may be important to control the invasion of native grasslands by woody plants, or ecologically undesirable thickening of tree or shrub layer, through appropriate fire management

12. If possible, avoid using introduced pasture plants

- where introduced pastures are considered essential, make sure introduced species can't spread outside a controlled area
- prevent exotic pastures from becoming dominant monocultures, as this can reduce wildlife diversity, and eliminate palatable native grasses
- restrict introduced pastures to a small, concentrated portion of the property (such as those that are already cleared or in poor condition)
- the trade-off for introduced pastures should be lower stocking rates in other parts of the property

13. Be informed about biodiversity

- find out what habitats and species occur on your property
- try and observe annual and seasonal patterns of wildlife on your property
- find out where the special places and special species occur, and what special management they might require
- seek expert advice or assistance if necessary

14. Be aware of changes in biodiversity

- are some species declining or disappearing?
- are some species getting more common?
- are new feral (pest) species appearing?
- these changes may indicate management issues that need to be addressed
- if possible, keep a record of your biodiversity observations

15. Have a property management plan that considers biodiversity

- the plan would address all the issues listed above
- the biodiversity management section would integrate with the property grazing land management systems
- the property plan should be developed in the context of regional biodiversity values, neighbouring and regional landuse patterns, and regional and State NRM or conservation plans
- seek expert advice or assistance if necessary

Contacts:

Alaric Fisher

Department of Natural Resources, Environment & the Arts

PO Box 496, Palmerston, NT, Australia, 0810

email: alaric.fisher@nt.gov.au
ph: (08) 89955002

Alex Kutt

CSIRO Sustainable Ecosystems

Private Mail Bag PO, Aitkenvale, QLD, Australia 4814

email: alex.kutt@csiro.au
ph: (07) 47538547

Or download TRC1 research summary report from
www.lwa.gov.au/nativevegetation

Australian Government
Bureau of Rural Sciences

A VAST framework for measuring vegetation condition

By Richard Thackway

Till now, mapping vegetation condition has proven problematic for many natural resource managers. Vegetation condition can be assessed from a number of different perspectives. These include production capacity for economic goods such as timber or fodder, degree of land cover or degradation, ecological productivity and regeneration capacity, extent and type of past disturbance, presence of invasive plant species, or important habitat features for wildlife.

The native vegetation of large areas of Australia's landscapes has been significantly modified by historic landuse and management practices. In these environments remnants are intimately mixed with predominantly human-created ecosystems.

So how do we describe and map the naturalness or modification of vegetated landscapes? To help answer this, the Bureau of Rural Sciences has developed the Vegetation Assets States and Transitions framework (VAST) as a means for compiling and reporting mapped datasets that describe the modification of native vegetation condition states across the landscape (Table 1).

The VAST framework provides a means of scoring the present condition state of vegetation condition. This information can be used to identify and prioritise which vegetation types and areas should be targeted to provide maximum benefit to ecosystem functions and services, such as biodiversity conservation and optimising sustainable production for food and fibre.

Effective vegetation management involves developing management goals for different vegetation types with the aim of producing and maintaining different goods, services and values. It also involves monitoring and reporting the condition states of vegetation in relation to benchmarks, and reviewing and adjusting management in light of observed changes in diagnostic criteria relative to a defined benchmark. VAST can assist in informing discussions about potential vegetation futures by defining vegetation condition states in a mapped dataset that satisfy a benchmark or reference condition state that is fully natural (i.e. VAST I)). Figure 1 illustrates one application of the VAST framework for reporting the status of native vegetation condition across the landscape. The three case studies have used available national and regional scale datasets. The presence of three diagnostic criteria,

The VAST framework:

- Orders native vegetation by degree of human modification as a series of condition states, from a reference base-line condition through to total removal.
- Is not linked to any particular method of vegetation survey, and is designed to accommodate a range of survey data from which inferences (information) about vegetation composition, structure and regenerative capacity can be derived.
- Is not confined to any particular scale or resolution of data.

VAST can be used for:

- Assessing impacts of land management practices on vegetation type and extent.
- Accounting for multiple ecosystem services provided by a vegetation type/s.
- Discussing trade-offs and costs/benefits of on-ground management actions.
- Monitoring performance toward vegetation targets at the regional and local levels.
- Prioritising investments in on-ground actions in the context of Natural Resource Management targets and measuring and monitoring performance against these targets.

Table 1: The Vegetation Assets, States and Transitions classification framework.

INCREASING VEGETATION MODIFICATION FROM LEFT TO RIGHT

			Native Vegetation Cover			Non-native Vegetation Cover		
			Dominant structuring plant species indigenous to the locality and spontaneous in occurrence – i.e. a vegetation community described using definitive vegetation types relative to estimated pre1750 states			Dominant structuring plant species indigenous to the locality but cultivated; alien to the locality and cultivated; or alien to the locality and spontaneous		
VEGETATION COVER CLASSES			**STATE 0:** NATURALLY BARE areas where native vegetation does not naturally persist and recently naturally disturbed areas where native vegetation has been entirely removed. (i.e. open to primary succession)	**STATE I:** RESIDUAL native vegetation community structure, composition, and regenerative capacity intact – no significant perturbation from land use/land management practice	**STATE II:** MODIFIED native vegetation community structure, composition and regenerative capacity intact – perturbed by land use/land management practice	**STATE III:** TRANSFORMED native vegetation community structure, composition and regenerative capacity significantly altered by land use/land management practice	**STATE IV:** REPLACED - ADVENTIVE native vegetation replacement – species alien to the locality and spontaneous in occurrence	**STATE V:** REPLACED – MANAGED native vegetation replacement with cultivated vegetation	**STATE VI:** REMOVED vegetation removed – alienation to non-vegetated land cover
DIAGNOSTIC CRITERIA	Current regenerative capacity	Complete removal of in-situ regeneration capacity except for ephemerals and lower plants	Natural regenerative capacity unmodified	Structure is predominantly altered but intact e.g. a layer / strata and/or growth forms and/or age classes removed	Natural regenerative capacity limited / at risk under past and /or current land use or land management practices. Rehabilitation and restoration possible through modified land management practice	Regeneration potential of native vegetation community has been suppressed and in-situ resilience at least significantly depleted. May still be considerable potential for restoration using assisted natural regeneration approaches	Regeneration potential of native vegetation community likely to be highly depleted by intensive land management. Very limited potential for restoration using assisted natural regeneration approaches	Nil or minimal regeneration potential. Restoration potential dependent on reconstruction approaches
	Vegetation structure	Nil or minimal	Structural integrity of native vegetation community is very high	Structure is predominantly altered but intact e.g. a layer / strata and/or growth forms and/or age classes removed	Dominant structuring species of native vegetation community significantly altered e.g. a layer / strata frequently and repeatedly removed	Dominant structuring species of native vegetation community removed or predominantly cleared or extremely degraded	Dominant structuring species of native vegetation community removed	Vegetation absent or ornamental
	Vegetation composition	Nil or minimal	Compositional integrity of native vegetation community is very high	Composition of native vegetation community is altered but intact	Dominant structuring species present – species dominance significantly altered	Dominant structuring species of native vegetation community removed	Dominant structuring species of native vegetation community removed	Vegetation absent or ornamental
EXAMPLES			Bare mud; rock; river and beach sand, salt or freshwater lakes, rock slides and lava flows	Old growth forests; Native grasslands that have not been grazed; Wildfire in native forests and woodlands of a natural frequency and/or intensity;	Native vegetation types managed using sustainable grazing systems; Selective timber harvesting practices; Severely burnt (wildfire) native forests and woodlands not of a natural frequency and/or intensity	Intensive native forestry practices; Heavily grazed native grasslands and grassy woodlands; Obvious thinning of trees for pasture production; Weedy native remnant patches; Degraded roadside reserves; Degraded coastal dune systems; Heavily grazed riparian vegetation	Severe invasions of introduced weeds; Invasive native woody species found outside their normal range; Isolated native trees/shrubs/grass species in the above examples	Forest plantations; Horticulture; Tree cropping; Orchards; Reclaimed mine sites; Environmental and amenity plantings; Improved pastures. (includes heavy thinning of trees for pasture); Cropping; Isolated native trees/ shrubs/ grass species in the above examples	Water impoundments; Urban and industrial landscapes; quarries and mines; Transport infrastructure; salt scalded areas

including species composition, structure and regenerative capacity, are used to interpret and reclassify published condition state datasets into VAST datasets. Benchmarks enable different vegetation types to be assessed and reported at different regional and national scales.

VAST condition states 0, I, II, III, IV, V and VI are respectively described as: residual bare; residual; modified; transformed; replaced native; native (managed); and removed. For example, a native vegetation type may be currently in a 'poor' condition state (VAST III – transformed: regenerative capacity significantly altered by land use/ management practices).

Transitions between condition states result from changes in land management practices. For example changing VAST III to a better condition state could be achieved by changing a fire regime, using cell grazing, fencing out grazing animals from sensitive areas or revegetating degraded sites. Transitions can represent a trajectory where the condition state for a vegetation association is likely to undergo as a result of changes in land management practices. Transitions can also be unintentional. For example, fencing-off roadside reserves to protect areas of VAST II, may in time become severely degraded through lack of management effort to prevent invasive species, thus transitioning the remnant to VAST IV.

Condition states can be determined for an area based on how it has been managed; is being managed; or could be managed. The process of defining a vegetation condition state is not prescriptive. Rather it depends on the intent or purpose of stakeholder's need for monitoring and reporting.

Mapped information on condition states can be used to inform particular NRM priorities, for example, achieving a balance between sustainable production and biodiversity conservation or identifying the 'best of the last' patches of vegetation associations or targeting areas where for relatively little investment slightly degraded areas can be restored.

Landscape level condition state maps, like any dataset need to be informed by information on their reliability, which is a function of the scale of mapping, the accuracy and precision of the input datasets and the process used to infer or model the condition states and/ or transitions.

Comparison of VAST condition states in Bogan Gate NSW, using area of regional and national datasets

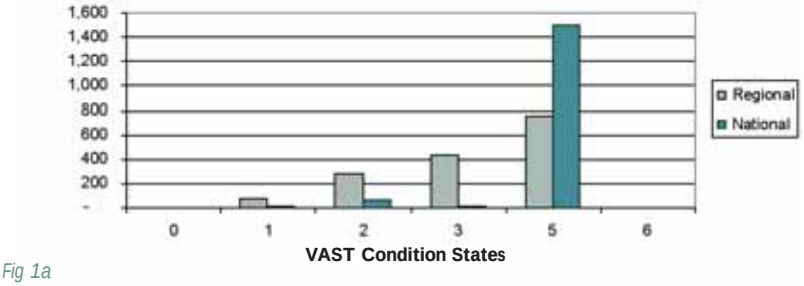


Fig 1a

Comparison of VAST condition states in north west VIC, using area of regional and national datasets

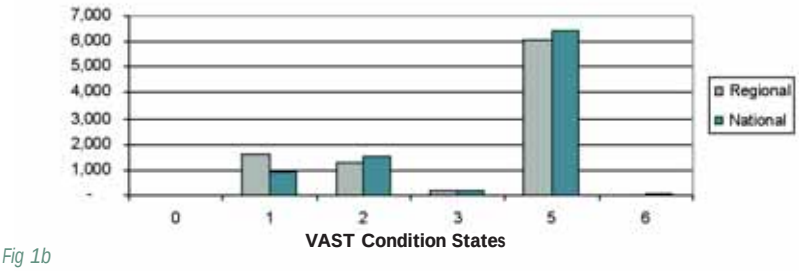


Fig 1b

Comparison of VAST condition states in NT, using area of regional and national datasets

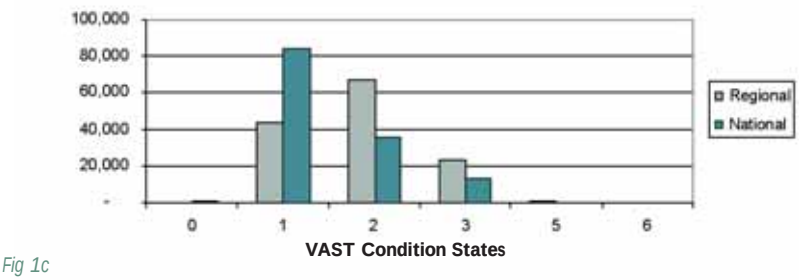


Fig 1c

For more information see:

Thackway and Leslie 2005, Reporting vegetation condition using the Vegetation Assets, States and Transitions (VAST) framework, Ecological Management & Restoration 7 (s1), S53–S62.

Download from:
http://www.daff.gov.au/brs/forest-veg/vast

Or contact
richard.thackway@brs.gov.au
phone (02) 6272 4856

Florabank – seeding the future

Regional groups across Australia have set ambitious revegetation targets in their catchment management plans. High quality native seed of known provenance is critical to the success of these projects so that the future plantings can become beneficial habitat and an on-going resource for seed collection and ecosystem services.

Until now, it has been difficult to find comprehensive and reliable information about seed for revegetation projects. A lack of accessible information about seeds can cause a range of problems. For example, it can mean that more seed is used than necessary because the germination requirements of the species are not understood, or because seed of poor physical or genetic quality has been purchased from suppliers who may not be storing the seed appropriately, or have collected seed of low viability. This can limit the range of species planted in revegetation projects and some species are consequently not planted because seed is less available. Much of the variability in success of direct seeding comes down to the viability of the sown seed.

People working with seed also want to know how best to collect, store and germinate it to maintain its viability so that seed of the best quality is collected, sold and sown for direct seeding or tubestock purposes. The Land & Water Australia project "Genetic and ecological viability of plant populations in native vegetation" has shown that the physical and genetic quality of native seed is usually more important than where it comes from. People planning revegetation programs need to know both where to find seed of required species and how to ensure the genetic and physical quality of the seed is high for successful revegetation projects.

Seedy People

In recognition of the difficulty in accessing information about native seed the Australian Government has funded a second phase of the popular Florabank programme which is being managed by Greening Australia in conjunction with ENSIS and Ag Tech Pty Ltd. One of the key delivery vehicles for Florabank will be a new website which will host information about seed and provide a vehicle for people to talk seed, through a web-forum where they can ask questions and have them answered as well as discuss issues to do with native seed management.

Seedy Information

Florabank is also working with Land & Water Australia, CSIRO, the Millennium Seed Bank project, and scientists from around Australia to develop an interactive database where data about seed including its provenance, supply and quality will be entered on the database so that seed users and collectors can find out how best to collect and manage seed for a wide range of species.

Sourcing Seed

In the future, the Florabank website will also bring together people who want to buy or sell seed. The website includes a directory of seed services around Australia, where businesses will be able to register themselves so that seed purchasers can find them. Business subscribers to the site will be able to respond to seed requests posted by people wanting to buy seed of particular species and provenances.

Training by experts

Florabank is developing and hosting training courses for professional seed collectors across Australia. Six sessions will be run around Australia starting in August 2007 and finishing in June 2008. These workshops are accredited training courses and details are available on the website.

For more information, visit the new Florabank website **www.florabank.org.au** or contact the Florabank Coordinator, Penny Atkinson on (02) 6281 8573.

Seed production area to facilitate new plantings. (Greening Australia)

Harvested seed being prepared for storage. (Greening Australia)

Australian Government
Department of Agriculture, Fisheries and Forestry

Demonstrating good farm stewardship

Farmers will have a recognised system to demonstrate their good stewardship of the land when a four-stage pilot project in the Tamar region of Tasmania is successfully completed.

As Ian Sauer, president of the Tamar NRM community based group, points out, 'We wanted a system that would be farmer driven, non-regulatory and voluntary, and which would clearly demonstrate to the wider community that farmers are good stewards of their land.'

Tamar-NRM was formed to look at, and be involved in, environmental issues in Launceston and in the Georgetown and West Tamar local government areas to the city's north.

The group obtained $150 000 from the Natural Heritage Trust for a Native Vegetation Regional Pilot Project to implement planning systems to help farmers identify environmental issues on their farms, become recognised for their environmental stewardship and improve native vegetation management.

Mr Sauer says the project followed on from a scoping study, during which participating farmers and scientists cast around for a system that would:

- help farmers make cost-effective decisions to improve resource condition in the region
- recognise sustainable farm management and stewardship of native vegetation
- work towards a simpler farm development approval process.

The answer was the ROOFS – Regional Outcomes for On-Farm Sustainability – property management system with four stages:

- mapping and environmental assessment of each participating farm property together with provision of information on decision support tools and services
- an assessment of its environmental issues and risks
- an action plan for environmental sustainability for each property
- third party review and approval.

'The first thing that happens on a participating farm is a visit by a field officer, who looks at everything on the property on a 1/25 000 map and discusses all aspects of the farm in the farmer's own terminology – buildings, fences, creeks, tree lines and vegetation,' Mr Sauer said.

ROOFS Co-ordinator discusses baseline mapping with Ian Sauer, a participant farmer and president of Tamar NRM.

'The officer also makes a quick assessment of native vegetation on the farm, and it has to be said that we have found other existing maps of the Tamar region are sometimes inaccurate in respect to what vegetation communities are actually there on the ground.

'When the field officer gets back to the office, he uses a computerised, geographic information system to put all this information onto a farm map and then provides a colour paper copy for the farmer to put onto their office wall as well as a digital copy on CD.

'Step two, risk assessment and identification of environmental issues, can be done by the farmer or can be facilitated. We encourage neighbourhood groups to work together on a similar process of looking at issues like soil and water management.

'Step three is the development of farm-specific Farm Action Planning, focussing on all the high priority actions identified by the farmer, with links to legislative requirements on issues like soils and native vegetation.'

Mr Sauer said the Tamar NRM group was still grappling with the elements of step four, the third party reviews that would provide valid recognition of what farmers were doing.

Ian Dickenson, who mixes cropping and livestock enterprises with forestry plantations and is a member of the Tamar NRM Management Committee, began property management planning back in 1995.

He says he had started to refine his plan just when ROOFS came along, and he liked the new concept because, while it was really 'just a glorified farm plan', it offered better prospects of being able to demonstrate his land stewardship to the wider community.

'I am proud of what we do with our land, I know we work to our best ability to do that, but waving a simple property plan around holds no sway in proving the rigour of what I've done,' Mr Dickenson said.

'A robust ROOFS can demonstrate that we are managing our soil, vegetation, water and the farm itself with scientific input from botanists, geologists and other specialists.

'But we are not yet to the stage of having our system recognised. We need runs on the board and we need to also include our Occupational Health and Safety policies, our CARE programs for cattle and sheep and our Quality Assurance through the ROOFS system.'

For more information

please contact the Tamar Region NRM on 03 6323 3310 or email tamarNRM@launceston.tas.gov.au.

Demonstrating soil testing with ROOFS farmers at a field day in October 2006.

The Tamar landscape – through the ROOFS Farm Action Plans, farmers identified priority environmental issues and actions to address these.

LandWater & Wool
Shaping the future

Natural values on wool growing properties

Jann Williams

Recent surveys have shown that commercial wool growing properties in south-eastern Australia can provide important habitat for many native plants and animals, including rare and threatened species. Woody native vegetation, both natural and planted, was found to be particularly important for birds, bats and arboreal marsupials. For example, close to 250 bird taxa have been identified in the wool-growing Traprock region of South-East Queensland, 109 in northern New South Wales and 73 in central Victoria, where tree cover is the lowest of these regions. In each of these regions, a number of declining woodland birds found suitable habitat on-farm. A diversity of wooded habitats encouraged a diversity of native animals, with different habitats providing the right conditions for a particular set of species. For example, to maximise the number of micro-bat species, which are important natural pest controllers on farm, it was found that a mix of wooded habitats was best, including planted windbreaks, old scattered paddock trees, dense timber and wooded creeks and streams. Wetter parts of the landscape, such as wooded streams and dams, were particularly important for micro-bats and frogs.

How do native plants fare on woolgrowing properties then? Many growers in south-east Australia utilise native pastures and bushland as part of their grazing operations, especially to produce fine wool. While some native species are grazing-sensitive, it has been found in Tasmania that sheep can graze on native pastures while maintaining a high diversity of native plant species on the property. This includes threatened plant species such as the Grassland Paper Daisy *(Leucochrysum albicans)* and the Grassland Cupflower *(Colobanthus curtisiaerelies)*. Another research site in Tasmania, on a farm that has 98% native vegetation, contained the highest number of vascular plant species recorded in the region and the most moss species ever recorded in the catchment. In northern New South Wales, where fertiliser is commonly used on native pastures, at least 219 plant 'taxa' (species and subspecies) in 52 families were recorded in pasture surveys, with about 68% (around 150) of these being native. Pastures such as these can contribute to the conservation of native species in the broader farming matrix and complement native vegetation managed primarily for conservation.

These and other findings demonstrate that native plants and animals can coexist on grazing properties that are well managed, with moderate levels of grazing, good ground-cover and a diversity of woody vegetation, wetlands and pastures present. Diverse vegetation management practices were also found to help maintain a diversity of plant species and communities.

Native plants and animals can coexist with livestock on grazing properties that are well managed.

Clarifying the focal species approach in Australia

By Nadeem Samnakay

Recently, Land & Water Australia commissioned and published a review of the focal species approach in Australia to assist land managers in planning revegetation and conservation projects.

Individual landholders, landcare groups and regional NRM bodies often have the difficult task of developing restoration plans for landscapes that have been over-cleared. More often than not, one of the objectives of restoration is to recreate habitat to conserve local flora and fauna.

In practice, this means making decisions about (1) key remnant areas to conserve and manage, (2) where, and how much, revegetation to undertake and (3) how to best design and manage the non-remnant parts of the landscape (the 'matrix').

Planning the restoration of landscapes for biodiversity is commonly based on some key guiding principles, such as creating linkages, expanding the size of remnant patches, ensuring revegetation has multiple layers etc. However, how big should remnant patches be? How wide should corridors be? Where and how many stepping stones are required? Rules of thumb that quantitatively address these questions for a particular landscape can be based on knowledge of one or more species or taxa. For example, restoration plans have been developed to meet the habitat needs of a single species, usually where the species is endangered. Mallee fowl recovery projects are one example. Similarly, restoration plans can be developed for multiple species in the landscape.

One such approach is the focal species approach (FSA). The FSA helps define the attributes required to meet the needs of most or all biota in a landscape and the management regimes that should be applied.

The FSA is based on the concept of umbrella species which are those species whose conservation is expected to confer protection to a large number of naturally co-occurring species. This concept has been suggested for use in determining the minimum size for conservation areas, selecting sites for inclusion in reserves, and setting minimum standards for the quality of habitats associated with the umbrella species.

The focal species approach must first identify an appropriate set of species. These are the species considered to be most sensitive to processes such as habitat loss, modification and fragmentation, predation, salinity, resource depletion, and inappropriate fire regimes. One or more focal species are identified for each threat or threatening process.

The approach assumes that creating landscapes that conserve these focal species will meet the conservation needs of most or all species or taxa. Obviously this will depend on how carefully and broadly the focal species are selected. Application of the process with just one taxa, such as birds, may or may not result in meeting the requirements of all taxa.

The other requirement for successful application of this approach is reliable quantitative information of the restoration needs of the focal species. Where lacking, such data will need to be acquired.

In recent times, the FSA has been adopted in several agricultural zones of southern Australia, sometimes with a limited application of the science behind the approach or without proper consideration of the strengths or weaknesses of the approach.

With this in mind, the review undertook to:

- Review current trends and clarify the FSA scientific debate;
- Summarise and synthesise key findings from Land & Water Australia-funded research based on the focal species approach;
- Identify key messages and opportunities for knowledge exchange, including the need for and targeting of case study analyses;
- Inform future strategic R&D investment in landscape design principles.

The review will be particularly useful to groups intending on developing restoration plans, especially based on multi-species recovery, or to those groups who have adopted the FSA and wish to evaluate its performance or application.

The review, titled 'A review of the focal species approach in Australia' can be ordered from the LWA website at **www.lwa.gov.au** or ordered free of charge from Canprint by calling 1800 776 616 and quoting product code PR071247.

For more information, contact Nadeem Samnakay on (02) 6263 6075 or email nadeem.samnakay@lwa.gov.au

Heath, shrub and mallee corridor planting that links two remnants supporting several focal bird species. "Nulands", Buntine-Marchagee Catchment, WA. Photo: Andrew Huggett

LandWater & Wool
Shaping the future

Exotics in the mix

Jann Williams

Have you wondered about the role that exotic plant species may play in meeting conservation outcomes in production landscapes? In areas of high conservation value, there is general agreement that exotic species are a threat to the values that are being managed. The role of exotic species in farming landscapes however, particularly in the context of revegetation, is a greyer one. From a conservation perspective, it is argued that local provenances of trees and shrubs that are replanted should be used. From a woolgrower's perspective, exotic species can play important functional roles especially where native species have been lost. These perspectives suggest that it is worth examining the role of exotic species further.

The NSW Land, Water & Wool project examined the role of exotic species directly, both in native pastures and woody vegetation. It asked the question 'do introduced trees and shrubs provide the same benefits for biodiversity as native species?' This was addressed by examining the birds on two properties owned by the Taylor family, which supported a wide range of planted native and exotic trees and shrubs, as well as good stands of native timber. Farm habitats dominated by native trees and shrubs or containing large old native eucalypts in the NSW study supported more birds than areas dominated by exotic trees and shrubs. However, the pines, poplars, oaks, cypress, and other species at 'The Hill' and 'East Oaks' were important as habitat in their own right for some birds, including declining and vulnerable species. Thus, trees, any trees, were found to substantially increase bird diversity – both the variety and number of birds – several-fold. The tree plantings on these properties have also played an important role in providing shade and shelter for sheep and reducing their energy requirements.

In the New England region, some woolgrowers report that the mix of sown and native species in naturalised pastures was best for wool production because of the wide mix of species for every season. The project found that naturalised pastures or sown pastures that had reverted to native dominance had similar numbers of introduced and native species as never-cultivated, fertilised native pastures on basalt soils. High pasture diversity and a mix of native and sown species also sustained high levels of wool production. Systematic surveys showed that naturalised pastures that had been previously sown but were dominated by volunteer native species produced most wool per hectare (about 19 kg wool/ha) in 2004. Never-sown native pastures produced 12 kg/ha, while native pastures beneath scattered trees and native pasture in dense timber all produced around 8–9 kg wool/ha.

These examples demonstrate that it is important to consider the multiple roles that exotic plant species can play in a farming landscape. Both the planting of exotic trees and a mix of native and introduced pasture species can have both conservation and production benefits. Giving flexibility to incorporate exotic species as part of a conservation management strategy could avoid seeing naturalised/native pastures converted to crops or sown pastures, and fewer trees planted. A greater understanding is required of the functional roles that exotic species (both native and introduced) may play in modified farming landscapes, how farmers value and perceive exotic species and the potential for native species to recover if natural processes are reinstated.

CASE STUDY:

Natives or Exotics? It's all about balance

NSW Northern Tablelands woolgrowers Jon and Vicki Taylor's chief enterprise is fine wool and they supply an Italian mill with a uniform style of fine 17.5-18.0 micron wool.

Across their two blocks, Jon and Vicki run about 3000 dry sheep (half wethers, half weaners) and join 2500 ewes. They shear 5500 sheep in late July–August and the annual wool clip fluctuates between 12,600 and 17,800 kilograms largely in response to seasons and subsequent adjustments to sheep numbers.

Since the late 1970s, the Taylors have invested consistently in tree planting on their property 'The Hill'. With time, this has developed into a radiata pine softwood enterprise based on harvesting about 1.5 ha each year.

Pines that Jon and Vicki planted in 1979–80 have already been commercially thinned and will be ready for final harvest in the next 10 years, with a continuous supply coming on-stream thereafter. Successive crops can be harvested when the price is right, or income from the timber is required.

The Taylors' plantations were accredited under a Forest Harvest Plan prepared in accordance with NSW legislation. Jon and Vicki have planted about 400,000 trees since 1979, mostly on 'The Hill', which brings tree cover to 15–20% of the property. Only a fraction of this is remnant native tree cover.

They plant about 3 ha per year, of which half is radiata pine and the remainder a diverse mix with the aim of reducing tree loss, improving species survival and encourage habitat for a diverse range of insects and birds in order to beat defoliation risks to native flora from insects.

Having more than 11% of their properties 'The Hill' and 'East Oaks' out of production in the past decade has had little, if any, impact on wool production.

Jon and Vicki Taylor have consistently invested in tree planting on their property – a balanced mix of exotics and natives. (Currie Communications)

Australian Government
Bureau of Rural Sciences

Revegetation monitoring and reporting in Australia

Why monitor and report on revegetation?

Revegetation is recognised as a major tool to protect natural resources and repair stressed ecosystems. A monitoring and reporting framework allows for information about success and failures to be easily shared amongst practitioners to improve future management. In order to account for the high levels of effort and financial investment in revegetation it is important to develop and use a consistent national attribute framework.

Investment in revegetation activities for land protection and vegetation enhancement has increased through programmes such as the National Action Plan for Salinity and Water Quality and the Natural Heritage Trust. Until now there has not been an effective method of reporting revegetation in Australia.

With the development of an attribute framework by the Bureau of Rural Sciences (BRS) we now have the ability to consistently monitor and report revegetation by natural resource management programmes and land managers on a national basis.

Why do we need the Attribute Framework for Revegetation Monitoring and Reporting?

The attribute framework provides the basis for reporting to government and the community on the many revegetation activities in progress. Government, community groups and landholders can also use the system to report and monitor their revegetation activities.

What is the Attribute Framework for Revegetation Monitoring and Reporting?

The attribute framework is comprised of three attribute categories that can be used as the basis for the collection, reporting and monitoring of activities, regardless of the scale or purpose of the project.

The attribute framework applies to a range of plantings and revegetation activities. It targets land protection plantings that are often small scale and support rehabilitation and environment protection as part of agriculture and natural resource management programmes. This can include broad acre and biodiversity plantings, streamside and gully plantings as well as fencing off and protecting areas to support natural regeneration.

How were the Attributes for Revegetation Monitoring and Reporting developed?

BRS developed the attribute framework in consultation with revegetation policy and programmes, community and research groups. The Mount Lofty region in South Australia was selected to conduct a pilot study so that the framework could be refined to achieve a practical set of attributes.

Where can I get more information?

For more information contact Richard Thackway richard.thackway@brs.gov.au or Christine Atyeo christine.atyeo@brs.gov.au from the BRS Forest and Vegetation Programme or from the BRS website **www.daff.gov.au/brs/forest-veg/** publications.

The framework has been developed in partnership with CSIRO, Greening Australia and the National Land and Water Resources Audit.

Site Attributes
Date
Location and Site Owner
Area
Existing Landcover

Establishment Attributes
Species being re/established – include Sp. name, provenance, growth form
Revegetation Objective – timber production, biodiversity enhancement, land/water conservation
Revegetation Method – e.g. seeding, protection, includes assistance such as mulch, guards and works such as ripping, mounds
Funding Source and $ Spent – includes estimated cost of volunteers
Threats to Revegetation – e.g. climate, feral animals, salinity
Use of Patch – e.g. shelter belt, amenity, woodlot

Monitoring Attributes
Monitoring Frequency
Management of site – types of activities and date of works
Revegetation – % revegetated, % survival planted/sown
Achievement of objective – success/failure/ongoing and reasons for failure if known; are the objectives of the revegetation activity being met?
Comments

Table 1 illustrates the three attribute categories developed by BRS.

Australian Government
Department of Agriculture, Fisheries and Forestry

CarbonSMART gives farmers a new product to sell

What do WOMAD, Melbourne City Council and the Australian Pensioners Insurance Agency have in common? They are all buying carbon offsets from Australian farmers through a new program called Landcare CarbonSMART.

CarbonSMART is based on the concept that vegetation planted since 1990 is already sequestering carbon, thus reducing the level of greenhouse gases in the atmosphere. CarbonSMART gives farmers the opportunity to trade this carbon and receive an income in return. The project has been supported by the Australian Government Department of Agriculture, Fisheries and Forestry through the Native Vegetation Regional Pilot Program.

According to CarbonSMART project manager Ben Keogh, there has been a positive response to the project from both buyers and sellers of carbon – the buyers being organisations that need to offset their carbon emissions and the sellers being farmers who have planted trees since 1990.

'The Victorian Government has purchased 10,000 tonnes of carbon offsets through the project, which has been a great boost,' says Ben. 'Melbourne City Council, WOMAD, Citypower/Powercor and the Australian Pensioners Insurance Agency are all buying carbon offsets from the project to neutralise the effect of emissions of their vehicle fleets.'

Four months after the launch of Landcare CarbonSMART by Landcare Australia Ltd (in March 2007), farmers have enthusiastically embraced the opportunity to earn income by selling the carbon held in trees and other vegetation that have been planted by human activity. The trees could have been planted as long ago as 1990 – and if they meet the project criteria they can begin earning their owners an income.

'In the first few months of the project there have been 125 applications from farmers around Australia, covering 3,500 hectares of vegetation,' says Ben. 'We are also assessing a massive 220,000 hectares in the NSW western division for eligibility.

'We don't simply count the number of trees that have been planted – we calculate the total carbon stock on site. That means in some places a farmer might be sequestering 15 tonnes of CO_2 per year, while in another site of the same size they might be sequestering five tonnes per year. Each site has to be calculated individually.'

Landcare Australia says that the carbon trading market is already climbing rapidly. 'Some estimates suggest the market will be worth US $2.3 trillion in five years time,' says Brian Scarsbrick, CEO of Landcare Australia. 'Landcare CarbonSMART will help stabilise farmers' income by providing annual payments for carbon from eligible forests even in drought years.'

Landholders can use areas as small as 0.2 hectares – provided they have been planted since 1990 and meet other eligibility criteria. Landcare Australia estimates that 10 hectares of trees could earn their owner approximately $20,000 over a 30 year period.

Farmer Garth Strong and his family run an 1820 hectare mixed farm near Narrandera in NSW. They have registered for CarbonSMART and will soon be receiving payments for their trees.

'We started planting in 1997 to reintroduce native vegetation to the area,' says Garth. 'We wanted to create wildlife corridors to link up to our nearby state forest and encourage native birds and animals back into the area. The trees also gave shelter for our stock.

'Because we wanted to bring back locally native species, we collected seeds from trees and remnant vegetation that was still living along the roadsides, so all the species are right for our area.'

The family had no idea back in 1997 that the trees they were painstakingly establishing for environmental reasons would one day earn them an annual income. Ben Keogh from CarbonSMART inspected the trees and found 21 hectares that met project guidelines set up by the NSW Greenhouse Gas Abatement Scheme (GGAS). The Strong family has now made a commitment to setting that land aside and trading the carbon held in the trees.

'The land is set aside for 100 years from the date of the last carbon sold, which for us means a minimum of 110 years and up to 200 years' says Garth. 'We can't remove the trees in that time, or else we would have to buy back the carbon we have already sold. We can graze the land occasionally but that's all.'

The Strong family is having the agreement noted on the official land titles information register, which is a project requirement. However, ownership of the trees and the land remain with the farmer. The family is looking at earning some $25,000 over 30 years for the area it has set aside.

'We're still finalising the payment amount, but we will probably get at least $40 per hectare per year for setting aside those trees,' says Garth. 'It's not enough to make us take an area out of production just for that income, but because we had planted the trees already, it gives us some cream on the top.'

Landcare Australia has launched the Landcare CarbonSMART program initially in NSW, with a scoping study in Queensland. The learnings from the program will also be used to inform any future national carbon trading scheme.

'Trees and other vegetation are a vital tool to help reduce carbon emissions because they take in carbon dioxide during photosynthesis and store the carbon as wood,' says Brian.

'This project provides an opportunity for landholders who revegetated part of their property to potentially get an income from their involvement in nature conservation plantings. If the price of carbon rises, the farmers will still benefit, as CarbonSMART will pass on any increases in carbon prices to landholders.'

Landcare Australia is inviting landholders throughout Australia who have five hectares or more of native trees planted since 1990 to get in touch. For more information and eligibility requirements call 1800 151 105 or go to **www.carbonsmart.com.au.**

This line of trees on Garth Strong's property are an example of early plantings that now qualify for the CarbonSMART payments. (Photo: Garth Strong)

LandWater & Wool
Shaping the future

Keeping an eye on interactions

Jann Williams

Considering interactions between different factors is very important when interpreting the impacts of sheep-grazing and other variables on native plants and animals. For example, when examining the response of vegetation to livestock grazing in Victoria, complex interactions were identified by Land, Water & Wool between phosphorous levels and tree cover. It was found that total species richness was positively related to tree cover except under frequent grazing at high stocking rates, suggesting that heavy grazing eliminates the patterns in space and time that trees impose.

Interactions between sheep-grazing and fire regimes have also been identified. The importance of fire regimes to native plants and animals is widely recognised, but is rarely studied in conjunction with other factors. In Tasmania, it was found that the interaction of fire management with sheep grazing regime was critical in determining the species composition of both vascular plants and invertebrate animals. This finding is likely to apply more widely. The type of plant species that are found over time were also shown to be influenced by the availability of moisture, the presence or absence of trees and the degree of soil acidity.

These studies support similar findings elsewhere, that species vary in their responses to environmental and management conditions in space and time. In order to promote species diversity, it has been proposed that a variety of management regimes and vegetation types are necessary at a landscape scale. When studying the impact of grazing on native plant species, it is also critical to consider the range of other environmental and management factors that may have an impact on the results.

When studying the impact of grazing on native plant species, it is also critical to consider the range of other environmental and management factors that may have an impact on the results. (Currie Communications)

Genes ain't genes – genetic diversity affects remnant health

By Linda Broadhurst

In Australia's fragmented landscapes, many landholders and community groups are working towards re-establishing and enhancing the extent of vegetation in the landscape. These efforts are primarily reliant on harvesting seed from remnant populations of plants as the source of reproductive stock. Hence seed production from these often limited areas of remnant vegetation is, in essence, the material that will characterise the genetic health of our future landscapes.

Conventional wisdom states that seeds should be sourced as close to the locality in which they will be re-established – often referred to as local provenance seed. However, researchers from CSIRO Plant Industry and the Western Australian Department of Environment and Conservation have discovered that careful consideration needs to be given to choosing seed sources, and in determining where revegetation efforts should occur.

The research assessed how population distribution and landscape configuration influence the genetic and reproductive health of remnant vegetation, and whether these factors represent serious constraints for long term persistence of plant populations.

Species under investigation

Seven common plant species from two different ecosystems were targeted for investigation and were chosen to represent the different life-histories present in each of the ecosystems (see Table 1). These differences included pollination vectors and seed dispersal mechanisms which are influenced by fragmentation effects such as the distance between patches and population size. The research assessed the reproductive success and genetic 'health' of each plant species. Common species were deliberately targeted for this study because as the most abundant plants in remnant vegetation, their loss is likely to impact on a host of other species in a variety of ways.

Key research findings

The responses of remnant plant populations in this study have identified a number of key factors influencing the conservation and management of remnant vegetation.

1. Habitat fragmentation is having negative effects on the genetic fitness, integrity and population structure of common native plant species, similar to those observed in less abundant plant species, and irrespective of the ecosystem being studied.
2. Characteristics of reproductive biology played a major role in the response of species to fragmentation. For species that cannot self-fertilise, such as acacias, fewer compatible mates in smaller populations resulted in declining seed production. Reproduction in self-fertilising species was not affected in small populations but the germination and growth of seedlings from these populations was poorer.
3. Population size is critical to the persistence of remnant populations. Results indicate that irrespective of which species was assessed, major negative effects were encountered when population size fell below 100 – 200 reproductive plants.
4. Increased hybridisation has been identified as a major threat to the genetic integrity of plant species in small remnants. This is likely to be a widespread issue for several

TABLE 1 Target species and life-history characteristics

ECOSYSTEM	TAXA	LIFE FORM	POLLINATION	DISPERSAL	LONGEVITY
Grassy woodlands of S.E. Australia	*Eucalyptus aggregata*	Tree	Insect	Wind/gravity	>100y
	Acacia dealbata	Tree	Insect	Bird/gravity	>20y
	Acacia acinacea	Shrub	Insect	Bird/gravity	>20y
	Swainsona sericea	Herb	Insect	Insect/gravity	>5y
Shrublands of S-W Western Australia	*Eucalyptus wandoo*	Tree	Bird/insect	Wind/gravity	>100y
	Calothamnus quadrifidus	Shrub	Bird/mammal	Gravity	>40y
	Eremaea pauciflora	Shrub	Insect	Gravity	>40y

important Australian plant groups, such as the eucalyptus, which readily hybridise.

5. Results from *Eucalyptus wandoo* showed that small populations can be genetically rescued by other remnants in the landscape over a scale of several kilometres through the movement of pollen and seeds. This indicates the importance of managing all the patches of vegetation in the landscape rather than individual populations.

What does this mean for landscape management?

Based on the key findings above, there are a number of recommendations for better management of remnants and revegetation sites.

1. **Maintain species populations larger than 100–200 reproductive plants where possible.**

   Larger reproductive populations have better rates of reproduction, harbour greater genetic diversity and have less inbreeding than smaller populations.

2. **Minimise isolation between populations.**

   Neighbouring populations rely on each other for gene flow and seed dispersal, which helps maintain fitness and reproduction. Nearby populations may also act as stepping stones for pollinators and help to maintain gene flow among populations.

3. **Site condition was not a useful indicator of remnant responses to fragmentation.**

   The study found site condition such as high species diversity and weed cover were not good indicators of genetic and demographic performance.

4. **Populations should be managed at the landscape level rather than as a series of populations independent of other vegetation in the area.**

   Biological connectivity between remnant populations must be considered in remnant management activities.

Remnants as seed sources

Choosing which remnants to use as seed sources is important for restoration success and to generate future high quality seed sources that do not show negative effects associated with inbreeding. This study indicated that, where possible, collections should be taken from large populations as these will provide genetically diverse seed that will generate high quality revegetation sites. When this is not possible, seed from a small population should be combined with seed from other populations to ensure that the newly restored populations have high genetic diversity to limit inbreeding effects as plants become reproductive.

Further research

The findings of this research project have led to a successive round of Land & Water Australia funded research to study the frequency, extent and scale of genetic and demographic connectedness among populations.

It will assess the importance of gene flow and seed dispersal among populations for determining local species persistence, and how this is affected by landscape configuration. This will permit development of "landscape leverage" maps that quantify the influence of different patches on local ecological and genetic dynamics which, in turn, will assist landscape design.

This new project, titled "Understanding genetic constraints to vegetation persistence in fragmented landscapes (Project number CPI13)", is expected to conclude in March 2009.

Acacia dealbata plants from seeds with low genetic diversity. A number of seedlings show poor vigour and can reduce the success of revegetation activities. Photo: Linda Broadhurst

For further information, see:

Managing genetic diversity in remnant vegetation: Implications for local provenance seed selection and landscape restoration

Download this publication from www.lwa.gov.au/nativevegetation or order a copy by phoning Canprint Communications on 1800 776 616 quoting product code PK071323

Contacts

Dr Linda Broadhurst
Linda.Broadhurst@csiro.com
Phone: (02) 6246 4988

Dr Andrew Young
Andrew.Young@csiro.com
Phone: (02) 6246 5318

Australian Government
Department of Agriculture, Fisheries and Forestry

Getting the water balance right

Adapting agroforestry to climate change scenarios

Having spent the past four years transforming a barren salty wasteland into an oasis of native vegetation, members of the Northern United Forestry Group (NUFG) are now turning their attention to a new challenge. Their task is adapting sustainable agroforestry practices to the challenge of climate change – in an area traditionally considered too low in rainfall to support agroforestry in the first place.

The NUFG is an incorporated, community-based group of 45 farming families who have been working together in northern Victoria since 1998. The group's extensive research into suitable native trees for farm forestry has led the way in establishing low-rainfall farm forestry as a commercially viable enterprise, providing forest products, environmental services and community benefits. As well as planting more than 23,000 trees and shrubs, members have established native grasses and saltbush and restored a salt affected area to productive land on a demonstration site at Kamarooka.

The project will examine the effects of spring and early summer rainfall on groundwater recharge, looking particularly at salinity and waterlogging. The Australian Government's Natural Resource Innovation Programme has come to the party with more than $110,000 in funding to help the group achieve its goal.

'The redistribution of rainfall through the year as a result of climate change has a profound effect on farm management,' says Tim Johns, secretary of the NUFG. 'The project will look at how we can

NUFG member Mal Brown downloads electronic rainfall data while Pauli keeps watch.

correctly place perennial species to reduce soil erosion and therefore reduce the amount of nutrient escaping into our catchment.

'We are using five properties in the foothills and plains of northern Victoria to develop guidelines for managing perennial vegetation in response to climate change. The properties will be audited, then monitored to track the status of soil, ground water, rainfall and vegetation.

'We will develop strategies to improve both productivity and the natural resource base on each farm, in the light of different climate change scenarios. From the base of these four farms we will spread the knowledge out to other member properties and the wider community.'

According to group chairman Ian Rankin, the NUFG's Kamarooka project proved that strategic revegetation could lower watertables – but the group wanted to take their research one step further and analyse how climate change could be affecting the situation. Members set up a series of data loggers that measured water table levels every 10 minutes, providing an unprecedented look at the details of watertable behaviour.

The group is lucky that one of its members, Phil Dyson, is a hydrogeologist who is running the technical aspects of the project.

'We are applying the principles that have been successful at Kamarooka to the monitoring and measurement and evaluation of climate on farms attempting to come to grips with climate change,' says Phil.

The group was committed to continuing its scientific approach and use of digital based technology, while combining it with community-based monitoring to explore how climate change impacts on agroforestry.

'The idea is to have the group learning from the measurements we're taking over demonstration sites,' says Phil. 'The old rain gauge nailed to the strainer post on the gate has to go and be replaced with electronic recorders that tell us so much more about how much rain fell and at what time and at what intensity.

'On four farms we've set up rainfall loggers, bores to measure the watertable and some evaporation units. This information is coupled with data on watertables and evaporation to help us better understand how our farming systems interact with the climate and the environment.'

Armed with this knowledge, group members can estimate the impacts of climate change on their trees and make decisions about how to adapt to changing conditions.

'We're not doing it through a typical scientific approach where the data is collected and you get a paper in the end,' says Phil. 'This is involving the landholders themselves in setting up the equipment, recording the results and collecting and analysing their own information.'

The 10-year drought in the district has given the group some major challenges. 'It's had a huge impact on the uptake of farm forestry in this low-rainfall area,' says Mal Brown who manages the Kamarooka Project. 'But now we're starting to see plantations like Ian's and others that have been in since 1998. They are really good showcases of what you can achieve with farm forestry.'

For more information

about the Northern United Forestry Group or to become a member, contact Ian Rankin on 03-5488 2271 or visit **www.nufg.org.au**

NUFG member and hydrogeologist Phil Dyson demonstrates a datalogger.

LandWater & Wool
Shaping the future

Understanding 'sense of place' delivers the message

Jann Williams

Delivering conservation advice to the farming community can be challenging, but there is help at hand! If the advice is delivered in the context of the farm enterprise/business, as well as recognising the importance of a landowners 'sense of place', then the opportunity to build relationships and encourage community ownership is likely to be stronger. Several Land, Water & Wool projects found that introducing native vegetation/biodiversity management in the context of topics that were of interest to the land manager can make the topic more attractive. Discussing native vegetation as part of the overall farm business and making conservation advice make sense in terms of each farmer's enterprise were identified as two ways of engaging farmers. For example, advice that might suit an 'improved country set stocker' may not suit an 'improved country rotator'. In another project it was felt that achieving 'incidental' goals can strengthen the chance of long-term success. In this instance, increasing productivity was the initial focus of the project, with topics such as perenniality introduced along the way.

Recognising and acknowledging the strong 'sense of place' farmers have was also identified as a crucial component of communicating conservation/NRM advice to wool growers. This is likely to apply more widely to other farmers. Sense of place is a multi-layered concept, which emerges from involvement between people, and between people and place. A location itself therefore does not create a place, it is the spectrum of meanings and emotions that individuals attach to a particular location. Sense of place includes the economic aspect of farming, and most importantly the social and environmental aspects. For many landowners, their special 'place' is integral to their identity, so it is vitally important that this is taken into consideration before recommending changes to the way they do things on their farm. If a change in the landscape threatens a landholders' sense of place, then this has been identified as a barrier to attitude change and NRM practice.

"The psychological benefit of a biodiverse farm is important." Rob Adams, Armidale, NSW. (Currie Communications)

A condition score for the environment

How do woolgrowers know if their native vegetation is healthy? QuickChecks (see www.landwaterwool.gov.au) provides the tools to measure the condition of pastures, soils, woody vegetation, birds, productivity and waterways. Its checklists and monitoring tables are easy to use and take away the guesswork. Woolgrowers can now use QuickChecks to determine the condition of native vegetation, biodiversity and river health on their farm and choose management options that maintain or improve that condition to meet their goals for the property.

QuickChecks takes the guesswork out of assessing the environmental health of your farm.

Biodiversity Conference

The Tamar NRM conference Biodiversity: Balancing Conservation and Production – Case Studies from the Real World held at University of Tasmania in association with the Centre for Environment was a huge success by all accounts.

With 265 attendees the Conference was seen as one of the few events where farmers, and fish and forestry practitioners engaged in a co-operative dialogue with NRM professionals, Commonwealth, state and local government officers, researchers and academics.

The keynote speakers set the scene for the theme that became, through common consent, "integrating biodiversity conservation and production" by the end of the Conference. The NRM North sponsored Public Forum broadened the dialogue to a discussion looking to a sustainable future.

The Conference Summary being developed for the Department of Economic Development and the Tasmanian Industry Council is shaping to be an exciting and innovative "document". The plan should be available on the website by mid August. The website currently includes The Tamar Principles, Key Stories, and Current and Emerging Trends which will be useful to a number of regional NRM bodies. Case Studies and other supporting material will also be made available via the site. The Conference Book will be available through CSIRO Publishing in early 2008 with a copy to be sent to all delegates.

For more information, contact:

Kay Bailey, Executive Officer
Tel: 03 6323 3348
Email: kay.bailey@launceston.tas.gov.au
Or visit **www.tamar-nrm.org.au**

Australia's Native Vegetation: A Summary of Australia's Major vegetation Groups, 2007

This publication, developed by the Department of Environment and Water Resources, is based on the National Vegetation Information System (NVIS), and represents the most detailed, up-to-date and accurate national information on Australia's native vegetation. It has been collated through the active participation of all Australian state and territory governments, under the Executive Steering Committee on Australian Vegetation Information (ESCAVI).

It has been produced for natural resource managers, researchers and educators in the field of native vegetation management and biodiversity conservation. The booklet contains a CD inside the back cover which provides GIS-ready vegetation data in a range of formats.

Copies of the publication can be obtained by emailing ciu@environment.gov.au or calling 1800 803 772. Details of this and other products from the National Vegetation Information System can be accessed online at:

www.environment.gov.au/erin/nvis

Australian Government
Bureau of Rural Sciences

New vegetation management series profiles Mitchell Grasslands

The Bureau of Rural Sciences (BRS) will shortly publish the first in a series of vegetation management booklets 'Toward sustainability for vegetation management — Mitchell Grasslands'. The booklets will provide factual, up-to-date information about key vegetation types in the agricultural landscape.

Mitchell Grasslands are a major Australian grassland ecosystem equivalent to the prairies of north America, pampas grassland of south America and the savannas of Africa.

The key issues identified in the Mitchell Grasslands booklet include:

- The Mitchell grasslands are found in the semi-arid interior of north and northeast Australia. They occur over an area of about 57 million hectares, stretching from northwest New South Wales through west Queensland and to the mid-north of the Northern Territory. There are smaller, scattered patches in the East Kimberley and the northern parts of South Australia.
- The Mitchell grasslands support an extensive pastoral industry that generates more than $500 million each year from sheep and cattle products. Pastoralism occupies a large area, is highly dependent on natural resources and has a central role in land management. As such it is a critical component in the sustainable management of the Mitchell grasslands.
- The major challenge for land managers is ensuring the landscape is not overgrazed. Light to moderate grazing of the Mitchell grasslands can be sustainable under the right conditions, which allow other native species to persist and the ecosystem as a whole to continue.
- The introduction of exotic species, especially the woody prickly acacia, if not properly managed, has the potential to threaten the biological values of the grasslands.

The profiles are aimed at a broad audience, including primary producers, government and local government agencies, regional managers, policy makers and the general public. They can be used as a handy reference for general interest, or as a basis for decision making. Other booklets under development in this series include temperate and tropical grassy woodlands.

The Mitchell Grasslands profile complements other work done by BRS on Australia's rangelands, titled 'Towards Sustainability for Australia's Rangelands: Analysing the options.'

Copies of these publications are available in hard copy from the BRS Shop phone 1800 020 157 or to download from the BRS website, **www.brs.gov.au/publications**

For more information, contact:

Richard Thackway
richard.thackway@brs.gov.au
Phone (02) 62724856

A natural Mitchell grass community on cracking clays in the Central Downs subregion, Qld. (David Akers)

Australian Government
Department of Agriculture, Fisheries and Forestry

Drought licks salt– for now anyway

Australia's 'worst ever' drought has provided ideal conditions for a group of tree conscious farmers in north-central Victoria to use native plant species against salinity and to develop a sustainable, permanent, grazing and forestry system in the process.

In 2007, three years after the trial commenced, it is clear that the combinations of eucalypts, acacias, saltbush and native grasses have lowered the water table in a notoriously saline paddock and along the way improved the scientific understanding of the 45 families involved.

The Northern United Forestry Group's trial at Kamarooka, 40 kilometres north of Bendigo, won the 2004 Telstra Country Wide Landcare Research Award and the 'proof of the pudding' is now posted on the group's website www.nufg.org.au for the world to see.

Group chairman Ian Rankin says the website includes before and after photographs of the trial paddock, which had been known to soil scientists and local farmers for its high salinity interest since 1959. It had been bare and unproductive for 50 years before the trial was mooted in 2004.

'That paddock, which the Hay family agreed to let us use for the trial, was not a pretty sight at the start; you could see the salt gleaming on the ground in places and the water itself was three quarters as saline as seawater,' Ian said.

'As a group we were all agro-forestry oriented, and as a group we took the master tree growers course from Melbourne University, in which one subject was salinity.

'We applied for and got an $80 000 Natural Resource Innovation Grant from the Department of Agriculture, Fisheries and Forestry to tackle this 40 hectare site near the Kamarooka recreational reserve. The grant came on a dollar for dollar basis, with us matching the cash in labour and kind, so altogether it was a lot of money in a small area.

And rather than asking for a top-up to the grant, we had enough money left to add another eight hectares to the trial without extra funds.'

Ian said Kamarooka was a typical, mixed farming area, but on the edge of the riverine plain, beside the bare foothills, whose clearing caused the area's salt problem.

The Northern United Forestry Group has been working since 1998 to identify native trees suitable for low-rainfall farm forestry to revitalise the natural ecosystem and reduce the threat of increasing salinity.

The 2004 plantings on the Hay family property totalled 11 000 trees, 10 000 saltbush plugs, six hectares of direct-seeded saltbush and native grasses and five kilometres of direct-seeded trees. Another 5000 trees were planted in 2005.

The group relied heavily on advice from specialist agro-forestry scientists from Western Australia's Department of Agriculture and CSIRO's Division of Forestry, while hydro-geologist Phil Dyson was employed as a groundwater consultant and liked the group's work so much he became a member.

'Nearly everything we've planted has been native indigenous, with the odd exception like South Australia's sugar gum (wirrabra provenance) and the flat-top yates (*Eucalyptus occidentalis*) from Western Australia,' Mr Rankin said.

'We've planted quite a few wattles, too, and they have gone reasonably well. We did plant the species known to be more salt tolerant in the more saline areas, and the less tolerant where there is less salt.

'The extra eight hectares we added are under agro-forestry and eight of the 12 groundwater bores are fitted with measuring equipment that automatically records the levels of groundwater.'

Participants were surprised by the results — such as finding out that trees go to sleep at night when there is no sun and the watertable rises.

'Yes we are lowering the watertable, but we have done it during the drought, which has been a window of opportunity, the driest time on record. We'll just have to wait and see what happens in a normal season, although we believe our trees are adapted to the landscape here.'

Ian said the group already had many of its trial results on its website, which also has links to the Victorian Departments of Primary Industries and Sustainability and Environment as well as the CSIRO.

While the group has been fortunate – thanks to the Natural Resources Innovation Grant – to be able to spend a lot of money on a small site, its findings could be transposed elsewhere at much less cost.

Salt bush could be planted in an alley-farming format, rather than in a block, while agro-forestry could be incorporated as a shelter belt or a windbreak along paddock boundaries.

For more information

Contact the Northern United Forestry Group or to become a member, contact Group Chairman, Ian Rankin, on 03 5488 2271 or visit **www.nufg.org.au**

LandWater & Wool
Shaping the future

Production and profitability – demonstrating the benefits

Jann Williams

Whole-farm economic modelling has provided a useful way to estimate some of the costs and benefits involved in managing native vegetation as part of a commercial wool growing enterprise. In the Victorian hill country, information was collected on vegetation, agronomic potential and the farm business situation. The effect on the farm business of adopting four management strategies (based on grazing, fertiliser use and natural regeneration) that could potentially improve farm environmental outcomes was then tested. One of the strategies examined was the adoption of deferred grazing, where sheep are taken off hill country in summer. By doing this, it was demonstrated that woolgrowers can simultaneously improve stocking rates and avoid bare hills in summer (a major erosion risk). It was found that whole farm profits can be conservatively increased by 10% to 30% using 25% – 50% higher stocking rates on hill country, achieved within three years of adopting this strategy. In the Clare region of South Australia, many woolgrowers believed they gained economic benefits as a result of making pasture management changes – with associated increases in native pasture regeneration and stocking rates.

Retention of native pastures is low-cost and can make an important contribution to maintaining native biodiversity on grazing properties. They also play an important role in producing high-value, fine wool. Sown pastures are generally more productive, allow higher stocking rates, enable turn-off of stock at higher weights and prices, and provide adequate nutrition at critical times of the year to breed or finish off saleable stock. These potential benefits need to be weighed up against the costs. Modelling the financial impact of sown pasture development on the whole farm in northern NSW showed that: (1) higher return fattening enterprises are necessary to justify the investment in sown pastures on current costs and returns; and (2) the financial outcome is sensitive to the productive lifespan of a sown pasture – pasture replacement intervals of 14 years are required to justify the expense, even with higher gross margin enterprises.

Investment in shelter on properties where tree cover is low can both increase gross margins and improve the environment. The cost of planting shelterbelts is more than offset by increasing lambing percentage and a survival of adult sheep. Results from the whole-farm model in northern NSW indicated a substantial return on investment in shelter, as a result of higher lambing percentages (steadily rising from 80% to 90% over a 10-year period), fewer deaths (50% reduction in adult sheep mortality), and therefore increased sales of surplus ewes and wether hoggets. On average, the gross margin was improved by $11/ha, despite stock exclusion from planted paddocks in the first year after planting, and gradual re-introduction of stock to full carrying capacity 6 years after planting. No income from commercial timber was included in the analysis, but the potential for greater aggregate income per hectare from timber and livestock is obvious. In the Victorian hill country, establishing shelter using natural (rather than planted) vegetation was considered a long-term option because of the opportunity costs from lost grazing while the trees are establishing. In this context, it was expected that the shelter benefits, which would generate an extra operating profit of $6.53/ha over the whole farm, would not be realised for 15 years. Ways to decrease the break-even time included re-introducing stock to tree areas earlier and reducing the size of the area allowed to regenerate.

Many woolgrowers are interested in learning more about short rotational grazing (variants include planned grazing and cell grazing). When done well, a number of environmental benefits can arise from these grazing regimes and stocking rates can be increased. Several woolgrowers in the NSW regional project have implemented this form of grazing management on parts or all of their properties. Using a whole-farm economic model, the financial impact of changing from continuous grazing to planned grazing was estimated for a 1347 ha farm with native and naturalised pastures, averaging 7.3 DSE/ha, and running 2238 ewes (16.7 µm), 2185 wethers and 123 cows. A change in grazing management would lead to a 21% increase in whole-farm gross margin (from $189,200 to $229,700), a 97% increase in net farm income (to $106,300) and a ten-fold increase in farm business return (to $55,200) over 20 years. The profit boost comes from increased stocking rate, weaning percentage and livestock income, a reduction in labour, sheep drenching and drought feeding costs, improved wool quality, and a 70% reduction in fertiliser costs. Whether the latter is sustainable in terms of nutrient budget needs to be tested.

Retention of native pastures is low-cost and can make an important contribution to maintaining native biodiversity on grazing properties. (Nick Reid)

CASE STUDY:

Back to basics a proven formula for the Neals

For southern Queensland graziers John and Jill Neal, the quality and long-term nature of grazing offered by native pastures is a strong incentive to maintain and improve the natural resources underpinning their 3600-hectare grazing operation.

For the Neals, retaining about 30 per cent of woodland vegetation on their property is 'about right'. More than one quarter of the property contains large areas of woodland, while the Neals are allowing smaller clumps to naturally regenerate for shade and timber belts on land previously cleared. Cultivation areas of the farm have been returned to native pasture, which is gradually improving in quality.

Native pastures are a personal choice for the Neals and their business for long-term sustainability – and in particular for feed during the protein-deficient months of winter.

The Neals have done the sums when it comes to comparing the direction of the present operation with a full development program. They believe that they will be ahead in productivity terms over the long term by returning to a native pasture base and diverting the considerable funds (estimated to be $250,000) that would be required for improving pastures to other areas.

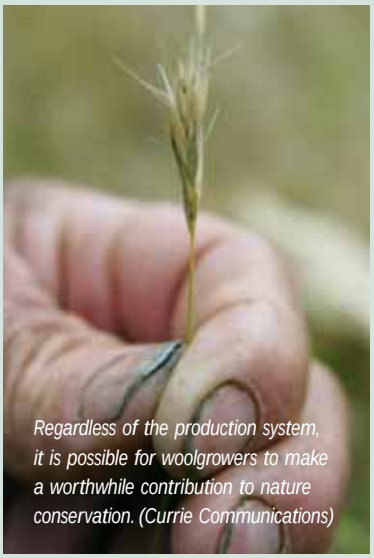
Opting to return to a native pasture grazing system has saved Queensland woolgrowers John and Jill Neal an estimated $250,000 in development costs. (Currie Communications)

Resources for land managers and woolgrowers – Native Vegetation and Biodiversity Sub-program

Jann Williams

The following resources represent an example of the large range of information resources available from the Land, Water & Wool program. Products can be ordered from our website www.landwaterwool.gov.au

- Insights – case studies of how woolgrowers are successfully managing native vegetation and biodiversity for profit and sustainability
- The Tasmanian Native Pasture Guidelines and key species Fact Sheet series
- How to Make Money out of Grass (SA)
- Farm Business and Biodiversity – 'Barking Up The Right Tree' brochure and extension notes
- QuickChecks – Natural Resource Management Monitoring Tools for Woolgrowers
- Land, Water & Wool Northern Tablelands Project Fact Sheets, Case studies and Testimonials.



Regardless of the production system, it is possible for woolgrowers to make a worthwhile contribution to nature conservation. (Currie Communications)

Mulga – fodder for stock or a feast for all things great and small?

By Teresa Eyre and Chris Chilcott

Research on ecological thresholds in poplar box woodland remnants in a fragmented landscape in southern Queensland revealed the value of maintaining existing habitat in good condition for biodiversity (Land & Water Australia project QNR28). The project also revealed how the area of vegetation retained in the landscape contributed to the maintenance of the ecological integrity of the remnant patch. In particular we found that the amount of native vegetation cover in a paddock and property was a determinant of presence of some taxa, so it was likely that future management of regrowth would play an important role in biodiversity outcomes, both on farm, and in the local area. However, this left us wondering how important regrowth actually was in maintaining remnant vegetation condition and habitat value in the landscape.

In Queensland, regrowth vegetation is defined as woody non-remnant vegetation that is not mapped as remnant vegetation for the purpose of the Vegetation Management Act 1999. Regrowth can be re-cleared, or retained and thus provide a cost-effective solution to targeted habitat restoration – once we know more about the functionality of regrowth in the landscape. But, does regrowth really contribute habitat value? How functional is a small patch of remnant vegetation in a landscape of regrowth vegetation? Does a patch of regrowth vegetation in a landscape of remnant vegetation contribute habitat value? And if it has habitat value then what constitutes "good" and "poor" condition for both biodiversity and agricultural production?

Concurrently, as we were deliberating these questions in the lead up to the next round of funding by Land & Water Australia, a number of EdgeNetwork© Grazing Land Management (GLM) workshops were being run by the Queensland Department of Primary Industries and Fisheries in the mulga lands. The purpose of these workshops was to assist participants in implementing management strategies that both maximise productive potential while minimising the offsite impacts. It became apparent through these workshops that regrowth plays an important role in maintaining production (via fodder) and that it also had the potential to provide habitat value and other functional attributes, such as maintaining soil condition. Landholders at the workshop were keen to see on-property research into the multiple functions regrowth play on their places.

All this led us to design a new project specifically aimed at quantifying the contribution regrowth mulga ecosystems play in the healthy functioning of a landscape. Interestingly, the mulga lands are often described as "intact" landscapes, because historically

Recording fallen woody material in regrowth mulga. (Daniel Ferguson)

broadscale clearing for conversion to pastures has not been a productive or feasible pursuit.

Nevertheless, as a consequence of various approaches to harvesting mulga for fodder, distinct landscape-scale patterns can be differentiated between regrowth and remnant mulga . For example, mulga can be pushed or pulled or selectively lopped in strips or clumps.

For the current Land & Water Australia funded project (EPQ5) we have specifically targeted landscapes in the mulga lands of four types;

- landscapes comprised predominantly of remnant mulga;
- landscapes comprised of small patches of remnant mulga in a predominantly regrowth landscape;
- landscapes comprised of small patches of regrowth mulga in a predominantly remnant landscape; and
- landscapes comprised of predominantly regrowth mulga.

The project team are looking at species groups thought to be indicative of condition across various scales, including invertebrates, reptiles, birds and bats, and we are measuring field and landscape-scale habitat characteristics. We are sampling ground flora composition, indicators of soil condition, landscape function, and land condition for pastoral production across the remnant and regrowth gradient using paired sites.

The ecology of the landscape we are presently working in and its disturbance pressures are vastly different compared to that investigated during the previous poplar box woodland project. Nevertheless, while we have not quite finished the first season of surveys, we are seeing some familiar 'increaser' and 'decreaser' species response patterns. Increaser species are defined as those species whose abundances respond in a positive manner to disturbance pressure, whereas decreaser species respond negatively. For example, the white-browed treecreeper – a tree hollow-dependent species and tree-trunk forager – appears to be acting as a 'decreaser' species, in that they have predominantly been recorded in intact remnant mulga landscapes so far. Other species, such as the termite-foraging beaked gecko, appear to be less sensitive, as they seem to occur wherever there is less mature mulga. Or is what we are seeing more a factor of sampling season? Time will tell, as we complete our first and second round of surveys, and learn more about the functionality of regrowth and remnant mulga landscapes.

For more information, visit the Native Vegetation & Biodiversity R&D Program website at
www.lwa.gov.au/nativevegetation

For more information

Teresa Eyre
Biodiversity Sciences Unit
Environmental Protection Agency
teresa.eyre@epa.qld.gov.au

Beaked Gecko Rhynchoedura ornata. (Michael Mathieson)

Loving what mature mulga has to offer, White-browed Treecreeper Climacteris affinis. (Graeme Chapman)

Australian Government
Land & Water Australia

Land & Water Australia is keen to hear about your information needs arising from the content in this publication. If you would like to know more about the research or topics presented in this issue, please contact

Mick Quirk, Program Coordinator
0401 299 752, Michael.quirk@lwa.gov.au

Nadeem Samnakay on (02) 6263 6075
email nadeem.samnakay@lwa.gov.au

Jim Donaldson on (02) 6263 6061
email jim.donaldson@lwa.gov.au

Printed on 150gsm Revive Silk 15% post consumer, 20% pre consumer waste, 20% Mill broke. 100% Australian Made.

LandWater & Wool
Shaping the future
another innovation

Australian Government
Bureau of Rural Sciences

Australian Government
Department of Agriculture, Fisheries and Forestry

Greening Australia

CSIRO

This publication can be ordered free of charge from Canprint Communications
Freecall 1800 776 616 or email
lwa@canprint.com.au
Product Code PN071324

Visit our website to view, download or order our publications
www.lwa.gov.au/nativevegetation

If you would like to be on the mailing list for *Thinking Bush*, please send an email to subscribe@lwa.gov.au with your name, address and contact details.

ZOO 30291