Australian Government
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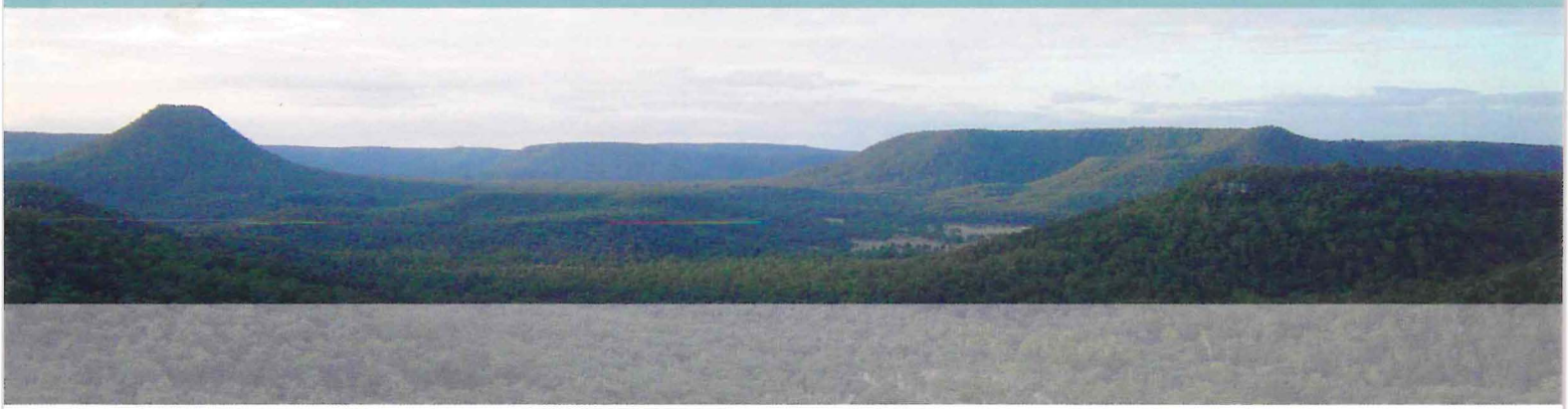
ThinkingBush

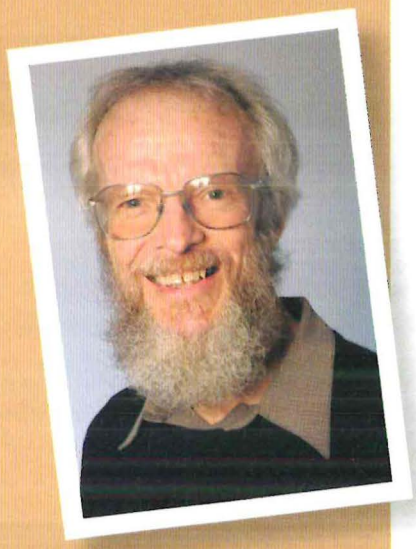
Knowledge for managing native vegetation in Australian landscapes

ISSUE 6 • March 2008



Coordinating national standards
in vegetation data and information

NATIVE VEGETATION AND BIODIVERSITY R&D PROGRAM



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Foreword

John Childs

Articles in this issue by the National Land & Water Resources Audit (the Audit) and the Bureau of Rural Science (BRS) emphasise the need for nationally consistent information collation and reporting mechanisms.

All states and territories have invested considerable time and effort to describe, map and better understand their vegetation extent and composition. Through a collaborative effort with the states, territories and supporting agencies, the Audit and BRS, have developed nationally consistent reporting criteria allowing agencies at both the national and state levels to better monitor and evaluate the impact of vegetation management policies and practices.

Such data sets can provide a national picture on aspects of native vegetation extent and composition. Over time, these data sets can provide critical information about rates of change in vegetation cover, changes in land use and impacts of land use policies.

Thinking Bush Issue 5, on page 16 provides a framework for mapping vegetation condition, known as Vegetation Assets, States and Transitions (VAST) developed by BRS, and on page 26 of the same issue describes key attributes for describing and mapping revegetation activities that can be recorded to provide nationally consistent information.

In this issue of Thinking Bush, articles by the Audit and BRS explain the mechanisms for compiling nationally consistent data sets and standardising the methods of describing and mapping vegetation.

High quality data and information provided at the appropriate scales for decision making can lead to better resource management decisions. Over time, users of this data such as policy makers and land managers can make better adaptive decisions with respect to sustainably managing our vegetation resources. The articles provide an entry point to accessing further information on national vegetation datasets and how this information can assist users in making informed regional planning and investment decisions.

National Land & Water Resources Audit

An Initiative of the Natural Heritage Trust

Monitoring Australia's native vegetation

Nationally consistent vegetation information is critical to better manage Australia's natural resources, achieve sustainable land management and improve our capacity to manage biodiversity and other environmental values.

The National Land & Water Resources Audit (the Audit) is working in partnership with the Australian Government and states and territories to develop consistency in data collection for the monitoring, reporting and assessing of Australia's native vegetation resources. This is part of a broader National NRM Monitoring and Evaluation Framework that considers a range of high priority natural resource issues and themes (called Matters for Target).

The national partnership, supported by the Executive Steering Committee for Australian Vegetation Information (ESCAVI), has recommended three indicators of the integrity of native vegetation communities – the extent, type and proportion of remaining pre-1750 native vegetation.

Much of the native vegetation information available across Australia is based on a mix of historic and recent mapping projects. Whilst it provides valuable information on the types of vegetation (e.g. heath, forest, woodland, grassland) in Australia, it does not provide a comprehensive statement of what vegetation is left in the landscape at any single point in time, where it's located and it's condition or status.

The Audit is working with states and territories to develop an authoritative baseline of the extent of native vegetation in Australia as at 2004–2005, which will be reported in early 2008. Methods and capacity to update the extent information are also being developed so that trends over time can be monitored and reported. This information will be useful for a range of decision making such as in evaluating the success of revegetation activities or in assessing priority areas for further investments.

Vegetation type mapping and pre-1750 (industrial development era) vegetation maps are at best patchy across the country. Some areas have high quality, detailed mapping while others are very poorly documented. Future investment is required to improve our capacity to report on vegetation type mapping and modelling of historic vegetation.

ESCAVI is also working to develop indicators for the 'condition' of native vegetation. At a recent meeting in Hobart, ESCAVI agreed to an approach to capture condition information which includes – developing benchmarks for all major vegetation types; developing a nationally agreed classification for the state of native vegetation based on the level of modification; promoting site based data collection for vegetation attributes relative to vegetation condition; modelling a first approximation map of the state of native vegetation based on available site data and other environmental data sets; and providing summary statistics of the proportion of each major vegetation group in each modification class.

The Audit and the Bureau of Rural Sciences, with significant input from a number of vegetation information agencies and experts, are developing a national "Vegetation Assessment" to consider the current status of our vegetation resources and the sustainability of Australia's natural resources. The report is anticipated to be released in 2008.

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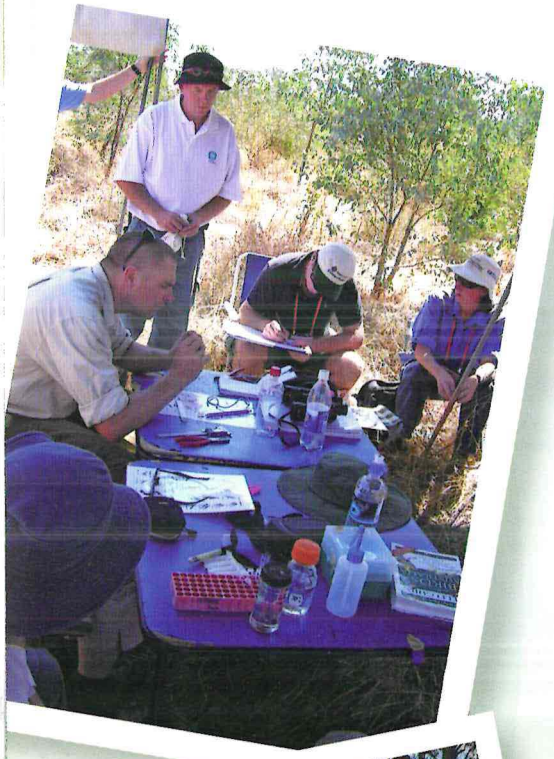
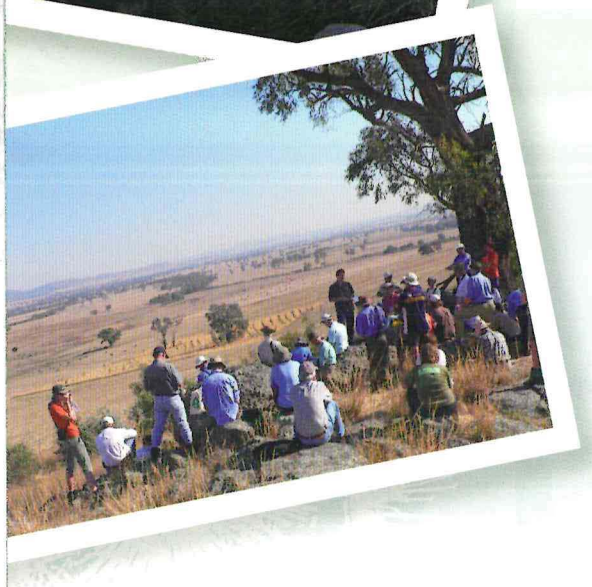
Remnant vegetation along the upper reaches of the Shoalhaven River, NSW
Photo: Peter Wilson

Australian Government
Land & Water Australia

Greening Australia





Veg Futures 08 – The conference in the field. 20-23 October 2008

Following on the heals of a successful Veg Futures conference held in Albury – Wodonga in March 2006, Greening Australia and Land & Water Australia are co-hosting Veg Futures 08 from the 20-23 October 2008.

The Veg Futures 08 conference will be hosted in Toowoomba, perched at the top of the Great Dividing Range about an hours drive west of Brisbane. Toowoomba is an ideal location for such a conference as it straddles different land use types which will allow conference delegates to learn and share experiences on the multitude of vegetation management issues typical of many regional areas nationally.

The conference will bring together vegetation experts and practitioners, representatives from NRM regional groups, landholders, Landcare groups, state and national agencies and industry sectors.

Given the practical focus on land management, Toowoomba provides a convenient location to explore content around the conference themes including carbon trading and sequestration, adaptation to climate change, landscape scale project management, stewardship, peri-urban expansion and the role of people in the landscape.

The conference will feature keynote speakers, field trips and workshops to engage delegates and will again be guided by the following five key questions:

- How do we use native vegetation to meet regional targets?
- Who pays for native vegetation management?
- Conservation and production – how do we balance competing demands?
- What are we doing about vegetation and how do we measure it?
- What are the threats to native vegetation?

Paddock sessions, which were a highlight of Veg Futures 06, are likely to include an exploration of topics such as:

- Managing for multiple values in production landscapes (e.g. timber, forestry, agriculture, mining)
- Managing the peri-urban landscape
- Valuing biodiversity – Species and habitats in a fragmented landscape
- Managing riparian areas and the multiple roles vegetation has in water outcomes
- Designing vegetation for environmental services (including greenhouse).

Greening Australia and Land & Water Australia are now calling for papers for the event. Go to **www.greeningaustralia.org.au**

Top: Participants at Veg Futures 06 studying the Holbrook landscape, NSW, prior to discussing vegetation management issues. Photo: Jim Donaldson

Above: Participants on the Veg Futures 06 field trip get a hands-on look at bird banding and surveying techniques being used in a revegetation monitoring site at Holbrook. Photo: Jim Donaldson

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Veg Futures

Australia's national vegetation conference | 08

20 to 23 October 2008

Toowoomba, Queensland

Greening Australia and Land & Water Australia bring you Veg Futures 08

A comprehensive, practical conference about national issues affecting native vegetation management

Topics include:

REGIONAL ISSUES

- > Urban and peri-urban development
- > Mining
- > Legislation around native vegetation management
- > Catchment Management needs
- > Perceptions of landscape

CLIMATE CHANGE

- > Impacts and opportunities

STEWARDSHIP AND INCENTIVES

- > Market based instruments
- > Management actions for better bush

LANDSCAPE SCALE PROJECTS

- > Gondwana Link –Western Australia
- > Planning, partnering and paying for it

SPECIALIST AREAS

- > Riparian
- > Tropical
- > Saline or acidic soils
- > Urban

Greening Australia

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CALL FOR PAPERS OPEN

For more information or to register, visit:
www.greeningaustralia.org.au/vegfutures

Australian Government
Bureau of Rural Sciences

Revising national guidelines for describing and mapping Australia's vegetation types

In the early 2000's developers of the National Vegetation Information System (NVIS) framework recognised an opportunity to develop and promote national guidelines for describing and mapping vegetation types.

Vegetation has been surveyed, classified and mapped in Australia for more than 150 years. The process of describing and mapping vegetation types at national, State and Territory levels usually involves compiling numerous datasets. Invariably this process highlights disparities between the input datasets—largely due to the influence of the different systems used to survey, classify and map vegetation communities for different purposes and using different methods.

With a view to developing a national standard for describing and mapping Australia's vegetation, Specht in the early 1970s developed a schema for surveying and classifying site-based vegetation using the foliage cover and height of growth forms. That schema became accepted as a national standard for vegetation survey. This was followed by Walker and Hopkins in 1984 with more robust definitions for cover classes based on crown cover, extra height classes and methods to include floristics (i.e. plant species and relationships in a given area) in the classifications.

A driving force in continuing the use of structural attributes and dominant species was the linking of site descriptions to remotely sensed imagery. The Walker-Hopkins system (1990) in the Australian Soil and Land Survey 'Yellow Book' became the de facto national standard in the latter part of the 20th century and early 21st century, underpinning the attribute frameworks for compiling the National Forest Inventory (NFI) and the National Vegetation Information System (NVIS) datasets.

In revising and updating the site-based vegetation guidelines, the basic structure of the 1990 version was retained. Hnatiuk et al. (in press) describes a consistent and comprehensive method for collecting actual values for height and cover and for converting these into classes for use in classifying site-based attributes into associations and sub-associations. These classes have been

TABLE 1 Attributes required to define Levels 1, 2 and 3

	ATTRIBUTES REQUIRED	LEVEL OF DETAIL		
Recognise	Dominant stratum			
	Mid stratum (if present)			
	Lower stratum (if present)			
Record (for at least the dominant and ground stratum)	1. Life form (woody or non-woody plant)	Formation (Level 1): record 1–2	Structural formation (Level 2): record 1–7	Broad floristic formation (Level 3): record 1–8
	2. Cover of the dominant stratum (crown separation or foliage cover)			
	3. Crown type			
	4. Growth forms in each stratum			
	5. Height of each stratum			
	6. Foliage cover of the lower stratum			
	7. Emergents (if any)			
	8. Species of only the dominant stratum			

NB: Defining Levels 4–6 requires the addition of more strata and dominant species in each stratum.

designed to enhance the capacity of field data to more readily be incorporated into the NVIS attribute framework. Terms such as dominance, emergents and growth forms are clarified and sections considered useful to a wider range of users, such as wetlands, cool temperate rainforests of Tasmania, and vegetation stage and condition, have been added. These guidelines are fundamental in establishing repeatable, comprehensive and systematic national information on Australia's vegetation types.

The revised system uses three levels of detail: the broadest units, *formations*; the next level of detail, *structural formations*; and the more *detailed, broad floristic formations*, as shown in **Table 1** and **Figure 1**. Further subdivision to include more strata or plant species is also possible—the level ultimately depends on the purpose of the survey and the resources available. These levels are conceptually equivalent to levels in NVIS and add a broad level intended for use with imagery (formation, i.e., woody or non-woody plant) to the previously recommended system (Walker and Hopkins 1990).

The progression from the simplest to a more detailed vegetation classification can be illustrated by the example of *Eucalyptus populnea* (Poplar box) vegetation with height 21 metres and crowns nearly touching. Using the appropriate tables in Hnatiuk et al. in press, this vegetation can be classified at different levels. The example shown in **Figure 1**, a hypothetical site with four strata and emergent trees is used. The full names and codes at four different levels of classification are as follows:

Formation (Level 1)

Name: 'Mid-dense woody plants'
Code: **Mw**

Structural formation (Level 2)

Name: 'Emergent very tall trees with very tall mid-dense trees'
Code: **E8w1.0/8Mw1.0**

Broad floristic formation (Level 3)

Name: 'Emergent very tall *Angophora* with very tall mid-dense *Eucalyptus* trees'
Code: **E8Angophoraw1.0 /8MEucalytpusw1.0**

Broad floristic sub-formation (Level 4)

Name: 'Emergent very tall *Angophora* trees over very tall mid-dense *Eucalyptus* trees with tall sparse Eucalyptus tree understorey over dwarf very sparse *Eremophila* shrubs with a tall sparse *Bothriochloa* tussock grass ground stratum'
Code: **E8Angophoraw1.0 /8MEucalyptusw1.0 /7SEucalyptusw1.0 /4VEremophilaw3.0 /3SBothriochloag3.0**

The system of attributes presented in this latest revision satisfies the current demands for an approach that integrates all vegetation within landscapes, including both native and human created or induced vegetation.

The site-based attributes have been developed through a partnership between the Bureau of Rural Sciences, National Land and Water Resources Audit, CSIRO and the Executive Steering Committee for Australian Vegetation Information (ESCAVI).

Australia now has the following three integrated guidelines for describing and mapping vegetation:

- field-based vegetation survey (Hnatiuk et al. in press), described above, which provides the way vegetation data should be collected in the field;
- classification and mapping of vegetation types (Thackway et al. in press), which provides a consistent framework to classify the field collected data according to the National Vegetation Information System (NVIS) framework; and
- compiling existing mapped datasets into national, State and Territory NVIS datasets (ESCAVI 2003).

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FIGURE 1: An example of coding a sample site using the classification.

Top height	E	A	B	C	D
Stratum	Emergent	Dominant stratum	Mid-stratum 1	Mid-stratum 2	Ground stratum
Life form[a] (code)	Woody plants (**w**)	Woody plants (**w**)	Woody plants (**w**)	Woody plants (**w**)	Non-woody (**nw**)
Crown cover[b]	2%	67%	22%	13%	25%
Crown separation ratio[b] (name, code)	4.0 (emergent, **E**)	0.1 (mid-dense, **M**)	0.9 (sparse, **S**)	1.5 (very sparse, **V**)	0.8 (sparse, **S**)
Growth form[c] (code)	Tree (**w1.0**)	Tree (**w1.0**)	Tree (**w1.0**)	Shrub (**w3.0**)	Tussock grass (**g2.0**)
Height[d] (name, code)	28m (very tall, **8**)	21m (very tall, **8**)	11m (tall, **7**)	2m (dwarf, **4**)	0.7m (tall, **3**)
Description[e]	Emergent very tall trees	Very tall mid-dense trees	Tall sparse trees	Dwarf very sparse shrub	Tall sparse tussock grass
Genus or species	Angophora	Eucalyptus	Eucalyptus	Eremophila	Bothriochloa
Broad Floristic formation (Level 3) full code		8M Eucalyptusw1.0			
Broad Floristic sub-formation (Level 4) full code	E8 Angophoraw1.0	8M Eucalyptusw1.0	7S Eucalyptusw1.0	4V Eremophilaw3.0	3S Bothriochloag2.0

Gubinge: an opportunity in the north

A project investigating the cultivation of a bush 'wonder' fruit in the Kimberley and Top End of the NT is being driven through TAFE training and collaborations with government agencies and Traditional Owners.

The WA Department of Environment and Conservation (DEC) along with the Department of Agriculture and Food (DAFWA) and Charles Darwin University (CDU) in the NT are currently supporting the initiative to investigate cultivation models for the fruit, known in Broome as gubinge and as Kakadu plum in the NT.

In the early 1980s nutritional studies of bush foods across the North by the Australian Army accompanying the Bush Tuckerman television series found *Terminalia ferdinandiana* (its botanical name) to contain the highest levels of vitamin C of any fruit in the world.

More recently the pale green, cherry-sized fruit has been found to also contain high levels of antioxidants mooted as having anti-aging, immune system boosting and even cancer fighting qualities.

Research work carried out by CDU two years ago revealed there were 17 major health and cosmetic companies worldwide interested in trialling gubinge fruit in new product development.

The emerging industry was largely instigated by the Sydney based company Coradji who have established international markets and patented a technique which turns the fruit into a powder while maintaining the high levels of natural vitamin C.

Since 2003 Coradji have purchased wild harvested fruit from licensed pickers in the Broome region and the Top End of the NT paying between ten and twenty dollars a kilo. But the supply has consistently fallen short of their targets of around 12 tonnes a year.

Late last year a forum on the emerging gubinge industry was organized by the WA Department of Agriculture and hosted at the Kimberley College of TAFE, Broome Campus. It brought together major players in the industry from around the country.

The forum established conclusively that the development of the industry and its security is at risk because of a lack of local supply. It also acknowledged there are concerns about the environmental impacts of wild harvesting on sensitive areas of bush.

It concluded that cultivated plantations, based on organic principals that preserved natural biodiversity presented a way forward for the industry. The concept known as 'enrichment planting' is currently being trialed through a practical training program run through the Kimberley College of TAFE, Broome Campus.

The trial is stage one of an initiative between Kimberley TAFE and DEC to establish a training and research facility in horticulture and land management on the outskirts of Broome.

This initiative is supported by the Department of Agriculture and Food through a special project known as NOTPA (New Opportunities for Tropical and Pastoral Agriculture).

Since late 2004 training programs delivered through Broome TAFE have successfully established the first cultivated plantations of gubinge in the region. A critical element being that the young trees have been watered using the latest technology in micro irrigation. The training programs have predominantly involved Aboriginal students from remote Kimberley communities.

Program coordinator and horticultural lecturer Kim Courtenay said "the work was being carried out with the approval of and in close association with Traditional Owners". He said "work by the students had proved that gubinge can successfully be grown in plantations using modern agronomy techniques and that drip irrigated trees often produced an extra crop each year".

"These are exciting times but we have to move quickly and carefully to consolidate the opportunity for local people," he said.

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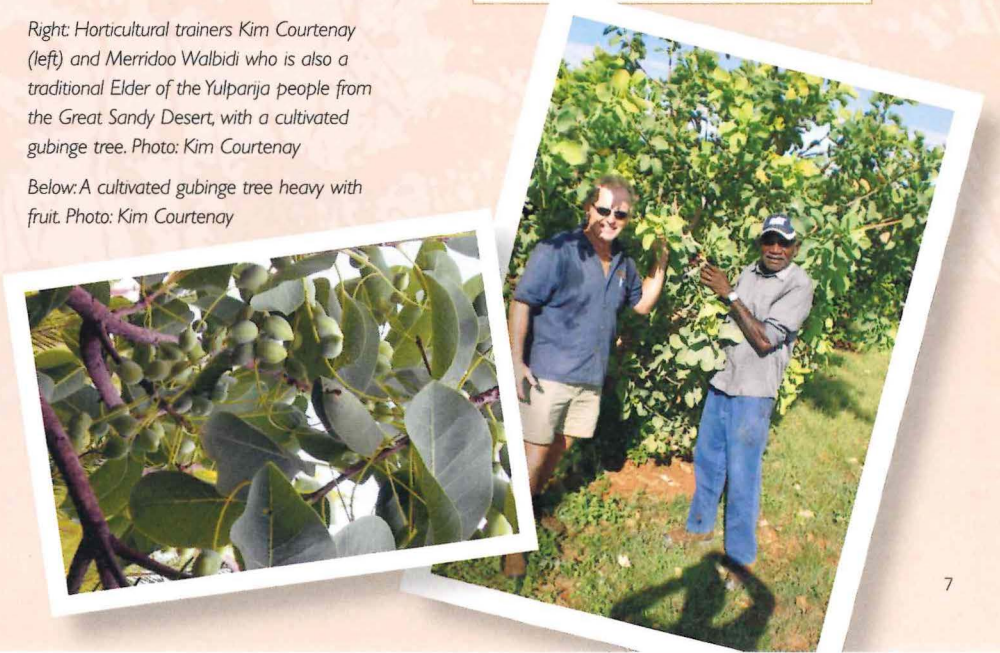
Right: Horticultural trainers Kim Courtenay (left) and Merridoo Walbidi who is also a traditional Elder of the Yulparija people from the Great Sandy Desert, with a cultivated gubinge tree. Photo: Kim Courtenay

Below: A cultivated gubinge tree heavy with fruit. Photo: Kim Courtenay



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Landholder participation in competitive tenders

By Andrew Reeson

Competitive tenders, such as Bushtender-style conservation auctions, need the right level of participation by landholders in order to achieve their potential for cost-effective NRM outcomes.

Competitive tenders are increasingly being applied to deliver incentives to landholders for natural resource management (NRM) outcomes. They are a form of market-based instrument (MBI) in which landholders bid for funding to carry out NRM projects. Tenders are typically less prescriptive than alternative incentive programs. Landholders can choose, in consultation with the funding agency, exactly what sort of project to offer. They are also free to determine their price. Funds are awarded to those projects that offer the best value for money, in terms of NRM outcomes per dollar of public money invested. In this way, competitive tenders maximise the returns from available NRM funds, while providing landholders with real choice and flexibility.

Given the need for competition in such schemes, it is essential to ensure sufficient landholder participation. Participation rates have varied markedly from tender to tender, and there is a perception that it is a common problem for such schemes. However, closer analysis suggests that this is not necessarily the case. In narrow economic terms, the more landholders participate in a tender, the greater the competition, and the better the result for the NRM agency. Think of selling a house at auction; the more bidders participate in the auction, the better the chances of getting a good price, so sellers work hard to ensure that as many people as possible take part. However, participating can be a costly process for bidders, including the time and effort taken to attend an auction, and additional costs for surveys and research.

The same is true for NRM tenders. Participation can have costs both for landholders (e.g. the time, effort and advice required to submit a bid) and the NRM agency (e.g. site inspections and assessment). Unsuccessful bids also represent a disappointment to a landholder, who has taken time and trouble to engage with a scheme. While the nature of competitive tenders requires a range of bids from which to choose, and necessitates that not all bids can be successful, excessive participation can be an inherently wasteful process all round. Therefore tenders should be designed in a way that optimises, rather than maximises, landholder participation.

So what is optimal participation? Well as an economist would say, it depends! A number of factors should be considered in order to set an approximate target, representing the ideal level of participation in a tender. The first is the amount of funding available, and the expected average cost of bids. If the budget is likely to be sufficient to contract with only a small number of landholders, there is clearly less to be gained from having large numbers participate. The level of variability among landholders in the costs of their projects is also relevant. If there is a lot of variation, then higher participation will be more beneficial as it will increase the number of low cost projects available.

Of course, no agency can know precisely in advance what the costs of running a competitive tender will be (otherwise there would be no need to run a tender). However, it should be possible to get rough estimates,

Landholders in a Wimmera CMA workshop taking part in a simulated tender exercise. Such workshops can help potential participants better understand the tender process and assist with developing a bid. Photo: CSIRO

which can then be used to determine an optimal target for participation. For example, if there is $200,000 available, and the average project is expected to cost around $20,000, then as a very rough estimate around 10 projects are likely to be funded. In order to select cost effective projects, a degree of competition is required. As an approximate rule of thumb, if there are around twice as many bids as can be funded there will be good competition without too many unsuccessful bids.

There are a number of stages in the implementation of a tender. A scheme may be launched with a mail-out or media campaign inviting landholders to register their interest. Interested landholders are provided with additional information, and may be invited to a workshop at which the scheme is explained in greater detail. This will be followed by a site visit, in which an NRM officer works with the landholder to develop a suitable project. Following the site visit the landholder must decide whether to formally enter the tender, and how much money to request for their project.

Typically a proportion of potential tender participants will drop out of the process at each stage. Therefore if around 20 bids are required, it will be necessary to do around 30 site visits, which will probably require at least 50 landholders to initially register an interest in the scheme. The tender should be designed and implemented with these targets in mind. The scope of a tender, for example whether it covers a whole catchment or just a particular sub-catchment, will determine how many landholders are eligible to participate. Defining the scope with a participation target in mind will help to ensure good levels of participation.

While it cannot be known exactly what the participation rate will be, previous schemes in the region may provide some guidance. The design and implementation of the tender itself will also have a significant impact. Schemes which involve on-farm benefits, or target issues that are recognised as important by landholders, are likely to have higher participation rates. If participation is likely to be low, it may be necessary to adjust a scheme, for instance by increasing the amount of funding on offer or making a greater effort to communicate on-farm benefits.

The process of engaging with landholders is also crucial. Local bodies with a strong community presence are generally best placed to engage with landholders. Better contact will provide better outcomes, but it comes at a cost. In particular, a site visit by a knowledgeable field officer greatly facilitates engagement. Workshops to provide more information and familiarise potential participants with the tender mechanism have also proved useful, particularly where competitive tenders are a novel concept. The resources invested in engaging with potential participants can be adjusted upwards or downwards depending on progress towards meeting participation targets.

Contracts with successful bidders, and any follow-up monitoring, should be kept simple. This not only minimises costs for all concerned, and therefore encourages participation, but can also promote trust and better overall outcomes. It is also important to engage with landholders whose bids are unsuccessful, for example directing them towards alternative schemes or providing feedback to assist them in preparing more attractive projects for subsequent tenders.

We have looked at these issues in some detail as part of an ongoing LWA/CSIRO/Central Queensland University research project "Achieving coordinated landscape scale outcomes with auction mechanisms". Other aspects of this research are focussed on adapting competitive tenders to incorporate landscape connectivity objectives, for instance wildlife corridors. This involves designing and testing auction mechanisms which can deliver cost-effective connectivity outcomes, and incorporating a framework for assessing the biodiversity benefits of alternative landscape configurations into the tender assessment process.

The full report "Barriers to and opportunities for increasing participation in conservation auctions" and an associated policy brief are available at: **www.csiro.au/science/markets**

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Tender simulation exercises were held in far north Queensland to protect the cassowary (top) by protecting its rainforest habitat (above). Photo of cassowary, Willem van Aken (CSIRO)

Grain & Graze™ 2
Profit through knowledge

250,000 bugs have a story to tell

A project that has seen researchers sort through a quarter of a million individual 'bugs' is discovering important information about biodiversity on mixed farms.

Australia's largest study of biodiversity on farms, carried out by the national Grain & Graze Program on 47 farms around the country, is finding that mixed farming systems have the potential to conserve biodiversity at all levels, from landscape through to individual species.

The Biodiversity in Grain & Graze (BiGG) project has been collecting information from four land-use types on each farm, twice a year over two years. The different land uses include a cropped paddock, a paddock under rotation as a break crop or pasture phase, a perennial pasture and an area of remnant vegetation.

The project measures plants, invertebrates (beetles, ants and spiders), birds and soil microbes (fungi and overall biological activity).

The project aims to answer two questions: does enterprise diversity lead to increased biodiversity? And is there a relationship between site conditions, land use, landscape and biodiversity? Ultimately the results should help inform farmers about how to maintain and enhance biodiversity on their mixed farms.

Getting the numbers right

BiGG researchers have found more than 150 bird species (including some rare and threatened species) on the 47 participating farms. Having logged more than 250,000 individual 'bugs', the team has found that they represent more than 780 different species of beetles, ants and spiders.

According to Grain & Graze's National Operations Coordinator, Dr Richard Price, the effort involved in gathering and collating the information has been massive.

'Our BiGG people and their collaborating farmers had to collect data simultaneously across nine regions, keep the pitfall traps they had for insects free from the perils of feral animals, and freeze their cotton collection strip samples and airfreight them to be sure they arrived at the University of Tasmania in a fit state,' he says.

'Every single bug has been categorised by staff from the University of Tasmania, led by Dr Bridle,' he says.

Dr Kerry Bridle, National Coordinator of the BiGG project, whose position is funded by the Natural Heritage Trust, says that mixed farms may provide important refuges for native flora and fauna.

'Research across Australia's mixed farming landscapes show that many have been extensively cleared, and species that relied upon them – like woodland birds – have declined in number. In some parts of the country this loss is continuing,' Dr Bridle says.

'This makes on-farm remnant vegetation of considerable national value and significance, especially when it forms stepping stones between larger blocks of vegetation, or refuges from which vestiges of native populations of plants and animals may be able to recover.'

To date the research is showing that the remnant vegetation areas on farms had the highest richness of bird, plant and invertebrate (insect) species. According to Dr Bridle, project findings to date indicate that good quality remnant vegetation can provide adequate habitat for conserving threatened species and even remnants that are small or in poor condition can help preserve biodiversity.

Biodiversity can help production

Biodiversity is about whole systems – ecosystems (their structure, function and composition), species (the number of species present and the abundance of individuals), and genes.

While the word 'biodiversity' also refers to farms, livestock, crops and the landscapes in which they exist, the term is often used to refer primarily to native systems and species; natural settings in which native plants provide food and shelter for a diverse range of native fauna.

In a mixed farming context, biodiversity can be critically important to production. For instance, a healthy soil biota makes nutrients readily available to plants and combats root diseases. A native or salt-land pasture can provide valuable out-

Stuart Doyle recording cover of exotic and native plants in a wheat paddock to provide data for the biodiversity assessment of the alley farming trial at Condobolin, November 2005. Photo: Julian Seddon

of-season or standby feed and it can be a habitat for beneficial insects and birds that help control crop and pasture pests and so reduces pesticide costs and risks.

Farms and their biodiversity can also be critically important to conservation at a regional and national level by supporting vestiges of rare native grasslands or threatened species of woodland birds.

Biodiversity and farmers

The BiGG project has also found that many farmers are taking a real interest in biodiversity and a pride in their role in maintaining and enhancing it.

'Many farmers now want to know more about biodiversity and how best to look after it,' says Dr Bridle. 'Yet biodiversity is a complex subject.'

'Many farmers said they found involvement in the BiGG project to be a real eye-opener as they were not aware of the many native species present, some of which performed functions vital to agriculture such as water-table management or control of pests.

The support of participating farmers was vital to the project.

'They showed a strong interest in finding out exactly what biodiversity was present on each farm, and there was often considerable surprise at the large numbers of species recorded, says Dr Bridle.

'Besides collecting, analysing and interpreting a vast amount of data, the project also helped to build capacity in the Grain & Graze regions to collect and interpret ecological data, and to establish links between farmers, catchment bodies and researchers.'

Farmers gather to review the data

In January 2008, the project findings were presented to mixed farmers from around the nation. In a forum where hard science came face to face with life on the land, participating farmers shared their experiences of the project and researchers presented their interpretations of the data, its relationships to their farming systems and possible implications for the future.

'Many of the project scientists know from experience that Australian farmers are generally correct with their gut-feelings or hunches about what is happening on their farms,' says Dr Price. 'That's why the Grain & Graze Program brought the project's collaborating farmers to Hobart to ask them what the data suggested to them in terms of their future management practice.'

Grain & Graze is a collaborative partnership between Meat & Livestock Australia (MLA), Australian Wool Innovation (AWI), the Grains Research and Development Corporation (GRDC) and Land & Water Australia (LWA). It aims to boost the profitability of Australia's mixed farms while simultaneously improving management of their natural resources.

Stephen Rose (Wickepin farmer, Avon region WA) and Susie Murphy White (Avon Biodiversity in Grain & Graze Co-ordinator, WA Dept of Agriculture & Food) in a remnant site that was monitored for on-farm biodiversity. Cotton strips in the foreground are buried to collect and monitor soil biological activity as an indicator of how active the cellulose consuming bacteria and fungi are in the soil. Photo: Kristy Westley

For more information:

For more information about the national Biodiversity in Grain & Graze Project, or the Farmer Forum, contact the National Project Coordinator, Dr Kerry Bridle, on 03 6226 2837.

For further information about the Grain & Graze Program, contact National Coordinator, Richard Price, on 02 6295 6300, mobile 0409 624 297; Gillian Stewart on 02 6263 6042; Merryn West on 02 6263 6013 or visit **www.grainandgraze.com.au**

Greening Australia

Green farmers support the arts

WOMADelaide is Australia's premier World Music festival, and was a huge success in 2006 with 78,000 ticket holders and over 200 artists and musicians from around the globe performing for three days in the beautiful Adelaide Botanic Gardens.

From an environmental perspective it was an even bigger success thanks to the participation of South Australian (SA) farmers in a plan to link regional landholders to this city based event through Carbon Offsetting.

WOMAD events worldwide pride themselves on being at the cutting edge of environmentally friendly practises – particularly when it comes to re-using, recycling and composting to minimise the waste stream that these types of festivals usually produce. Last year the event organisers, Arts Projects Australia, in partnership with Greening Australia, went one step further by offsetting the carbon footprint of WOMADelaide '07. This offset includes all of the CO_2 produced through lighting and power requirements on site as well as the flights and travel of both local as well as overseas artists.

To undertake this project Greening Australia teamed up with SA based carbon offset provider, Canopy, to plant thousands of local native trees on land provided with the assistance of dedicated landholders within the mallee region of South Australia. What makes this program so successful is that the revegetation is being undertaken on what was previously unproductive or unusable farmland. Trees are planted on landholders sites that are deemed high priority due to salinity and other environmental problems.

Landholders receive all revegetation for free and all onsite works are undertaken by Greening Australia, from planning and site preparation to planting and ongoing maintenance. "Despite the low rainfall in these areas, mallee eucalypt has a

The Greening Australia SA vegetation services team. Photo: Greening Australia SA

unique ability to store large volumes of carbon in the long term as well as regenerate fully after fire", said Mark Anderson, CEO Greening Australia SA.

"Unlike other carbon offset providers using plantation species, this initiative supports the permanent planting of local provenance native trees. This type of revegetation initiative not only sequesters the carbon dioxide, it also contributes to salinity control and acts to preserve the biodiversity of the region." Mr Anderson said.

Greening Australia and Canopy's carbon offset plantings are Kyoto Protocol compliant and meet Federal Government Greenhouse Friendly Program requirements. Plantings are registered on the land title, ensuring that the carbon offset is permanently secure and legally registered.

All carbon offset plantings are undertaken in accordance with the Interim Australian Standards for Carbon Accounting for Greenhouse Sinks – Afforestation and Reforestation AS 4978 and utilise measurement systems including the carbon accounting tools of the Australian Greenhouse Office and the Australian National University.

One of the up coming activities for 2008 is the River Murray Forest project. This project is significant in the way it combines private investment in carbon biosequestration planting with State Government biodiversity funding.

The program initially focuses on an area 20 km either side of the River Murray, from Morgan to the SA border. The first step will be to undertake over 100 hectares of biodiverse revegetation, on property adjacent to the River Murray north of Berri in the states east. "We are looking to identify many more properties for habitat restoration in the area, recreating homes for threatened species such as the Mallee Fowl and the Regent Parrot." Mr Anderson said.

Greening Australia are inviting landholders in this region to participate in this exciting project.

For more information:

Please phone Greening Australia on (08) 8372 0100 or email: general@greeningsa.org.au

Revegetation at Langhorne Creek in SA where carbon offset activities are being undertaken. Photo: Greening Australia SA

Australian Government
Land & Water Australia

Fire management in northern Australia: Integrating ecological, economic and social outcomes

The management of fire is a pervasive issue across the savanna landscapes of northern Australia, affecting the sustainability of agricultural and ecological systems, and the health and viability of regional communities. Savanna fire regimes directly or indirectly impact on biodiversity, arguably to a greater extent than any other variable, and contribute significantly to greenhouse gas emissions. Recent assessment of the extent of burning derived from satellite imagery shows that, over the period 1997-2004, an average of approximately 370,000 km² (19%) of the 1.9M km² tropical savannas was burnt annually, mostly under severe late dry season (Aug-Nov) conditions (see Figure 1). This comprises ~70% of national fire extent over the same period. Between them, Aboriginal people and pastoralists own, manage and occupy more than 80% of the savannas.

Over the past decade a large number of community-based, applied research projects have been, and continue to be undertaken in different regions across the north, addressing fundamental problems of how to implement ecologically sustainable fire management programs which meet the management requirements of multi-sector stakeholders (principally pastoral, indigenous, conservation), while at the same time addressing and promoting biodiversity issues.

Economic sustainability is obviously a key challenge facing landscape-scale fire management across most of fire-prone north, especially for indigenous communities and pastoral concerns on marginal lands with few resources and limited infrastructure. Such fire management problems are compounded by the vast geographic scale of the problem, attendant very low population densities, generally flat to subdued terrain with few barriers (tracks, large watercourses) to halt fire-spread once started, and a reliably long dry season where grassy fuels are sufficient to carry fires every one to two years. Under such conditions individual fires (although often developed from multiple ignition sources) may burn over tens of thousands of square kilometres.

One response for better management of fire regimes has been to explore opportunities for payment for environmental services (PES), where land managers and indigenous Community Ranger groups can be contracted to deliver a variety of environmental and cultural management services or outcomes, e.g. weed management, erosion control, cultural site maintenance, fire management, fencing. In recent years these PES options have been augmented by growing appreciation that strategic savanna fire management may also provide economic opportunities through regionally based projects aimed at greenhouse gas emissions abatement. The Western Arnhem Land Fire Abatement (WALFA) project provides a tangible example of the potential for such projects, and below we describe in detail some of the key features of that project.

The WALFA model

WALFA has been developed since 1996 to address chronic fire management problems in Aboriginal-owned, high biodiversity savanna landscapes of western Arnhem Land. In particular, the essential problem has involved extensive impact of annual wildfires occurring late in the seven month dry season period; over the period 1995–2004 the 28,000 km² WALFA region has been burnt approximately 40% on average (see Figure 2), with 32% of this annual average occurring in the late dry season. Nearly the entire amount of this burning has been attributable to human (anthropogenic) ignitions.

'Prescribed burning of savannas' attributable to anthropogenic sources is an accountable activity, as listed in Annex A of the Kyoto Protocol. Greenhouse gas emissions of the gases nitrous oxide and methane are accounted for in Australia's National Greenhouse Gas Inventory (NGGI). Contributions from savanna burning to Australia's NGGI amount to ~2-4% annually. Since 2000 it has been recognised (through the Australian Greenhouse Office) that appropriate fire management in the WALFA region could substantially reduce emissions of greenhouse gases.

It is important to appreciate that a savanna fire abatement project differs substantially and essentially from forestry-style sequestration projects established under different provisions of the Kyoto Protocol. No sequestration is involved; rather, accredited abatement projects operate against a pre-project baseline. Emissions abatement may be achieved annually against that baseline, both through reduction in the overall

area (hence amount of fuels burnt), and also by shifting the intensity / seasonality of burning (also reducing amount of fuels burnt) through the undertaking of strategic management practices (e.g. prescribed burning of strategic firebreaks; prescribed burning earlier in the year to implement more patchy, more low intensity fires). In the case of WALFA, such fire management practice (burning throughout the year, typically under prescribed conditions) was undertaken extensively by Aboriginal people before societal collapse and associated abandonment of traditional practices with the advent of European settlement.

WALFA was formally established as a greenhouse emissions abatement project in 2006, as part of a recognised (Australian Greenhouse Office—AGO accredited) greenhouse emissions offset arrangement between the Northern Territory Government and ConocoPhillips. That arrangement arose out of a requirement for ConocoPhillips to gain licensing approval to establish and operate a liquefied natural gas plant in Darwin Harbour. It is notable that the company undertook exhaustive assessments of other, more conventional offset options (e.g. pine and blue gum plantations) before making their decision.

The WALFA arrangement essentially involves the offset of 100,000 tonnes CO2 per annum against an established contemporary baseline (1995–2004) for the WALFA region, and for which ConocoPhillips pays over $1M p.a. (indexed for CPI) for the provision of the environmental service (fire abatement, delivered by regional land owners). The agreement is for 17 years (life of Stage 1 of the natural gas plant). Approximately $100 000 per annum is also provided by the company for independent annual auditing of the greenhouse gas emissions abatement achieved; this is currently performed by the Tropical Savannas CRC.

Importantly, the WALFA project operates as an offset arrangement; that is, the abatement achieved through enhanced regional fire management is recognised officially by the AGO and the Northern Territory Government as providing an offset against the emissions generated from the liquefied natural gas facility in Darwin Harbour. Future savanna burning emissions projects will doubtless be required to be registered and accredited through the AGO's Greenhouse Friendly program. That accreditation also provides significant potential benefit for other commercial arrangements through developing carbon trading markets. At the present time discussions are well advanced towards the development of two new savanna burning projects in central Arnhem Land and the north Kimberley, with ongoing discussions concerning future projects in the Gulf region across the NT/QLD border, and on Cape York.

A second issue requiring addressing is that the WALFA project operates entirely on Aboriginal freehold land. At the time of writing we are seeking advice from the AGO concerning the applicability of accredited savanna burning projects operating in multi-sectoral (e.g. pastoral lease, freehold, government lands) and tenure settings.

The LWA-funded research project

The current project augments substantial research and policy development that has backed the development of WALFA, through the undertaking of three components as follows:

Governance arrangements and PES models—the WALFA model exists under a complicated dual contractual arrangement between firstly the Northern Territory Government and ConocoPhillips, and then also between the Northern Territory Government and the Northern Land Council, on behalf of indigenous land owners and representative community organisations. Key foci of this research component include (1) learning from the strengths and weaknesses of current WALFA institutional arrangements, (2) documenting institutional capacities and requirements for developing proposed savanna burning projects in central Arnhem Land and north Kimberley especially, and (3) ultimately providing an informed basis for selecting appropriate governance and PES models

Aerial Prescribed Burning from helicopter in Arnhem Land. Photo courtesy: Bushfires NT

National Land & Water Resources Audit

An Initiative of the Natural Heritage Trust

Mapping and reporting on Australia's native vegetation

The need for a consistent approach to the collation of native vegetation data Australia wide was recognised during the National Land & Water Resources Audit's first assessment of Australia's native vegetation in 2001 (see http://www.anra.gov.au/topics/vegetation/index.html).

The National Vegetation Information System (NVIS), a set of nationally consistent standards and databases, is being progressively developed by Australian, state and territory governments as a response to this need.

The NVIS framework:

- specifies guidelines for standardising the collection, collation and reporting of data and information on Australia's vegetation (see **http://www.daff.gov.au/brs/forest-veg/nvis/guidelines**)
- stores data on the type and extent of native vegetation (see **http://www.environment.gov.au/erin/nvis/index.html**)
- provides a framework for holding standardised geographic and attribute vegetation data across Australia that facilitates analysis and reporting (see **http://www.environment.gov.au/erin/nvis/publications/avam/index.html**)
- provides and maintains the technical infrastructure to support these activities.

The national NVIS database collates data provided by the states and territories that have been collected over decades of vegetation surveys and mapping. This collaboration represents a major achievement in combining disparate state and territory data to form a consistent national collation. The national dataset has been used to develop a map of major vegetation groups (see **http://www.environment.gov.au/erin/nvis/publications/major-veg-map.html**) and to describe major vegetation subgroups.

The application and adoption of NVIS means that Australia has a robust and flexible system for collecting, compiling, analysing and reporting on vegetation information from regional to national levels.

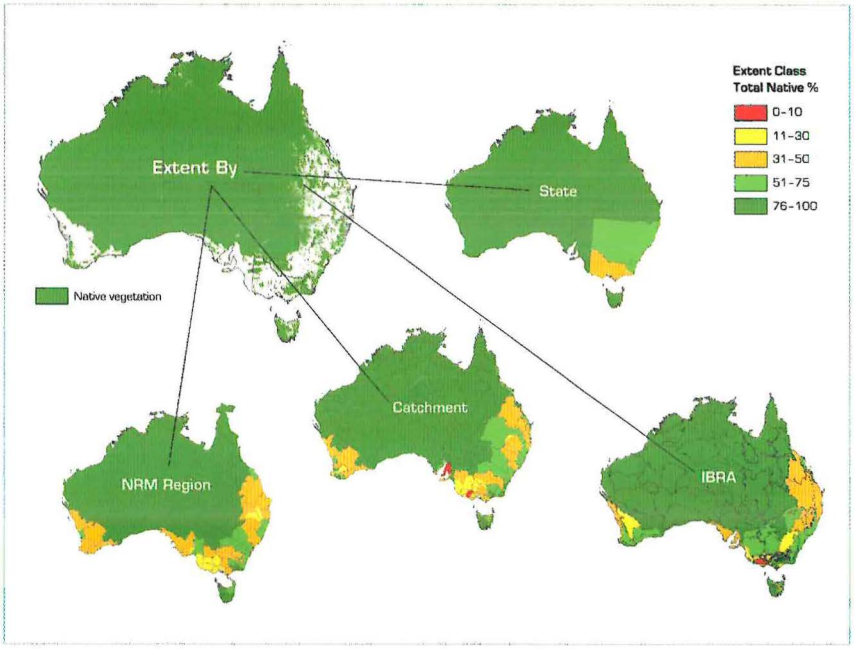
NVIS is supported by the Executive Steering Committee for Australian Vegetation Information (ESCAVI), which comprises senior representatives from the Australian Government and each state and territory government, as well as the National Land & Water Resources Audit. ESCAVI meets four times a year to consider issues such as coordination and partnerships, standards and indicators, data systems, information delivery, analysis and assessments, and communication.

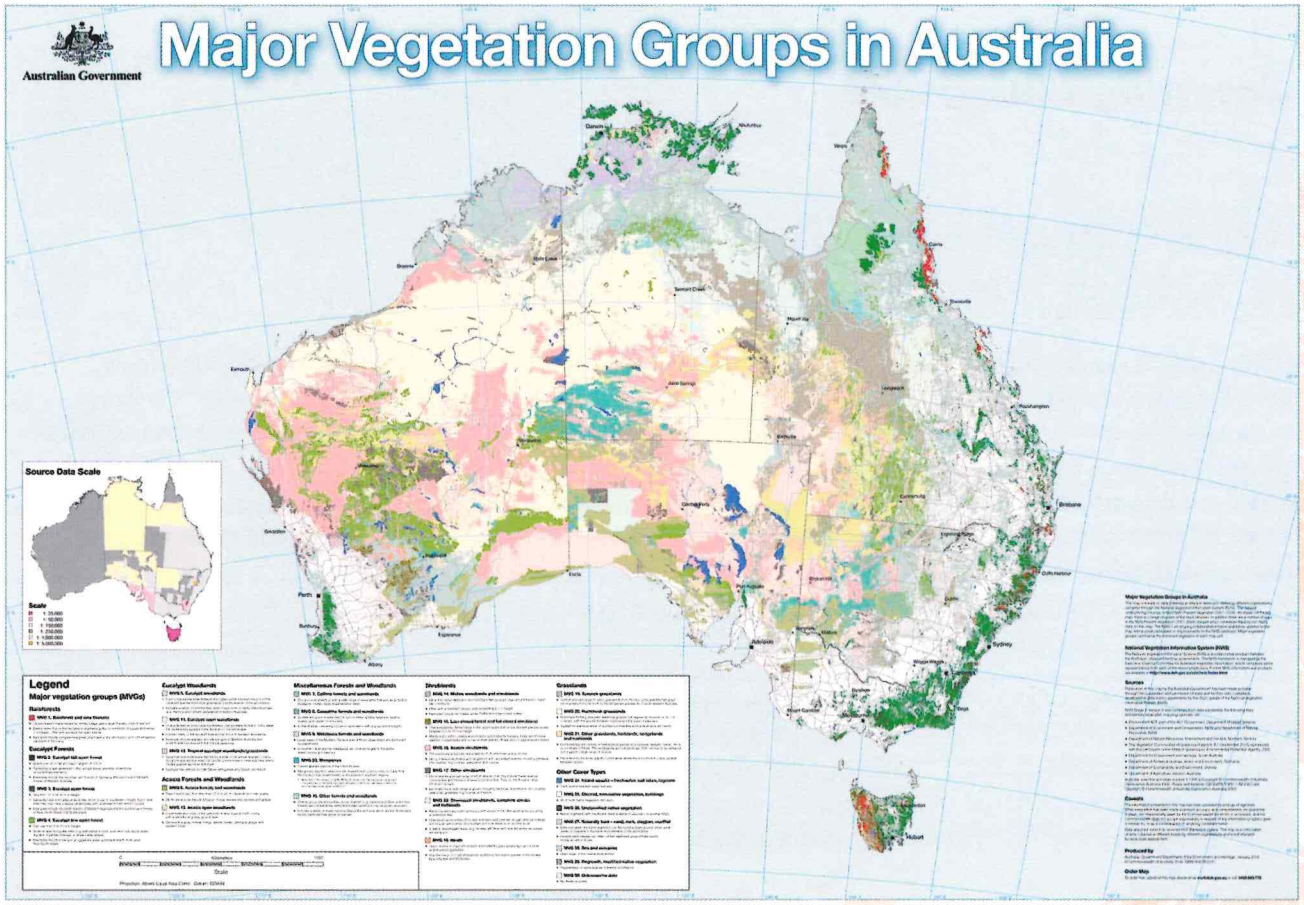
Who can use NVIS?

Applications of NVIS include informing decisions regarding nature conservation, catchment management initiatives and regional vegetation management planning. Vegetation information is critical input to managing priority issues such as climate change, salinity and soil erosion abatement, water quality and quantity modelling and bushfire risk mitigation.

The Australian Natural Resources Atlas provides access to the wealth of information compiled on Australia's native vegetation by the Audit and its partners at **http://www.anra.gov.au/**.

Building on the Australian Native Vegetation Assessment (2001), the Audit has recently published a booklet on the status of information for reporting on native vegetation indicators. The Audit and the Bureau of Rural Sciences are also producing a vegetation assessment for release in 2008.





For more information:

For more information go to the National Land & Water Resources Audit's website **www.nlwra.gov.au** or contact the Audit's communications officer on (02) 6263 6081.

Products available (free)

- Australian Native Vegetation Assessment (2001), NLWRA.
- National Land & Water Resources Audit, Final Reports (1997-2002), CD or DVD, NLWRA
- Major Vegetation Groups in Australia, poster and booklet – DEW
- Native Vegetation – status of information for reporting against indicators under the National NRM Monitoring and Evaluation Framework (2007), booklet, NLWRA
- Native Vegetation – assessment report (in prep), NLWRA and BRS.

Previous page: Data and information on native vegetation extent will be reported by the Audit for a range of purposes according to different boundaries of interest, such as state, catchment, IBRA and NRM region.

Left: This booklet on Native vegetation has recently been published by the Audit. It is part of a series that describes the status of data and information relevant to national indicators agreed under the National NRM Monitoring and Evaluation Framework.

Top: The nationally collated NVIS dataset has been recently updated to include data up to 2004-2005 and has been used to generate a national map of major vegetation groups.

Repairing grasslands at Point Henry in Victoria – lessons for revegetation

Native grasslands are some of the most threatened ecological communities in Australia and up until now there has been limited research on the effectiveness of restoration efforts in these communities. This may be changed through groundbreaking work by the Grassy Groundcover Research Project, led by Dr Paul Gibson-Roy and Paul Koch from Greening Australia together with Steve Ford from Alcoa of Australia. This team have developed a technique to dramatically increase the effectiveness and methodology of revegetation techniques for grassland communities. The work is soon to be trialled over 115 hectares of Alcoa's land management area at Point Henry near Geelong in Victoria.

The Grassy Groundcover Research Project has developed a new technique for grassland restoration which collects seeds from remnant herbaceous perennial grassland species (forbs) of known quality and provenance. Collecting seed from forbs is a relatively new concept as they haven't commonly been used in revegetation activities.

Alcoa of Australia has made this parcel of land available to Greening Australia, and the University of Melbourne's research team, along with over $1.7m in funding which will be used for continuing research and monitoring on the Grassy Red-Gum woodland.

Seed supply from grasses and other native species is also a critical issue. At present there isn't enough suitable seed to meet the needs of current revegetation and restoration targets

Paul Gibson-Roy, centre, with colleagues in front of a large revegetation site at Point Henry, Geelong.

and thus seed production nurseries are also being established.

Seed production nurseries

Seed production nurseries are relatively new to the NRM industry although they have been used in horticulture for some time. They are a valuable tool as they potentially produce seed from a variety of plants, which minimises seed collection times and increases the potential to harvest a variety of seeds. It also reduces the stress on populations of plants in remnant bush as seeds need only to be collected from them in the wild once every 3–4 years instead of annually.

Revegetation sites are prepared by scraping the top 100mm of soil to reduce the weed and nutrient layer from the soil which can interfere with native grass growth. The seeds are then mixed together along with sand and sown directly into the site using a specialised seeder that first places the seed on the soil across the entire area and then pushes the seeds into the soil.

What's different about the seeding?

Traditional seeding techniques typically involve planting or sowing in interspaced rows. The method being trialled by the Grassy Groundcover Project doesn't use rows and the grassy layer is planted first, given time to establish and then trees and shrubs are included. This is quite different from traditional revegetation projects where trees and shrubs are planted and the grasscover layer is expected to colonise opportunistically.

Alcoa and Greening Australia's Point Henry Grassy Groundcover Project is ambitious and multi-pronged. A large scale management program for the wetlands (both salt and fresh water) that are contained within the Point Henry site has been developed. Part of this management programme is addressing critical issues of seed supply and bird fetching, which looks at ways to minimise birdstrike on powerlines, is also being targeted. Utility companies are taking a keen interest in this aspect of the project.

Alcoa aims to develop a centre that will become a hub for restoration practitioners in the region, the State and beyond at the Point Henry Site. The centre will ultimately feature a combination of science laboratories, nursery facilities, warehouse-sized seed storage areas and interactive displays that will highlight both environmental and cultural heritage issues.

Dr Paul Gibson-Roy, the Project Leader for the Grassy Groundcover Project notes that 'Alcoa is to be applauded for the initiative and commitment they have invested in this project. By far the easiest option for them would have been to put buffer plantings around the smelter site but they chose to invest in the site over the long-term and have initiated many innovative restoration ideas and have been open to trialling and testing new methods. For Alcoa, it's a long term ecological investment and when complete, the Point Henry site will be available for recreational activities as well as long-term ecological monitoring of the revegetation.'

Written by Fleur Flanery, Exchange Program, Greening Australia with support from Dr Paul Gibson-Roy, Project Leader, Grassy Groundcover Project and Kylie Cirak, Environmental Partnerships and Alcoa Foundation Manager, Alcoa of Australia.

Seed production nursery at Werribee, Victoria. Photo: Greening Australia Ltd.

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Australian Government
Land & Water Australia

Fire and its relationship to managing fauna – the mallee fire and biodiversity project

By Mike Clarke and Andrew Bennett

It is often said that "fire is a natural part of the Australian landscape". But what precisely do we mean by natural? The pattern of fires across a landscape can vary in several important ways including the time interval between two fires (fire frequency), the intensity of the fire, the time of year in which the fire occurs, and the size and patchiness of the fire. Each of these components may have profound implications for the flora and fauna at a site and whether or not they can recover after the fire. A major problem arises if, through either extinguishing all fires or becoming over zealous in prescribed burning, we impose a fire regime with which an ecological community is ill-equipped to cope. Some animal and plant species may never have had to recover from fires that frequent, that large, that hot or at that time of the year.

To date, most fire management in Australia is built upon a major untested assumption, that if the fire frequency is right for plant species to persist, then the animals will be accommodated as well. But is this always true? Can we assume that the needs of animals will necessarily be met by meeting the needs of plants? We already know that many animals depend on resources that are available only in older stands of vegetation; that is, long after the plant has reached an age when it can replace itself. For example, the hollows needed for nesting by numerous parrots, cockatoos, possums and bats may take over 100 years to develop in many Australian eucalypts. Knowing that a particular plant species has been sufficiently resilient to persist at a site is not enough. It is often the structural features of a plant species that are of primary importance to the animal, not just its presence at a site. Further, it matters little to many of our native plants whether the area burnt was 1 ha or 10,000 ha because they have adaptations to regenerate on site. In sharp contrast, many animals become temporarily extinct at a site after fire and then rely on recolonisation of the site from unburnt refuges. Consequently, the size and spatial configuration of suitable habitats (e.g. recently burnt or long unburnt vegetation) may have potentially profound effects on whether an animal with limited dispersal ability can recolonise a site – to put it crudely, for many animals size matters!

In the absence of detailed knowledge of the habitat requirements and dispersal abilities of most animal species in this country, land managers have developed fire management plans upon a basic premise that landscapes exposed to a greater diversity of fire regimes will support a greater biodiversity than landscapes that have a more uniform fire history. Consequently, the aim of many fire plans is to avoid uniformity in fire history over large areas and instead aim for a mosaic of fire regimes across a land management unit. But which mosaic? Are all equally desirable, will all assist in maintaining the diversity of animals as well as plants? The spatial configuration of some mosaics may be acceptable for plants, but inadequate to sustain viable populations of some animal species.

In March 2006 we embarked upon a large study of the effects of fire on biodiversity in mallee ecosystems of the Murray Mallee region of SA, NSW and Victoria. Birds, reptiles, mammals, key invertebrates and plants are being surveyed at 280 sites, scattered across 28 study landscapes, each 4 km in diameter, located on public and private land. The study aims to address two key questions: 1. Are some mosaics more desirable than others, in terms of conserving both flora and fauna? 2. Are the responses of plants to different fire regimes good indicators of the responses of animals? If not, what might serve as better indicators?

Assoc Prof Mike Clarke and Assoc Prof Andrew Bennett lead a team of eight scientists and seven PhD students based at La Trobe University and Deakin University, each contributing particular skills and specialist taxonomic knowledge to the project. From the outset the study has received strong support from both public and private land management agencies, who are keen to have a better basis for managing fire on their land, particularly with respect to fauna. Ten agencies have contributed funds and on-ground support to the project, and over 100 volunteers have already been involved in the fauna and flora surveys.

We anticipate that a project of this scale and diversity will generate many important insights. At a regional level, the project will provide much greater knowledge of the habitat requirements of the mallee fauna, and assist land managers to identify areas of high value to wildlife on their properties or reserves. Results from this project will become available towards the end of 2008. We plan to incorporate results from this project into a GIS software tool that will enable managers to evaluate alternative management options for ecological burning and to consider the ecological losses and gains that might be achieved by burning or protecting parts of the landscape from fire. At a national and international level, we hope that the project will enhance conceptual understanding of the properties of mosaics that have the greatest potential for conserving both flora and the various faunal groups being studied.

Above: PhD student Sarah Fergusson and volunteer Mandy Ash sample for termite diversity by checking baits. Termites play important roles in mallee ecosystems by recycling nutrients and affecting the soil structure. Photo: Mike Clarke

Right: Sam Barnes, from Lethero Station, NSW, with a Western Pygmy possum caught at one of the pitfall trapping study sites on Lethero Station. Photo: Lauren Brown

Below: Bushfires in the mallee can be important for regenerating plant species under certain conditions but their impacts on fauna species are largely unknown. Photo: Aymeric Zeller

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Grain & Graze™
Profit through knowledge

High-tech check on biodiversity spending

"What if", computer-based, scenario analysis technology is helping biodiversity research scientists identify landscapes in Central West New South Wales where the best environmental and biodiversity value can be obtained with limited investment funds.

And already the research is suggesting to the scientists that some desired landscape management outcomes are likely to be beyond most farmers' means and require significant outside funding.

The project, "Biodiversity in mixed farming landscapes", has two components:

- the first involving regional studies by the NSW Department of Environment and Climate Change (DECC) in collaboration with NSW Department of Primary Industries (NSWDPI) and
- a national component being conducted by NSW DPI staff in collaboration with the Grain & Graze Program.

Grain & Graze is a collaborative partnership between Meat & Livestock Australia (MLA), Australian Wool Innovation (AWI), the Grains Research and Development Corporation (GRDC) and Land & Water Australia (LWA) that aims to boost the profitability of Australia's mixed farms.

According to Julian Seddon, an Ecologist with DECC, the value of the "what if" scenario analysis is that it allows his research team to compare the "virtual" outcomes of different landscape management scenarios like pasture cropping and alley farming as well as revegetation efforts.

In addition to Mr Seddon's assessment of biodiversity outcomes, farming systems Economist Andrew Bathgate is comparing the effect of the same land use changes on stream salinity, stream yield, carbon sequestration and farm profit.

Land use scenarios under comparison are:

- The status quo, with no change in land use and continued progressive decline in the biodiversity condition in remnant vegetation,
- Biodiversity investment, aimed at enhancing the long term viability of native biodiversity with revegetation and ecologically sustainable grazing systems,
- Salinity mitigation, aimed at producing the best hydrological outcomes by establishing permanent pastures and targeted revegetation, and
- A change in farming systems, with the establishment of alley farming or pasture cropping on suitable land units, with 25, 50 or 100 per cent adoption.

"We chose the Little River catchment, south of Dubbo, for the study because it is typical of much mixed farming country in NSW, and because a lot of exciting biodiversity and land use information already existed," Mr Seddon said.

"Basically the problem is over-clearing with associated loss and fragmentation of native vegetation. Also, many areas of high conservation value such as the grassy box woodlands have poor long term prospects due to a lack of natural regeneration.

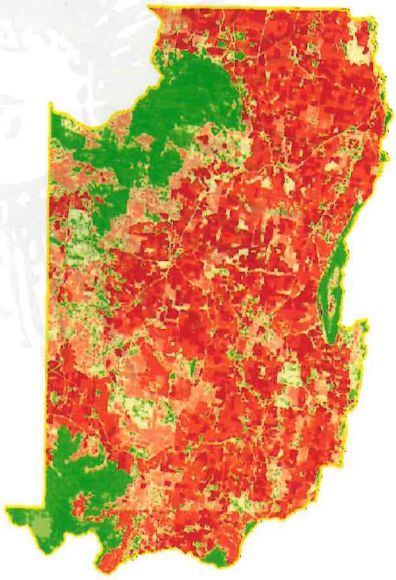
"As the patches of native vegetation become smaller, the remaining biodiversity in them is more vulnerable to predators and feral animals. The climate also changes in them, because there is more edge and less middle.

"Our work is building on what has been done by the Catchment Management Authorities and, because so much of this type of land is in private hands, we are looking for the best areas where outside investment will address losses in biodiversity and even improve it."

Mr Seddon said researchers knew certain parts of the Little River delivered a lot of salt into streams but a substantial reduction in stream salinity would require a much greater area of deep rooted perennial plants.

These could be revegetated shrubs and eucalypts and even lucerne, which, while not a native plant, has excellent ability to extract deep water from soils and also contributes to a profitable enterprise for farmers.

Other options in the campaign to distribute limited funds to the areas of greatest benefit could also include strategic grazing management aimed



This image of the Little River catchment south of Dubbo, in central-west NSW shows an estimate of the current status of native biodiversity. Green areas indicate relatively good condition, that is least modification and degradation due to modern anthropogenic disturbance. Red areas are in poor condition and have been heavily modified post settlement. The image forms a baseline for comparison of future biodiversity status under a range of different land use options.

at improving biodiversity values, such as promoting recruitment and cover of native species.

"Although we still haven't finished our analysis of the data, there are signs that existing efforts may not lead to as big an environmental difference as was expected. It looks like the scale of on-ground investment will need to be substantially greater than perhaps has been realised," Mr Seddon said.

"The message most likely to come out of this research is that a lot more money will be needed to achieve real change in biodiversity status and long term viability on mixed farms in the NSW Central West/Lachlan region.

"And, in some cases of farm profitability analysis, the level of investment required will be beyond the resources of many farmers. Substantial public investment will be needed."

Mark Bourne (left) and Julian Seddon (Right) measuring cover and diversity of native plant species in planted Old Man Saltbush and crop to provide data for the biodiversity assessment of the alley farming trial at Condobolin, October 2007. Photo: Stuart Doyle

For more information:

For more information about the "Biodiversity in mixed farming landscapes" project, contact Project Officer, Julian Seddon, on 02 6242 1754.

For further information about the Grain & Graze Program, contact National Coordinator, Richard Price, on 02 6295 6300, mobile 0409 624 297; Gillian Stewart on 02 6263 6042; Merryn West on 02 6263 6013 or visit **www.grainandgraze.com.au.**

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Maximising woodland bird diversity in the Brigalow Belt

Alison Howes and Martine Maron
Australian Centre for Sustainable Catchments, University of Southern QLD

The Brigalow Belt Bioregion is one of Australia's biodiversity hotspots. Although much of the more fertile soils have been cleared for agriculture, including those which supported the Brigalow woodlands, the region is one of Australia's richest in terms of its woodland bird assemblages. In particular, it is home to many species which are threatened and declining in the more heavily cleared temperate agricultural regions to the south (see Thinking Bush September 2007).

Although the Brigalow Belt has some of the country's most fragmented landscapes, it also has some of the largest remnants of eucalypt woodland in temperate and subtropical Australia. As woodland bird declines creep north, this vast belt of woodland stretching to the Carnarvon Ranges would appear to represent a major opportunity to conserve large, ecologically functioning populations of fragmentation-sensitive bird species. Knowing how to manage these areas to enhance their conservation values may well prove critical for the future of many woodland birds. However, our knowledge of the main threats to avian biodiversity in these woodlands, and management options which might alleviate them, is far from adequate.

Land & Water Australia is supporting a new project intended to address these knowledge gaps. The University of Southern Queensland (USQ), in partnership with Bush Heritage Australia, has embarked on a research project aimed at developing strategies for management of the Brigalow Belt woodlands to maximize their value as a woodland bird refuge. Much of the Brigalow Belt's woodlands are managed for cattle production, but with the purchase in 2001 of Carnarvon Station by Bush Heritage Australia, the area managed for conservation has increased to about 6,000km^2, including the adjacent Carnarvon National Park. On both public and private land, however, there are many management challenges. Grazing by cattle and feral horses, fire management and weed control are major issues, all likely to impact on the native biota of this important region.

One of the biggest challenges to the maintenance of woodland bird diversity in the Brigalow Belt is the dominance of a single, highly competitive bird species across the region. The noisy miner is a native honeyeater, well known in fragmented southern Australian landscapes as a major player in woodland bird declines. Colonies of this aggressive species exclude smaller passerines from their territories. However, the noisy miner is typically considered to be an 'edge' species, for which fragmentation has allowed substantial increases in abundance. Previous research has identified the species as primarily associated with disturbed habitat fragments, usually smaller than 50 ha. Yet, puzzlingly, it dominates apparently intact landscapes throughout the Brigalow Belt.

How extensive is this dominance of noisy miners, and what impact is it having on the woodland birds of the subtropical inland? Could anthropogenic changes to fire and grazing regimes have facilitated the domination of vast areas by noisy miners? If so, how can these important habitats be managed, both by graziers and public and private conservation land managers, to reduce their impact? These are the questions that USQ researchers are investigating on grazed and ungrazed parts of both public and private land, including Carnarvon Station Reserve. The juxtaposition of several fire and grazing management histories in close proximity allows quantification of the impacts of grazing pressure and the time since its removal on habitat structure and avian assemblages, including on noisy miner abundance. Ultimately, the project will provide management recommendations to help reduce the abundance of the noisy miner and encourage the return of avian biodiversity to the area.

Preliminary results have confirmed the extensive occurrence of noisy miner colonies across the region. Where noisy miner abundance is high, small passerine abundance is reduced to just one-tenth of that in areas with low noisy miner abundance. The presence of a dense understorey appears to be important in supporting a greater species richness and abundance of small passerines, largely through reducing habitat suitability for noisy miners, which prefer more open habitats with little or no understorey. Grazing has also been identified as an important driver of noisy miner abundance, which is highest in areas subject to high grazing pressure. Noisy miners often forage on the ground, and the reduction in ground vegetation cover by feral grazers may increase their foraging opportunities.

These preliminary findings start to identify some of the challenges involved

in managing for multiple conservation goals. Regular burning regimes are often used in an effort to reduce the high stem densities that are often associated with regrowth vegetation in areas which had been previously disturbed, and to encourage the return of native grassland species. While the technique appears to be successful in encouraging the return of the native Queensland bluegrass, the accompanying reduction in stem density and understorey may have a negative influence on avian biodiversity through increased habitat suitability for noisy miners. This project is investigating the interactions between fire and grazing to determine how such conservation goals can be reconciled.

Other management interventions on Carnarvon Station Reserve have included a significant reduction in feral grazing across parts of the property. As this project continues, the trajectory of change in the bird communities of these areas will be monitored to see whether the noisy miners' apparent preference for grazed areas translates to a reduction in their density in previously grazed sites. If so, reduced grazing pressure may be a key tool in maintaining healthy woodland bird populations in the region.

In order to communicate the findings of the research effectively, a user-friendly predictive management tool is being developed which can be used to explore the effects of different management scenarios on woodland birds. Understanding the interactions among fire, grazing and habitat structure, and their influence on noisy miner presence and woodland bird assemblages, will help improve our ability to manage native vegetation for biodiversity. Ultimately, this project will help fulfil the enormous conservation potential of the Brigalow Belt woodlands for birds.

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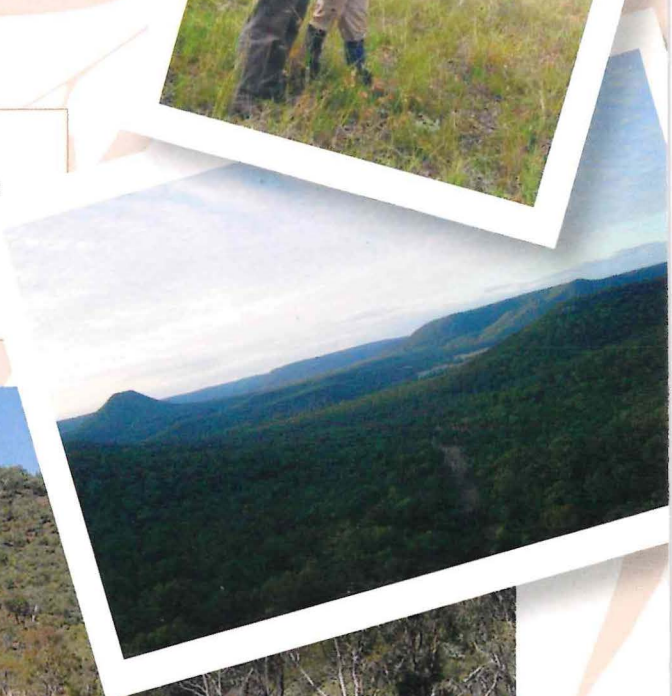
Below: Matt Warnock (BHA) and Alison Howes (USQ). Results from the study will assist land managers in restoring avian biodiversity.

Far below: Carnarvon Station Reserve covers approximately 60,000 ha of unfragmented native vegetation within central QLD.



The contrast is stark either side of the 'horse fence' on Carnarvon Station, which separates the feral animal-free part of the property from the still-grazed parts.

Restoring landscapes with confidence – an evaluation of the science, the methods and their on-ground application

Regional natural resource management agencies across Australia are becoming increasingly responsible for the development and implementation of on-ground actions for the conservation and management of native vegetation and biodiversity. At the same time, investment through initiatives such as Land & Water Australia's Native Vegetation and Biodiversity Program and its predecessors, have been investigating how best to protect, rehabilitate and restore native vegetation and biodiversity in agricultural and pastoral landscapes. Much of this work is being placed under the umbrella of 'landscape restoration' as defined in text box one.

Landscape restoration is the process of assisting the recovery of a landscape that has been degraded, damaged or destroyed. It is an intentional activity that initiates or accelerates landscape recovery with respect to its health (functional processes), integrity (species composition and community structure) and sustainability (resistance to disturbance and resilience). This project has a particular focus on the retention and restoration (via improved condition and/or extent) of native vegetation for biodiversity values.

Source: Landscape restoration definition modified from the Society of Ecological Restoration International

Research on landscape ecology and restoration undertaken by Australian scientists is world-class. It has led to a number of advances in our understanding of how our landscapes function, and helped tease apart the complex ecological processes and systems that maintain native vegetation and biodiversity. These advances include the seminal work on landscape principles and thresholds developed for grassy woodlands in eastern Australia, as well as research on focal species, plantation design, revegetation, landscape function and the location of watering points. National and international ecological research on such topics has the potential to inform the way that agricultural and pastoral landscapes are managed, how on-ground programs are designed, and restoration efforts monitored. It is currently unclear, however, what impact the science and practice of landscape and restoration ecology has had on the planning and implementation of on-ground activities at the regional, sub-catchment and property scales.

In order to shed light on this key issue, Land & Water Australia has commissioned the 'Restoring landscapes with confidence' project, which is currently underway. Drs. Siwan Lovett, Judy Lambert, Jann Williams and Phil Price are the consulting team undertaking the project. It is being managed by Land & Water Australia with co-funding from North Central CMA and Greening Australia. All of these organisations are represented on a steering committee, which also includes CSIRO.

Phase one of the project will assess how much of the research, tools and information that are currently available are being used by regional natural resource management agencies and other groups to achieve on-ground outcomes. The project will examine how well the science that has been undertaken is embedded in day-to-day practical restoration approaches, and investigate what makes some research able to be used so that it is relevant, meaningful and able to be easily integrated. The project will also assess why available research is not being used. For example, is it a lack of capacity, or the format in which the science is presented, or are there credibility or other social factors that intervene?

Overall, the project is investigating:

- The range of strategies, approaches, tools and knowledge that exist to assist regional natural resource management agencies and other groups better plan and manage native vegetation and biodiversity;
- Through discussions with a range of stakeholders and a review of the available literature, which of the strategies, approaches, tools and knowledge are/are not being used and why; and
- Through a possible second phase, how regional natural resource management agencies and other groups can best be supported to access the information and tools available, and what needs to be done to facilitate this;

Case Study Regions

Four regional workshops are being held between February and April 2008 to allow detailed discussions with a range of stakeholders to explore which research, tools and information are being used and why. Questions are also being asked about where gaps exist in knowledge and capacity to use what is available, and what the components of a useful and accessible 'resource base for landscape restoration' need to be. The four regional clusters are:

1. Northern Victoria (North Central CMA, Goulburn Broken CMA, North East CMA).
2. NSW (Lachlan CMA, Central West CMA).
3. South-west WA (Gondwana Link, South Coast, SCRIPT).
4. Qld (Fitzroy Basin).

Each cluster will have a review provided by the project consultants following their analysis and the workshops. This review will cover the research, tools, information and level of understanding in the region about landscape restoration. It will also provide an overview of the workshop findings and recommendations for how the region might maintain or improve work being undertaken in landscape restoration. The final report of the overall project will include a literature/research review of landscape restoration in Australia, four case studies based on the workshops, four desktop studies (to incorporate areas not covered by the workshops) and key recommendations. The 'state of the knowledge' literature review will be provided to all workshop participants and will be more widely available through Land & Water Australia.

The outcomes of the project will provide researchers and funding agencies with information on how to make research more accessible and relevant to regional bodies and other groups to assist them in their investment and planning decisions.

NORTH CENTRAL Catchment Management Authority

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Right: (L to R) David Crooks - Nature Conservation Trust of NSW, Toni McLeish - Grassy Box Woodland Conservation Management Network, Garry Germon - Lachlan CMA and Jann Williams, project consultant, engage in the second of the Landscape Restoration workshops held at Cowra. Photo: Nadeem Samnakay

Left: Jim Donaldson, Executive manager – Sustainable Landscapes at LWA facilitates the Nagambie workshop with participants from Victoria. Photo: Jann Williams

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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

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