ThinkingBush

Science for managing native vegetation in Australian landscapes

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VEGETATION
research & management **2002**

*farm*Land MAKEOVER

CONSERVATION *steaks*

Key findings bring comfort, surprises *& Challenges*

MOTIVATED ECONOMISTS
go bush

Patch*works* OF BUSH

NATIVE VEGETATION RESEARCH AND DEVELOPMENT PROGRAM

Contents

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Changing perceptions and values about native vegetation and how it can be managed.

Who's thinking bush?

Welcome to *Thinking Bush*, an occasional magazine full of new ways of thinking about, planning and managing the Australian bush. The idea is to provide people who manage native vegetation in particular with some help from the scientists who are actively researching how we might better manage and protect native vegetation in rural Australia.

What they have to say is sometimes comforting, such as when it supports some commonly held beliefs about native vegetation. Sometimes, the results are surprising and point to the fascinating complexity and robust adaptability in our native plants and animals. But sometimes what they say can be confronting, even daunting, especially when one looks at the scale of our landscapes and the task ahead for land managers.

However, we are all so much better off for the understanding scientists bring and their dedication to finding better management solutions. There is so much we still need to know.

In *Thinking Bush* there is a strong emphasis on the practical. We hope that you will find the information presented here useful, whether you are involved in policy, advising others, or carrying out native vegetation management yourself. We have all of you in mind.

Thinking Bush is based on the outcomes of more than 30 research projects under the Native Vegetation R&D Program, funded over the last five years. It comes as the second phase of the Program gains momentum, with another 12 projects under way that build on the work so far. Fact sheets are available on these new projects—see back page for details. Also keep an eye out on the Program website www.lwa.gov.au/nativevegetation for updates on these projects and others commencing soon.

Originally started by Land & Water Australia and Environment Australia, the Program is now managed by Land & Water Australia in partnership with CSIRO Sustainable Ecosystems and Plant Industry and the Murray–Darling Basin Commission. Other contributors to the Program include Greening Australia and state government agencies with the primary responsibility for managing native vegetation.

Our team is very keen to hear from readers about *Thinking Bush*. If you find the publication useful, would like to comment on it in any way, or want to find out more about the Native Vegetation R&D Program please contact Gill Whiting or myself by phone or email—our details can be found below. If you would like to forward *Thinking Bush* to a friend please do so, and if you'd like extra copies they're available free from our distributor CanPrint on 1800 776616. *Thinking Bush* may also be downloaded at our website.

Jann Williams, Program Coordinator

Getting there: vegetation research and management in 2012

By Rob Thorman

What a dramatic recent shift there has been in how the community values native vegetation! In the 1960s and '70s, governments, reflecting public attitudes, encouraged and even required landholders to clear native vegetation.

Now, governments are handing out large amounts of public money to re-establish it and have fined landholders for clearing without approval—even single trees. This shift in awareness and policy is seen in both rural and urban areas.

Few people could have foreseen such a shift 20 or 30 years ago.

Looking only 10 years ahead, how will we be managing native vegetation? How are we getting there, and what role will research play? How do some of the people at the forefront of research, monitoring, and management of Australia's native vegetation answer these questions? How do these leaders see our journey—*from* where we are now *to* where we're heading?

Andrew Campbell—Executive Director of Land & Water Australia, which invests in research and development (R&D) for improved natural resource management—sees vibrant native vegetation and natural resource management industries emerging, with the potential to export our expertise.

He said, "We're seeing a maturity in the relationship between Australian society and the landscape to a point that we're finally beginning to act as if we are here to stay and not just passing through.

"I see the Australian bush as fundamentally linked to our sense of identity."

Carl Binning, the new Chief Executive of Greening Australia, also has a track record of research into the barriers to conservation. He believes that we will have a much better understanding of vegetation management in 10 years time.

"Governments will be better able to target their investments, and farmers better able to understand how their own actions contribute to wider regional objectives, whether it's conserving biodiversity or controlling salinity", Carl said.

Jann Williams, the coordinator of the national Native Vegetation R&D Program, sees strength in the human dimension. She said, "I'm inspired by the amazing people you meet—the dedicated farmers who want to do things for the environment, but don't always know the best way to go about it".

Colin Creighton is the Director of the National Land and Water Resources Audit, which has for the first time just mapped the condition of the nation's vegetation across the whole of Australia in a consistent way. He said, "We've got to get the policies and institutional arrangements right; it's easy to waste R&D dollars if the policy setting is not in place".

"We're spending billions of dollars on revegetation projects, you would hope that it is being informed by science."— Andrew Campbell, Land & Water Australia

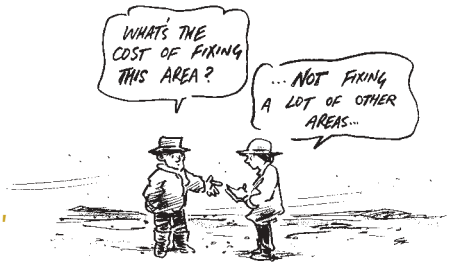
From guesswork *to* greater scientific certainty

"Our awareness and understanding of the role of native vegetation in the landscape has improved enormously, but we still need better knowledge about how our natural systems work", said Andrew Campbell.

"In some areas there's now a move away from the idea that 'any tree is a good tree' and questions are being asked about whether there can be too many trees in some landscapes. For instance, large-scale plantations may be reducing run-off and environmental flows in some areas.

"We need to know how much vegetation is required, of what type, and where on the landscape. We need more certainty on what the most cost-effective actions are to address issues like biodiversity loss, salinity, soil erosion, and declining water quality in our rivers and streams. We need science to help us answer these questions.

"We're spending billions of dollars on restoration projects, you would hope that it is being informed by science. In fact $2.5 billion has been committed over five years, but R&D funding in Australia is very small. Less than $5 million will be spent each year on research into native vegetation over the whole of Australia."



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* **Rob Thorman** has had a long involvement in natural resource management. He worked with the Australian Local Government Association on Landcare, was Director of Natural Resources with the National Farmers' Federation, the National Local Government Bushcare Facilitator, and was co-author of *Natural Advantage—A Blueprint for a Sustainable Australia* for the Australian Conservation Foundation.

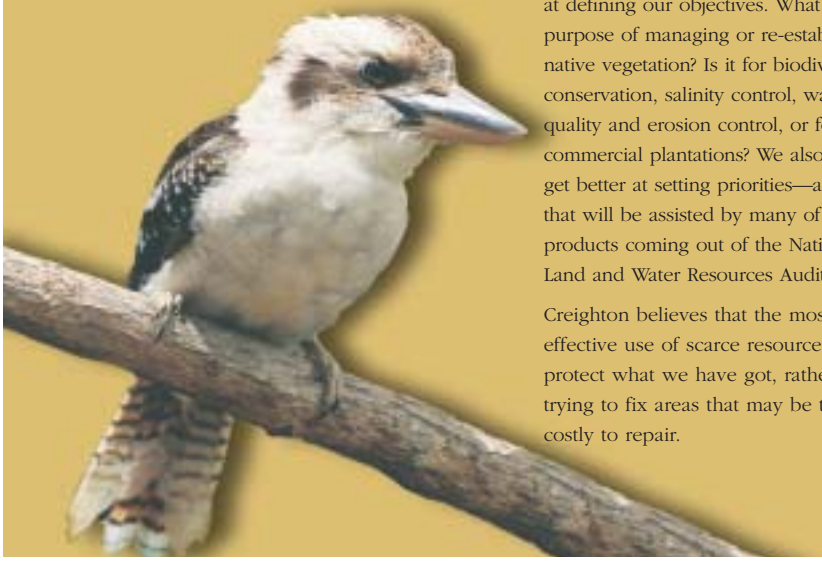
Campbell also believes there is still a lot of basic scientific research required into Australian species, which are so uniquely adapted to our environment. "Over the next 10 years, we should be building research capacity focused on our native species and ecosystems, and attracting some of our top young scientists to work on developing uniquely Australian land management systems", he said.

From remnants *to* landscapes

What will successful landscapes look like in 2012? Binning sees our focus shifting to a whole-of-landscape approach to vegetation management.

"We need to focus not only on the patches of bush that are left, but also on the wide spaces between", Binning said. "By focusing on the remnant patches of bush, we may get some short-term biodiversity benefits, but in the long term, these remnants may not be viable, they may be too small and too fragmented."

Over the next decade, we should be building research capacity focused on our native species and ecosystems and attracting some of our top young scientists to work on developing uniquely Australian land management systems.



"In some areas such as south-west WA many remnants may be damaged by salinity over the next few decades, regardless of efforts to protect them.

"In the highly cleared areas of southern and eastern Australia, vegetation management at the landscape scale will include shelter belts, riparian corridors, commercial timber plantations and remnant patches. The barrier will become blurred between what is currently viewed as planting for the public good, like salinity control or biodiversity conservation, and planting primarily for commercial purposes, such as timber plantations.

"Organisations like Greening Australia will increasingly provide an integrated service in vegetation management across the spectrum.

"R&D also needs to be carried out at the landscape scale, rather than as controlled experiments. All Greening Australia's work will eventually be linked to an R&D program of some sort, with a stronger two-way flow of information between landholders and scientists. An increased focus on monitoring and assessment of results will help us to learn from what we've done at the landscape scale."

From scatter-gun *to* targeted priorities

Although Landcare and the Natural Heritage Trust have moved us forward over the last decade, we have not had realistic benchmarks for measuring success. It is essential that we get better at defining our objectives. What is the purpose of managing or re-establishing native vegetation? Is it for biodiversity conservation, salinity control, water quality and erosion control, or for commercial plantations? We also need to get better at setting priorities—a process that will be assisted by many of the products coming out of the National Land and Water Resources Audit.

Creighton believes that the most effective use of scarce resources is to protect what we have got, rather than trying to fix areas that may be too costly to repair.

"The first call for limited dollars should be for protective management such as reduced clearing, protecting remnants, and managing fire, weeds, ferals and total grazing pressure. Then we need to look at revegetation with a focus on where we get the best bang for buck.

"If you look at the Audit's recent *Australian Native Vegetation Assessment 2001*, it shows (page 114) the sub regions where more than 60 per cent of the vegetation is in fragments. The unpalatable truth is that managing vegetation will cost more in areas like the Victorian Riverina and parts of the Avon Wheatbelt in south-west Western Australia. A strong case will be needed to invest in these very fragmented landscapes, such as the presence of unique plants and animals."

Binning points out that there are going to be different priorities and approaches for different types of region. "In the rangelands, for example, leases could become increasingly tied to environmental performance, through management of grazing pressure and watering points", he said.

"In significant areas, a far cheaper way of meeting conservation objectives will be providing incentives or some form of payment to leaseholders, as conservation stewards, instead of establishing reserves.

"In the human-dominated wheat sheep belt, the landscape of the future is likely to include systems of shelterbelts and commercial plantations patchworked to remnants. This will mean working closely with industry on regional planning and developing a range of incentives for landholders.

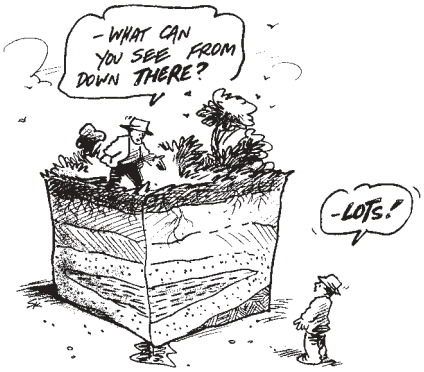
"In the coastal zone, increasing fragmentation as a result of urban growth is likely. The challenge here is for local governments to become increasingly proactive, ensuring that conservation assessment occurs before development and that guidance and direction is provided to landowners and developers.

"Where there are more 'lifestyle-focussed' landholders along the coast and urban fringes, who don't necessarily depend on the land for an income, there are opportunities for land to be managed for conservation. We therefore have the benefit of a rich private conservation estate. A cost-effective approach in these areas could be to provide landholders with information, support and recognition, through programs such as Land for Wildlife."

From working alone *to* genuine partnerships

Improved partnerships between government agencies, industry, landholders and scientists are singled out for attention by the four leaders. Creighton said that there is an important role for an information brokering service, facilitated by government, within government agencies, universities and the community and consisting of interdisciplinary teams.

"It is hard for people at the regional level to access information quickly",



Creighton said. "Knowledge brokers could pull this information together and help with decision-making on investment priorities."

Binning agrees: "Environmental management is a core issue, along with health and education, and knowledge brokering is a core function. It has a public benefit and should be publicly funded.

"There should be careers and professional networks in the environment as there are in health and education throughout regional Australia. At the moment, many of the networks involved in vegetation management depend on annual contracts and funding.

"Increased long-term government funding is essential, but we can't repair landscapes without the greater involvement of industry in changing industry practices."

Williams also views it as essential that vegetation management is integrated with the business profitability of farms. "Involvement of industry groups is vital and it's starting to happen", she said.

"The cotton, wool, grains, and meat and livestock organisations are currently, or will soon be, developing natural resource management guidelines for their sectors.

"I look forward to a time when a common message is being delivered by the various networks that exist such as agricultural extension, landcare, and industry groups."

From grants *to* market mechanisms

A greater diversity and mix of market-based mechanisms is needed to share the costs of vegetation management, rather than relying on government grants.

"Currently the market signals are too weak, people are not rewarded sufficiently for doing the right things, and sanctions are ineffective", says Campbell.

Binning and Campbell both talk about a range of potential market mechanisms, such as revolving funds or bush tender auctions, where landholders put in a bid to deliver a service that has been identified as a regional priority. Bids may be assessed for cost-effectiveness in meeting regional objectives.

Creighton points out that 60 per cent of our land is under some sort of grazing or agricultural activity, yet only 1 per cent of the land produces 80 per cent of our agricultural productivity. "So there are great opportunities to work with land managers who, in addition to their productive activities, can deliver ecosystem services such as biodiversity, groundwater and surface water quality, and carbon sinks", he said.


Photo by A Campbell

"We need to develop incentives to help land managers do the 'stitch in time' management of things like weeds, ferals and erosion", Creighton says. "This could help deliver ecosystem services and maintain the rural fabric. A form of mutual obligation may be required so that protective management is in place to deal with fire, weeds, and grazing pressure to support investment in vegetation management."

From vegetation management as a 'cost' *to* a vibrant regional and export industry

Revegetation should not be viewed as a cost, according to Campbell.

"It is a long-term strategic investment in natural capital that will maximise the long-term wealth of our country", he said.

Campbell sees the potential for a vibrant revegetation industry, with the expertise, techniques and machinery to efficiently carry out seed collection, planting, and maintenance, to serve both commercial and voluntary operations throughout Australia.

"Indeed, there are great opportunities to export our knowledge", he said. "Australia's expertise across a range of such areas is amongst the best in the world, and could have applications internationally."

More information

The **Land & Water Australia** Strategic Plan is available through CanPrint (see back cover) and at www.lwa.gov.au
Contact **Greening Australia** on (02) 6281 8585 or visit their web site www.greeningaustralia.org.au.
To obtain **Land and Water Resources Audit** publications call (02) 6257 9516, email <info@nlwra.gov.au> or go to www.environment.gov.au/atlas.

Finding the facts for a farmland make-over

David Freudenberger and the case of the disappearing birds. Photo by B Collis

By Brad Collis

The revegetation of farmland to improve biodiversity and ultimately lift the sustainability of Australian agriculture is shifting up a gear in a new three-year study into the real needs of threatened flora and fauna species.

The project, 'Testing Approaches to Landscape Design in Cropping Lands', is building on research already undertaken by the CSIRO in Western Australia and New South Wales into the 'focal species' concept.

This project was developed in Western Australia by Rob Lambeck as a way to measure threatening processes such as loss of habitat by clearing, isolation of habitat, and degradation of habitat by grazing and dryland salinity. To save time, given the urgency of the situation, he sought to identify the species that were the most sensitive to each particular threat, rather than trying to monitor the health of a wide range of plants and animals. Lambeck called the most threat-sensitive creatures 'focal species'.

Lambeck, and colleague David Freudenberger, who is heading up the new study, were working on the hypothesis that by identifying focal species and responding to their needs it might be possible to establish an ecological umbrella under which the needs of many other species would also be covered. It was expected that this would allow a more strategic approach to revegetation, particularly in the denuded wheatbelt of Western Australia.

The initial focal species chosen as indicators of threatening processes were woodlands birds, because there are many different kinds with many different habitat requirements. Some require a dense understorey or large patches of bush, which means revegetation has to involve far more than just planting a few rows of trees.

"We found that many woodland birds tend to drop out of the landscape once the bush becomes fragmented and the understorey over-grazed", said Freudenberger.

Photos by A Campbell

So an early rule of thumb we used to define habitat quality was if you could see through it, it wasn't a very useful habitat.

"These sensitive birds need a lot of three-dimensionality—trees and shrubs of varying height and density. So an early rule of thumb we used to define habitat quality was if you could see through it, it wasn't a very useful habitat. It usually meant the understorey, which these birds needed for nesting, feeding and for protection from predators, had been grazed out."

The other early finding from this work was that birds in highly cleared landscapes need much larger areas of dense bush than previously thought—10 to 100 hectares. This was the threshold that emerged from surveys of the Riverina, the western slopes of New South Wales, the WA wheatbelt and central New South Wales. Below this figure the bush simply seems incapable of providing all woodland birds with the habitat diversity they need for breeding and feeding.

Armed with this information, the new project—a joint Land & Water Australia and CSIRO initiative—will move beyond just birds. There is a need to fully test some of the assumptions drawn from the initial focal species work—such as whether or not the provision of an appropriate habitat for charismatic woodlands birds would indeed create an umbrella environment for other more cryptic species. Aside from the bird surveys, the team will be able to build on data collected from an intensive survey, which benchmarked biodiversity in the Riverina. Data was collected on birds, a full range of plants (including non-vascular plants like lichens and fungi), plus an extensive range of fauna. New data on other biota will be collected in the wheatbelt of Western Australia.

"The birds were a species of convenience for discovering vegetation thresholds in a short period of time, but we now need to identify other threatened species and see if they are covered by the needs of these birds—and this will take longer", Freudenberger explained.

Planting a few rows of trees does not provide the habitat needed to protect species such as small birds.

"This means refining the methodology, because the focal species approach is really only a starting point. So far it has told us that planting a few rows of trees does not provide the habitat needed to protect species, such as small birds, that are declining because of past land clearing. We now have to extend our knowledge to a wider range of species—to the threatened plants and the creepy crawlies on the ground and up in the trees.

"We also have to measure the impact of bush fragmentation across larger areas. For example, is a 10-hectare patch still enough if it is isolated? Leslie Brooker in WA is looking at how big an area is needed across an entire catchment; in other words how many 10-hectare patches are needed in say, 100 square kilometres. Leslie is defining the 'neighbourhood' for viable populations of sensitive birds."

Over the next three years, Freudenberger and his team in eastern and Western Australia hope to develop a guide for large-scale revegetation in cropping lands to ensure the long-term survival of remaining biodiversity. They will evaluate methods for assessing where to put revegetation, for assessing how much revegetation is required over how large an area, and for determining whether or not revegetation designed for one species or group meets the needs of others.

Freudenberger said the project would also help researchers convey to the community what biodiversity really means—the fact that it embraces a huge range of organisms with lots of different functions. "If land users are going to try and recreate useful habitats then it needs to accommodate all the species that can't survive in a sea of crops and pastures."

More information

A fact sheet (PF020198) is available on this project from the Program—see back page for details.

Contact

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Conservation steaks

By Wendy Pyper

Conservation and biodiversity management in native plant and animal communities may seem an unlikely outcome of beef production. Beef producers have argued for years that the two can co-exist.

Until recently, however, few scientific studies had been conducted on the extent to which this is the case. In a project just completed, CSIRO Sustainable Ecosystems economist Neil MacLeod and his colleagues in the Grazed Landscapes Management Team considered the costs and barriers involved in implementing conservation strategies for livestock producers on Queensland's grassy eucalypt grazing lands.

Finding that there are limited prospects for wide-scale private conservation without significant public support was a frustrating outcome for MacLeod, once a man of the land himself. Now he is determined to find alternative solutions, realistic approaches that can work in an urgent situation.

Photo by S McIntyre

Photo by T Martin

"In 1996, with funding through the Native Vegetation R&D Program, we started looking at the farm level impacts of adopting best practice conservation management that would be considered optimum in Queensland for biodiversity in rural landscapes", MacLeod says. The grassy eucalypt woodlands MacLeod researches are under-represented in formal conservation reserves because they're amongst the richest grazing lands in the country, and they're some of the oldest settled. They're also ecologically diverse, and maintaining that biodiversity is a high priority.

MacLeod wanted real world answers to questions faced by many beef producers: "What is the economic bottom line?" "How will changing management practices affect the present levels of production?" and "What are the economic implications of these changes?"

Down on the farm

He chose four beef cattle properties to study, at Crows Nest, west of Brisbane, and further north at Mundubbera: two small (900 hectares) intensive farms and two larger (1,700 and 10,000 hectares) farms. These properties represented the diversity of enterprises in the region, in terms of vegetation structure and commercial activity. All four were defined as having 'variegated landscapes', that is, the original native vegetation comprised the majority (60 to 90 per cent of the landscape. This definition is important as it has implications for the way that these landscapes should be managed.

"Treating them as 'fragmented' landscapes and seeking to only protect a few of their component species is likely to eventually lead to their degradation", MacLeod explains.

Principles and thresholds

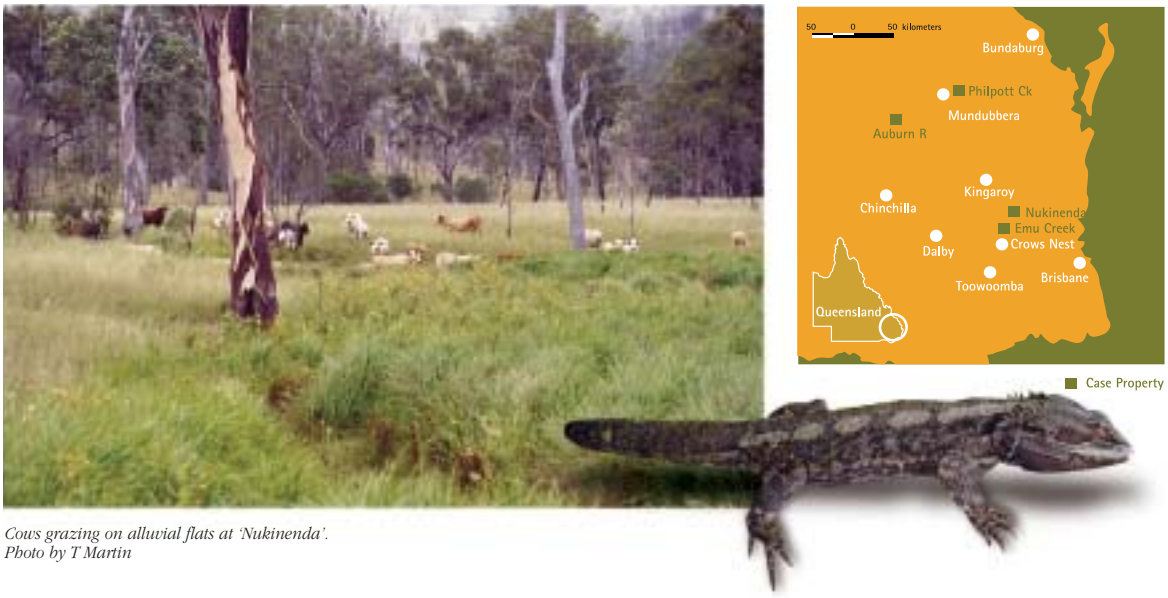
MacLeod and his colleagues assessed the ecological health of each property under its management system at the time. This involved vegetation and ground surveys, air photo interpretation and consultations with the landowners. The ecological information was turned into maps using Geographic Information Systems to show the distribution of different land uses and ecological elements in the landscape.

The maps were compared to a set of ecological principles for the sustainable management of grazed woodlands. These principles promote improved ecological function through the management of pastures, soils, trees, watercourses, wildlife and habitat. "The principles[1] were developed through a partnership between our project team and 11 scientific specialists with expertise in different aspects of landscape management, such as soils, hydrology, wildlife, tree grazing ecology, and farm forestry", MacLeod says.

Some of the management principles contain threshold values for minimum levels of native vegetation. For example, "there should be a minimum of 30 per cent woodland or forest cover on properties", "woodland patches should be a minimum of 5–10 ha [and] manage at least 10 per cent of the property for wildlife values".

"Thresholds are naturally contentious, but we've included them to show that as tree or grass cover gets below a certain threshold, some key ecological processes tend to change for the worse. Woodland bird populations decline or tree dieback increases, for example", MacLeod says.

1 S McIntyre, John G McIvor & Neil D MacLeod, "Principles for sustainable grazing in eucalypt woodlands: Landscape-scale indicators and the search for threshold", Chapter 13, pp. 92–100, in *Management for Sustainable Ecosystems* (2000), P Hale, A Petrie, D Moloney & P Sattler (eds), Centre for Conservation Biology, University of Queensland, Brisbane.



Cows grazing on alluvial flats at 'Nukinenda'. Photo by T Martin

The ecological health assessment revealed that the soils and pastures on each property were in good condition. The most significant issues for the four properties, however, were the state of their treescapes and the health of their riparian vegetation. While many paddocks had significant tree populations with a reasonable diversity of species, there were also many paddocks without viable tree populations. On all properties, the riparian zones had been extensively cleared (which is common practice), and continual use by livestock had significantly modified the bankside vegetation and soil structure.

"Most of the properties had more than the minimum threshold of trees, but they weren't necessarily in the right spots to be ecologically sustainable over time, or to sustain wildlife populations in the region", MacLeod says.

"Riparian zones are the real battlegrounds, however, because they are generally the most productive parts of the landscape. They were often the first areas cleared for pastoral settlement and remain targets for pasture development. But they're also critical for retaining local wildlife populations and ensuring adequate water quality."

To address this imbalance, MacLeod says landholders could implement a number of conservation strategies, in line with the ecological principles. These include limiting areas of intensive development, reducing stocking rates to minimise bare soil, retaining, regenerating and planting trees and shrubs, particularly in recharge and riparian areas, and excluding cattle from watercourses by fencing. But how much would these strategies cost?

Costs and barriers to conservation

If the conservation measures were adopted in full, the model projected a decline in net profit across the four properties of between 29 and 77 per cent.

MacLeod used an economic model to estimate differences in profitability between the current management systems and alternative conservation measures. The analysis was based on changes in grazing access, timber densities and stock carried, and the capital costs of the restoration options (fencing off watercourses, tree planting, dams and troughs).

If the conservation measures were adopted in full, the model projected a decline in net profit across the four properties of between 29 and 77 per cent. This was mostly due to the reduction in forage available to cattle as timber densities increased and access to riparian areas was restricted. The model also estimated that the capital costs for infrastructure and trees on the four properties ranged between $90,000 and $1.4 million.

As well as these economic losses, the grazing team identified other barriers to the adoption of the ecological principles they had identified. During paddock meetings, landholders and their neighbours pointed to the lack of available labour and skills to carry out tree plantings and infrastructure construction as important barriers. "Most farms are operated by a single person or a small family team, so the amount of effort required to plant and manage thousands of trees is very high", MacLeod explains.

"Farmers also like to trial new things before they adopt them. But augmenting a treescape or 'buffering' (planting trees and shrubs) along a creek can't be adequately tested on a small scale. Farmers also argue that replanted and fenced riparian zones would become

Photo by K Heard

Native sorghum is the largest grass in the district and amongst the most grazing sensitive

Photo by S McIntyre

weed, pest and fire hazards. They often say that the first fire would take the trees and the fence, costing $2000 a kilometre, with it. Planting riparian areas to trees is contentious, particularly in headwater areas, because shallow-rooted trees encourage bare soil and increased erosion."

Furthermore, MacLeod says, not all farmers accept that the landscape functions as poorly as ecologists claim, and they have to wait a long time to see any positive results that *might* accrue from alternative management. During this time, there may be no real evidence that ploughing money into a system that is supposedly damaged will fix it.

"The outcomes from the landholders' point of view are fairly adverse. They fear that any benefits from their management actions and capital outlay will go to others, with little recognition or compensation", MacLeod says.

New work to find solutions

MacLeod is frustrated by the general conclusion from this work, that "there are limited prospects for wide-scale private adoption of the conservation principles in the absence of significant public support. It's now a question of to what extent the landholder should bear the public cost of conservation, and vice versa", he says.

So, with the continued support of the Native Vegetation R&D Program, MacLeod has launched a new project that will attempt to resolve some of the economic and other issues raised by the landholders. The new project will consider the validity of the ecological principles in different vegetation communities, and at larger scales across 20 to 30 subcatchments (each 500 hectares) of Emu Creek.

"We are interested in whether every landholder has to apply the ecological principles, or can things operate at a different scale and get the same or better result?" MacLeod says.

"Can we get people to operate in groups, on a Landcare-type basis, and target parts of the catchment that would be priority areas? If so, we might be able to get some economies of scale on the effort or the outcomes."

Using economic modelling, the Grazed Landscapes Management Team will try to define costs for particular management activities, and how those costs might be distributed amongst a group of landholders. The team will also try to confirm that following the principles really does result in improved ecosystem function.

"We will go into the catchments and look for evidence that the landscape is or isn't configured the way our principles suggest", MacLeod says.

"We will look for output indicators—water quality, tree health, or wildlife populations—to see if subcatchments that appear to be consistent with the principles are giving a good outcome, if there's no difference, or if there is an in-between response."

The project will seek to maintain landholder interest by working with the Emu Creek Catchment Landcare Group, and, like the previous project, engage and consult landholders at every stage. MacLeod finds that farmers are quite happy to engage in a serious dialogue about contentious issues once their point of view is respected. He talks about Australian farmers as being notorious for finding their way around tricky problems with a bit of native ingenuity and feels that we need to tap into that kind of innovation if we are serious about fixing the barriers his study suggests are out there.

"In the previous project there were many exchanges of views and ideas, and I think it helped both sides understand each other and the nature of the barriers. We just have to be more creative in trying to break these barriers down and in solving some of the problems."

More information

A fact sheet (PF020205) is available on this project from the Program—see back page for details.

Contact

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Sometimes comforting, surprising, or challenging

SOME KEY FINDINGS OF RESEARCH ABOUT THE ECOLOGY OF BUSH MANAGEMENT.

By Jann Williams and Warren Mortlock

The current phase of research under the Native Vegetation R&D Program builds on these findings from the first phase of research over the last five years.

What is the minimum native vegetation cover necessary?

There is a lot of discussion at the moment about setting targets and thresholds for native vegetation and biodiversity within a regional planning framework. In southern Australia many areas have less than 10 per cent of their original native vegetation cover, which has had major impacts on native plants and animals, as well as on water and nutrient fluxes. Research shows that 10 per cent cover is a minimum threshold for the persistence of many species of fauna—and at this level of cover many species would already have been lost. In other words, these systems are being pushed beyond their limits!

Based on our current level of understanding across a range of research projects and locations, *a minimum* of 30 per cent woodland or forest cover is needed to avoid serious ecological damage. This is not an absolute or a maximum but it is a good indicator.

Where should we put it back?

Native vegetation in gully and stream areas must be retained and replanted—it has a positive role and impact well beyond the area it occupies. Gullies and streams were found to be critical for biodiversity conservation in all our research projects across very different environments. They support a different and more complex plant mix than surrounding land, and are a relatively rich habitat. Riparian corridors can be a key feature for dispersal of at least the smaller mammals.

Are small patches of native vegetation worth the effort?

Research supports the common belief that all native vegetation has some value. Landholders should not underestimate (and there is evidence that they do) the value of fencing and careful management of small remnants. We know that even small remnants can provide the base for revegetation: information on species composition and a seed supply for restoration work. They may also be of a significant vegetation type, or serve aesthetic or spiritual needs. Even individual trees provide habitat or resources for some fauna.

The research found that sympathetic management greatly increases the persistence of plants in small remnants. Remnants as small as 0.5 hectares were found to be valuable habitat for wildlife, especially for birds and reptiles. A consistent minimum patch size for bird habitat was found to be about 10 hectares with some (20 per cent) understorey. Remnants of equivalent size but on different land tenures can provide quite different habitat however.

Are big patches of native vegetation really better?

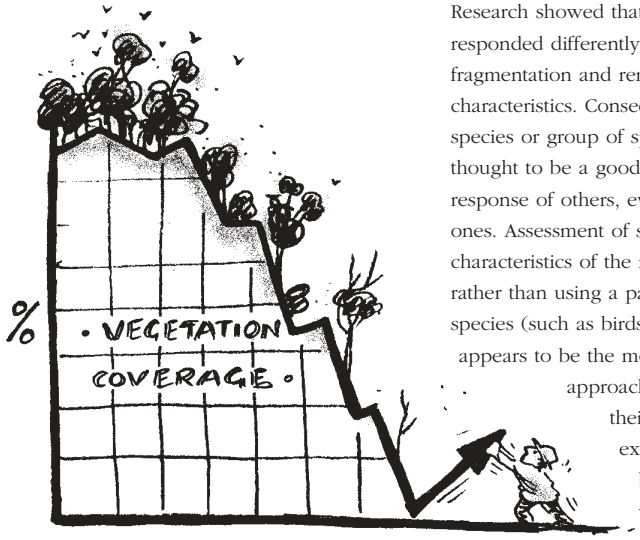
Again, general wisdom gets support from research. The bigger the remnant, the more value it is likely to have for larger animals such as birds and mammals. One research team found that remnants of about 80 hectares had a similar bird community to larger areas in adjacent forest. To maximise bird species diversity, another team found that woodland remnants should be greater than 150 hectares. Yet another team found that, for vulnerable woodland birds at least, conservation of large (more than 100 hectares) and structurally diverse woodland remnants is a high priority.

When areas are being revegetated, it is better to plant larger areas and wider corridors than to dot the landscape with tiny patches and thin strips.

What size, shape and location for replantings?

Our research on existing corridors has confirmed that they have significant value for the maintenance and dispersal of some fauna, and that it is vital we maintain the original native vegetation as linkages in the landscape. Roadside and streamside vegetation networks were found to play a critical role in maintaining habitat connectivity among remnants in the box–ironbark woodlands in Victoria. Corridors of native vegetation along riparian zones within a pine forest matrix also play a key role in the dispersal of some of the small mammals.

In the wheatbelt of Western Australia one team recommended that the distance between remnants should not exceed two kilometres for birds and that vegetation linking habitats occupied by some birds should be approximately 50 metres wide. In eastern Australia, it was found that many bird species were likely to occupy patches within 500 to 1000 metres of other remnants. Radiata pine plantings 50 to 100 metres wide were found not to be significant barriers to the movement of small mammals, but those exceeding 500 metres did limit movement between patches of remnant eucalypt forest.



In general, areas of remnant vegetation should not be too widely dispersed or isolated, especially for less mobile species like small mammals and arboreal marsupials. Nevertheless, isolated patches were found to have significant conservation value for many species (e.g. birds) and should not be cleared or ignored simply because they are isolated.

One project in the Australia Capital Territory found that birds respond differently to their habitats at different times of year, emphasising the importance of basing management decisions on information from more than one season.

How do you go about assessing the condition of remnants?

Remnant condition can relate to measures such as tree health, understorey diversity, structural diversity, the number of tree hollows, and weediness.

Plainly, remnants in good condition should be a high priority for conservation. But what of those that are not? In Tasmania, research showed that remnant condition is not linked to the occurrences of rare or threatened species, which were generally found in poorer-quality remnants (in terms of exotic species cover and species richness).

Research showed that animal species responded differently to landscape fragmentation and remnant characteristics. Consequently, no single species or group of species was thought to be a good indicator for the response of others, even closely related ones. Assessment of some characteristics of the remnant itself, rather than using a particular 'indicator' species (such as birds or mammals) appears to be the most effective approach to assessing their condition. For example, in the box–ironbark woodlands, the most useful measures included the level of disturbance to habitat resources such as ground layer cover and shelter, logs and woody debris, and large trees for hollows and nectar production.

Across the research, plant regeneration was found to be important for the long-term maintenance of native vegetation and critical for providing fauna habitat in the longer term. In addition, characteristics like the presence of feral predators and the amount of fertiliser drift can influence remnant quality.

The assessment of the health and sustainability of bushland patches, found in Kit 1 of the 'Save the Bush Toolkit' developed through the Native Vegetation R&D Program, scores 20 different characteristics of the bushland remnant to arrive at a health rating as an indication of the amount of management intervention needed.

Researchers found it useful to look at the type of natural stresses over time on a plant community (whether sclerophyll, rainforest, grassland, or wetland) and how similar they are to (or different from) the human-induced stresses that cause degradation. The recovery capacity of plant species can be used by managers to help predict the type and degree of human intervention needed to 'kick-start' natural recovery.

Approaching management

It is clear from the research that 'what we've got is all we've got'. Once the original vegetation disappears from a site, then it is very difficult to create the same system. Active management at the site, region and landscape scale may be required for many remnants to remain viable. Yet current management practices should not be changed unless there is an obvious reason to do so.

Particular management practices must be monitored and evaluated, and management adapted accordingly. Caution must be taken when

Photo by S McIntyre

Variegated landscape of grassy woodland of mixed eucalypt species in Southeast Queensland. Photo by S McIntyre

transferring results—what works in one place, might not in another. We emphasise that fencing is only the first step in an active management program for native vegetation. Strategic and controlled grazing of native vegetation is, for example, often possible, and sometimes even essential.

The more we research, the more we find that our approach to management depends on our objectives and the nature of the patches found in an area. Many conservation managers hope that a relatively simple recipe for conserving native plants and animals can be found based on managing a limited set of landscape variables, or perhaps on how much native vegetation is needed in the landscape.

Unfortunately, such a 'recipe' does not exist, although there are some general rules of thumb emerging. Overall though, decisions about the 'optimal' size, shape, connectivity or condition of remnants to conserve biodiversity will depend to a large degree on the species being targeted and the specific management objectives to be met. Even when the one group, such as birds, is being targeted, research has demonstrated that managing remnant vegetation is complex. Patch size, 'connectedness', distance to other remnants, and the vertical/horizontal complexity of vegetation, are all important factors for different species of birds during different seasons.

Regional vegetation management planning

We need to view remnant vegetation from a broader perspective than individual patches. We need to consider it at a number of scales, from the site to the region, with different scales of action required in relation to management goals. A number of pilot planning projects funded by the Program reinforced the value of planning for native vegetation management at a regional scale. They helped identify the critical success factors and weaknesses of particular approaches. Regional plans need an integrated, accessible and consistent database on natural and other resources. They must develop useful goals, and implement them at an appropriate scale.

The three key factors underlying the eventual implementation and adoption of native vegetation management plans were the involvement of community groups throughout; adequate time to build this community involvement into the planning process; and collaboration both within and between agencies.

The Program has consistently highlighted the importance of developing robust and durable regional structures for natural resource management, which must be allocated adequate human and financial resources.

More information

This article is a summary of some of the findings of the Program described in the full report *Managing the Bush* (PR000339)—available as hard copy, on the compilation compact disk Native Vegetation Research Reports (EC010030), or downloaded from the web. See back page for details.

Landscape language

By Wendy Pyper

Generalisations often provide a useful way of looking at complex systems. The ability to describe Australian landscapes, for example, has been assisted by the development of general terms or 'descriptors' that reflect a variety of landscape types and functions.

In the 1980s, 'habitat fragmentation' was a popular term amongst conservation biologists attempting to understand the impact of habitat loss on plants and animals. As research continued, biologists realised that the concept of 'habitat fragmentation' had limitations for describing the range of landscapes created by a variety of disturbances.

In the 1990s a second term, 'landscape variegation', was introduced into the research vocabulary. Rather than turning fragmentation and variegation into competing research models, CSIRO scientists Sue McIntyre and Richard Hobbs integrated them into the concept 'landscape alteration'. This concept described the extent to which habitat had been removed from landscapes through four landscape alteration states: 'intact', 'variegated', 'fragmented' and 'relictual' (see box).

"The descriptors of landscape alteration are very general, but they describe the range of Australian landscapes, and reflect the major differences in conservation status, relevant management priorities and landscape health", McIntyre says.

"They allow people to more accurately describe real landscapes, and have become a powerful communication tool in conservation biology."

McIntyre and Hobbs are now seeking to 'add richness' to this successful landscape classification system, to help improve communication in the landscape planning and management arena.

"Every square metre of land is different, but we can't afford to be paralysed by all this variation", McIntyre says.

"We need to identify general ways of describing landscapes, which people can use in everyday language, and build them into a framework that captures more variety than the four levels of landscape alteration."

To this end, McIntyre and Hobbs are in the early stages of developing a conceptual 'framework', or classification system, that reflects critical differences between landscape types. This framework will bridge the gap between the idea that all landscapes are the same, and other more technical classifications that attempt to capture much larger amounts of landscape variation.

The pair is currently in the process of identifying broad biophysical (environmental) features of landscapes, which reflect major differences in the way landscapes succumb to, or recover from, land degradation. They have considered six biophysical features so far, including geomorphology, hydrology, climate and vegetation. Climate currently stands out as hot favourite, in particular, the climate-related variable, 'moisture index'. This represents how wet or dry it is at different times of the year, and has implications for hydrology and salinity.

McIntyre says the suitability of each biophysical variable will be tested by considering their impact on the susceptibility of landscapes to threatening processes such as erosion, salinity and the incursion of exotic species.

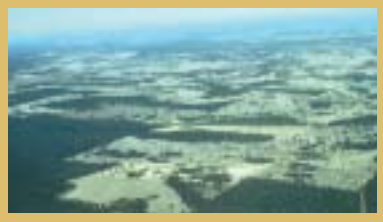
First, McIntyre and Hobbs must collate feedback on a draft framework from their peers. If the concept is accepted and a useful framework developed, McIntyre says it will provide a means for organising knowledge and ideas relating to landscape management and planning.

"It will mean a change in language rather than a change in what people do with the landscape", she says.

"We hope it will help improve communication of ideas about landscape ecology, research and management. And in the longer term, it should produce management that is better tailored to different landscapes."

Patterns of landscape alteration in south-western Western Australia seen as gross effects of human activity on tree distribution

Intact *Jarrah forest*



Variegated *landscape of Jarrah forest partially cleared for grazing*

Fragmented *mixed eucalypt woodland mostly cleared for cropping and grazing*

Photos by R Hobbs

Relictual *Jarrah forest mixed eucalypt woodland heavily cleared for cropping and grazing*

More information

A fact sheet (PF020204) is available on this project from the Program—see back page for details.

Contact

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Motivated economists: how two bean counters went bush

By David Mussared

Mike Young and Carl Binning—two economists—seem at first glance an unlikely pair to be setting Australia's national agenda for native vegetation management. Yet in the late 1990s, that is more or less what they did.

Over three years, Young and Binning, then resource economists with CSIRO, released five groundbreaking reports funded through the Native Vegetation R&D Program, calling for major changes in the way all levels of government regulate and steer native vegetation issues.

The two economists are themselves still a bit surprised by the results. Through a combination of good timing and good management, Young and Binning are in the unusual position of having seen most of their recommendations taken up by governments—influencing policy ranging as widely as federal tax laws, state government conservation incentives, and local government taxing powers.

"Young and Binning's work has directly influenced at least $100 million of Commonwealth expenditure under the Bushcare Program alone", says Land & Water Australia Executive Director, Andrew Campbell.

So what was it that made the two economists' work so effective? And, three years later, what do they now make of the results?

In 1997, *Motivating People*, the first, best-known and most influential of Young and Binning's five reports was jointly published by Land & Water Australia (then LWRRDC) and Environment Australia. The report reviewed how well land management agreements worked in conserving native vegetation. It found that agreements between landholders and governments to conserve vegetation in return for small financial incentives were an inexpensive way for governments to secure substantial conservation gains. The report listed 13 'policy opportunities' to expand the various agreement programs in existence, like Victoria's 'Land for Wildlife' scheme.

Motivating People also introduced a whole new lexicon to the conservation debate. It expanded on and gave practical force to some new ideas, which were first aired in an earlier report, *Reimbursing the Future*, prepared by a team led by Young for Environment Australia.

Motivating People delved into the vexed question of 'cost-sharing' (what portion of environmental spending should be paid by governments, and what by landholders), and argued that landholders had a legal 'duty of care' to manage their land sustainably. Young and Binning argued that a 'duty of care' (an obligation not to use property in a way which harms anyone else) was part and parcel of owning land, just as it was with any other kind of property, and that landholders should not expect to be compensated for meeting this duty.

In the case of native vegetation, they argued, the bounds of this 'duty of care' should be set by regional vegetation management plans, which could act as codes of practice for landholders in that each region. If society demanded environmental activities beyond those in the regional plan, they argued such 'public conservation services' should be purchased from landholders like any other crop.

Importantly, Young and Binning also argued that 'duty of care' was not a static benchmark and that, over time, with improved scientific knowledge and changed community expectations, the obligations on landholders would inevitably shift, just as obligations for occupational health and safety (OH&S) have shifted over time. Governments should use funding to help lubricate such shifts, they argued, but should not be locked into indefinite spending to compensate for them.

Young argued that governments impose OH&S costs on citizens and businesses all the time without offering compensation. He pointed to examples like compulsory smoke detectors in private homes and child safety restraints in private cars. Governments might fund a transition toward new standards, he argued, but they should not 'go on paying people forever'.

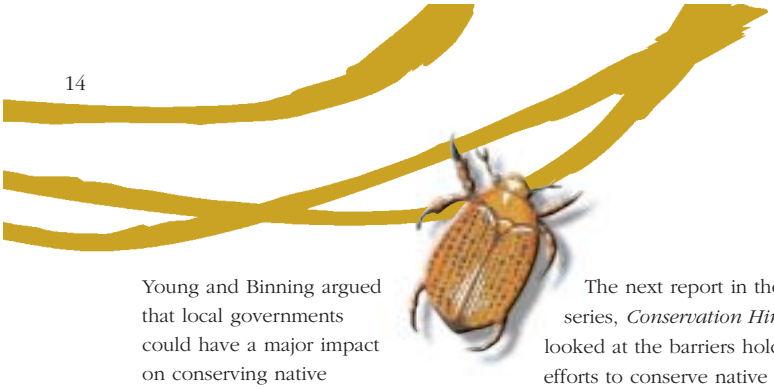
In late 1997, after talking to Young and Binning, the federal government's Productivity Commission picked up the 'duty of care' concept and made it the centrepiece of a major report into ecologically sustainable land management, *A Full Repairing Lease*. The concept has been central to natural resource policy debates in Australia ever since.

Convincing the councils

Motivating People was followed in close succession by B*eyond Roads, Rates and Rubbish, Opportunity Denied, Conservation Hindered*, and *Talking to the Taxman*. Six months apart, each report picked up the same 'duty of care' theme and much of their focus was on local government.

Beyond Roads, Rates and Rubbish called on local government to shoulder responsibility for natural resource management along with its traditional 'three Rs' (roads, rates and rubbish) role, while *Opportunity Denied* called for an overhaul of the legislation that sets local government powers so that councils could take up this responsibility. The two reports set out a road map for councils to play a much larger role in native vegetation management and other natural resource management issues.

Young and Binning's work has directly influenced at least $100 million of Commonwealth expenditure under the Bushcare Program.



Young and Binning argued that local governments could have a major impact on conserving native vegetation through schemes such as rate rebates and reductions, and revolving funds for buying high-conservation-value vegetation remnants. They also argued that local governments should be allowed to impose environmental levies to help pay for their expanded role, and called for changes in legislation in most states to give them the necessary powers.

Young and Binning say that this is one area where their work fell largely on deaf ears. Despite pathfinding work by some councils, they say, local government has largely not taken up the opportunity. Young now feels that it's been the project's main disappointment. Despite their disappointment at local government's failure so far to take on that expanded role, Young and Binning have not given up. They have since gone into partnership with the Australian Local Government Association (ALGA) to write a business plan for engaging local government more in natural resource management. The ALGA's Executive has endorsed the plan, which they have titled, not surprisingly, *Harnessing Opportunity*, and it is due to be released shortly.

I think we worked amazingly hard to get the language right, and then at communicating the findings.

Binning sees local government as a 'critical layer' in managing vegetation in Australia; one that is already involved at many levels. He thinks councils still see natural resource management being too hard, too big for them to take on. "They see it as a problem, not an opportunity", says Binning.

"Local government and state and federal government spend a lot of time blaming each other. We tried to make the point that every local council, irrespective of its size, could make a difference. If they could do that, then they would be a major player."

The next report in the published series, *Conservation Hindered*, looked at the barriers holding back efforts to conserve native vegetation. Again the pair zoomed in on local government powers and schemes, but also looked at state land taxes and other 'disincentives', which they argued actively discouraged conservation.

For example, Young and Binning cited the case of a 40-hectare block in Queensland, whose owner had to pay $12,079 a year in rates and taxes because they chose not to clear the land for agriculture, or to use it as their primary residence. If the landholder had converted the block to primary production, the economists said, rates and taxes would have plummeted to just $462 a year.

Young and Binning's final official report, *Talking to the Taxman*, called for changes to federal tax laws to create new incentives for conserving native vegetation and for donating land for conservation purposes. The legislation to introduce the changes has had a convoluted passage through Parliament, but most of the recommendations they made have now been introduced in some form—with the latest changes coming into force on 1 July 2002.

Why did it work?

"It was a very exciting time", Young recalls. "I think we worked amazingly hard to get the language right, and then at communicating the findings. Making sure we understood the processes that were going on and communicating the ideas effectively. Something in the way that we went about things worked but I don't quite know what it was."

Binning, who has since left CSIRO to become Chief Executive of Greening Australia, agrees. He says that, with his background in economics and policy, he was a 'very unusual' appointment for CSIRO, but that with Young's background in science and economics the pair made a powerful team. Even more unusually, he says, under Young's stewardship he was encouraged to put only half his effort into research, and the rest into communication.

"My brief was half research, half make it happen", he recalls. "I was given those two things, and a very long leash by CSIRO, which is very unusual. We had to figure out what how to make some quite theoretical thinking operational, and that's really what we spent the three years doing."

Both researchers also say the time was right—the federal government's Natural Heritage Trust Bushcare program was just starting up, and there was considerable government interest in vegetation issues. Both also say they had strong support from within the federal bureaucracy—from the likes of Andrew Campbell (now Executive Director at Land & Water Australia) who was then head of the Bushcare program for Environment Australia.

There is a third reason the two researchers' recommendations were picked up so widely by governments: most of them were cheap. Most of the spending they proposed was in the form of financial and tax incentives, which they argued would cost government little, but would have a disproportionately large impact on the ground.

And the two say their brief to 'make it happen' would not have been possible without access to more than 20 years of existing research into native vegetation, and the expertise it had generated, largely because of earlier projects funded by the Native Vegetation R&D Program and CSIRO.

More information

All of Binning and Young's reports are available individually (in hard copy or downloaded from web) or on the compilation compact disk *Native Vegetation Research Reports* (EC010030)—see back page for details.

Contact

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Patchworks of bush

By Lisa Robins

Looking back to 1993, it was the window seat on a flight bound for Melbourne that started Canberra-based researcher David Lindenmayer on a life's work.

Seeing the landscape of the Tumut area below, he became interested in the patches of native vegetation among expanding pine forest plantations. He wondered about those patches and the native plants and animals that persisted in them. Tumut, he saw, offered an ideal location to study the effects of habitat fragmentation on biodiversity.

The 'Tumut Experiment' was realised in 1995 when then LWRRDC (now Land & Water Australia) agreed to support his work across an unusually large study area of more than 100,000 hectares. The experiment focused on existing patches of remnant vegetation, of different shapes and sizes, across the Tumut landscape—called a 'cross-sectional' study.

A year later, Lindenmayer was approached by the Tumut plantation managers, State Forests NSW, together with Department of Land and Water Conservation, to look for better ways to design and establish new pine plantations. The research expanded to include the 'Nanangroe Experiment', looking at the biodiversity values and impacts of new plantations on woodland animals from the time of their establishment—called a 'longitudinal' study.

David says, "I do not think of them as separate projects, but a set of interrelated projects in the region".

Today, there is an army of researchers focused on understanding the relationships between native vegetation, pine plantations and wildlife in the Tumut and Nanangroe landscapes. Local landcare groups team up with geneticists, modellers, statisticians, ecologists, as well as a dozen or more Honours, Masters, and PhD students. David further supplements this team with the support of his wife, wildlife veterinarian Karen Viggers, and his father, who coordinates volunteer support from the Canberra Ornithologists Group.

Now the minimum patch size for clearing in NSW has been reduced to one hectare, as a direct outcome of this Native Vegetation R&D Program research.

What is the research telling us?

David believes that the most rewarding outcome has been the way this research has affected the thinking about how plantations should be designed and established. Small patches of native bush were usually cleared because they were considered to be without conservation value. Now, these small patches are protected.

The research is not just of academic interest: it provides land managers with answers to some of their real-life problems. Government agencies, local communities and land managers can see the benefits. The Tumut and Nanangroe Experiments have shown that pine plantations are not biological deserts, as is popularly believed. Through informed management, they can make a significant contribution to nature conservation.

This is an important finding that has emerged at a time when large-scale revegetation for farm forestry is high on the national agenda.

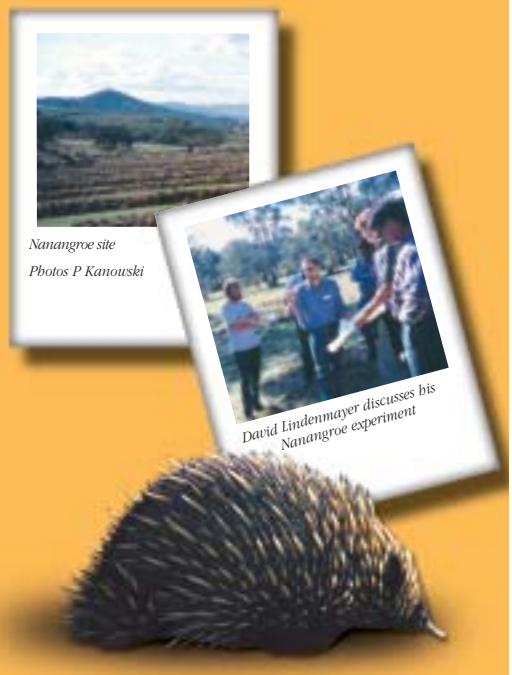
The researchers are also analysing the data to test the validity of key paradigms in conservation. The data so far does not support the 'focal species' idea—that if you protect an umbrella species like an eagle, you will automatically protect other lesser species. Rather, it has shown that there is no generic, across-the-board outcome for any of the six broad groups studied (plants, birds, invertebrates, amphibians, reptiles, and mammals).

"Landscapes are complicated, and the value of doing this sort of research is that it can provide quantitative evidence to challenge prevailing beliefs," says David.

"If there is one lesson from the work so far, it is that there are no quick fixes or magic bullets for how to design and manage landscapes to ensure the protection of all native plants and wildlife."

Lindenmayer is confident of these findings and sees great strength in the scale of the experiments and the rigorous empirical data produced. He credits the expertise of colleague Ross Cunningham, with 30 years experience in statistics, for this achievement.

Pine plantations are not biological deserts, as is popularly believed. Through more informed management, they can make significant contributions to nature conservation.



Nanangroe site
Photos P Kanowski

David Lindenmayer discusses his Nanangroe experiment

"We put in the hard yards to get both the experimental design and the analysis right at Tumut and Nanangroe. When it comes to debate we wanted to be sure that it is pretty hard to challenge what we have done", said David. This eight-year project bases its findings on tracking over 250 remnants for the six

broad groups of plants and animals studied. There is now a significant body of evidence from the research that shows just how important remnant vegetation really is to conservation. The principles and recommendations stemming from the research so far are summarised in the box opposite.

The National Action Plan for Salinity and Water Quality and the next stage of the Natural Heritage Trust will involve a massive vegetation protection and revegetation effort. Lindenmayer's research can guide the delivery of these and other conservation programs in understanding the very considerable value of even small patches of remnant vegetation.

This research sends a warning signal to land managers and policy-makers not to think about vegetation in different landscapes as being the same. While some general principles can be applied, every landscape is unique.

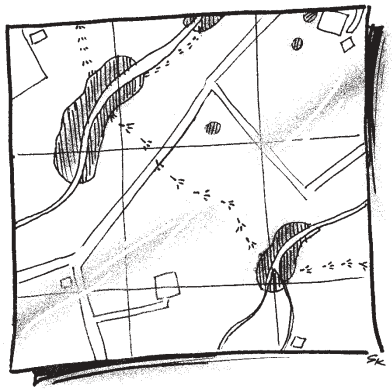
"Everyone is always looking for the right scale, when it is important to look at all scales—people shouldn't forget that, especially policy-makers", says David.

Where there is any doubt, as there is in most of our landscapes, David advises going out and getting more empirical information to inform the debate.

The future

A complementary landscape restoration study funded by the Native Vegetation R&D Program has recently commenced in the southern and northern Riverina, near Albury and Gundagai, with links to the Tumut and Nanangroe Experiments.

"The theme is the same—large-scale, long-term, lots of replications and carefully thought through design variables. It is a natural sequence from the earlier work—now we have the spectrum of landscapes covered", says David.



David Lindenmayer's research in the Tumut and Nanangroe experiments is not just of academic interest. It provides land managers with answers to some of their real-life problems. Government agencies, local communities and land managers have seen the benefits.

This study will help decide whether it is more cost-effective to target scarce funding in vegetation programs to landscapes with little existing vegetation, or to build on those with a greater proportion of remnant patches. This project operates on a large scale like its sister projects, comprising 164 sites in 21 landscape types on 82 farms. It looks at two size categories of remnant vegetation and replantings of various sizes. Like the Tumut and Nanangroe Experiments, it will investigate a range of wildlife, such as possums, gliders, reptiles and invertebrates.

Reflecting on 17 years of research, David said that Land & Water Australia is one of the few organisations that supports research for more than a standard three-year contractual period. He is now seeking additional funding, including some from America, to continue his work at Tumut and the related experiments.

"A lot of what we have done would not have happened without their seed funding. Land & Water Australia has some pretty amazing vision with some of their programs—thinking strategically and intellectually about native vegetation in the Australian landscape", says David.

However, David is still left with a sense that his vision is not yet complete. He gets at least one request each day from students in Australia and abroad wanting to work at the Tumut Experiment. He would like to support them all.

"What do you do when you have built something as big as this? How do you keep it running?"

David's dedication to his work and belief in the long-term value of the experiments is such that he hopes to still be actively researching at Tumut and Nanangroe in 15 years.

More information

A fact sheet (PF020200) is available on this project from the Program—see back page for details. Principles and recommendations from the research for new plantations adapted from *Guidelines for biodiversity conservation in new and existing softwood plantations*, Short Report No. 77, March 2000, Rural Industries Research and Development Corporation, Canberra.

Contact

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Principles and recommendations from the research for new plantations

Principles	Recommendations: New plantations	Recommendations: Existing plantations
Remnant patches of native vegetation are important habitat for native plants and animals—larger patches (more than three hectares) support more native animals than small patches; however, patches as small as one-half hectare are still of considerable value for biodiversity.	Retain all remnant patches of native vegetation during plantation establishment; however, if clearing is necessary, then retain all areas of one-half hectare or more.	
Remnant patches within 500 metres of large continuous areas of native vegetation are more likely to support wildlife (e.g. small mammals, arboreal marsupials and birds) than isolated patches.	Retain all isolated patches of remnant vegetation—do not clear them simply because they are isolated.	
Landscapes with a mix of remnant native vegetation and softwoods have significantly higher biodiversity value than radiata pine alone.	Avoid reducing the area of native vegetation during plantation establishment—replace cleared native vegetation elsewhere on the property, particularly along gully lines, if native tree removal is necessary for plantation establishment.	Re-establish 40 metre (or wider) buffer strips of native vegetation along streams within the plantation area.
	Maintain or establish an area of native vegetation that is at least 30% of the total plantation area in large-scale softwood plantations (more than 1000 hectares).	Maintain or establish an area of native vegetation that is at least 30% of the total plantation area in large-scale softwood plantations (more than 1000 hectares).
	Replant with local native tree species and link existing patches of remnant vegetation within the pine plantation.	Replant with local native tree species and link existing patches of remnant vegetation within the pine plantation.
New plantings of native vegetation can suffer high rates of death.	Determine the reasonable seedling loss rate you may experience and factor it into plantings. Plan to replace losses for the first years.	Determine the reasonable seedling loss rate you may experience and factor it into plantings. Plan to replace losses for the first years.
Biodiversity conservation is improved by establishing, maintaining or enhancing the diversity and connectivity in the landscape between patches of native remnant vegetation.	Link existing patches of remnant native vegetation within the softwood plantation along gullies and streamlines.	Re-establish native vegetation in gullies and along streamlines where it has been previously cleared for use as habitat and for dispersal of wildlife.
	Maintain, establish or enhance the connectivity (e.g. wildlife corridors) between native remnant vegetation or revegetated areas within and outside the plantation area.	Stagger the planting and cutting schedule of plantations next to remnants so as to ensure that, over time, eucalypt remnants remain linked by some areas of advanced pine growth.
The quality of retained vegetation will determine its long-term conservation value.	Exclude the collection of firewood and the culling of trees for at least five years from remnant patches or revegetated areas within newly established softwood plantations.	Exclude the collection of firewood and the culling of trees from remnant patches.
Exotic plants threaten the long-term biodiversity value of remnant patches of native vegetation.	Develop and use reproductively sterile radiata pine for softwood plantation establishment.	Develop and use reproductively sterile radiata pine for regenerating softwood plantations after the final clearfell harvest.
	Remove existing radiata pine wildlings from remnant vegetation patches.	As for new plantations.
	Develop and use hygiene protocols for logging and other machinery to stop the spread of weeds from the existing plantation (where weeds are already established) to areas targeted for new plantations.	Control minor outbreaks of weeds in recently established parts of the plantation (e.g. those planted in the past five years).
Windrowed eucalypt logs in pine plantations are important habitat for wildlife.	Retain windrows of eucalypts created when establishing the plantation, where possible.	Avoid accelerating the decay of windrowed eucalypt logs by damage from harvesting machinery during logging operations.

When every tree counts…

By David Mussared

When it comes to conserving Australia's native vegetation, researchers in most parts of the country talk in hectares—hundreds, thousands, even millions of hectares. But in much of South Australia scientists don't talk in hundreds or thousands of hectares—not even in single hectares.

Instead they talk in terms of the importance of single trees: scattered trees standing alone or in small groups in paddocks. So thorough and widespread has clearing been over the past 160 years that such scattered trees are often nearly all that remains of the vast redgum and bluegum woodlands that once dominated South Australia's southern landscape.

Increasingly, researchers are finding that these scattered trees are not just tombstones marking the gravesites of vanished woodland ecosystems. There is now strong evidence that they are important components of the life support system for those native species that still inhabit and sometimes thrive in the much-changed landscape.

Holly Bickerton, a project officer with National Parks and Wildlife SA, says research Australia-wide is now pointing to the same thing: that even scattered trees can be surprisingly important for wildlife.

"Many native birds, including several rare and threatened species like the red-tailed black cockatoo, depend on them for breeding and roosting", she says. "Reptiles and mammals use them for habitat, breeding grounds and feeding areas. Some remnant populations of native invertebrates live nowhere else."

And Ms Bickerton says that as well as being important refuges and breeding sites in their own right, scattered trees may also provide stepping stones—or wildlife corridors—for other, bush-dependent animals and birds to move between isolated fragments of remnant vegetation too small to sustain them on their own.

Mike Hodder standing next to a lone Stringy Bark (E. Obliqua) with a vineyard in the background. Photo by D Mussared

Scattered trees can be surprisingly important for wildlife

"The biodiversity value of the remnants may actually be affected by what's in the landscape around them", she says.

It is not an idle argument. In South Australia, native vegetation laws ban clearing unless developers first have permission from the state's Native Vegetation Council. By far the most common applications received by the Council have been for clearing just such scattered trees—usually to make way for new vineyards, bluegum plantations or irrigation developments.

Having to decide the ecological value of scattered trees presents the Council with a unique problem, and over the years it has had to come up with its own system. The system works, but it takes time and is labour-intensive. It means officers have to visit each

individual tree, or stand of trees, and give it a score out of 100 for various attributes, such as the number of hollows, size, health and fragmentation.

As a by-product of its assessments over the years, the Native Vegetation Council has accumulated a sizeable database of information about the ecological value of individual trees in contentious areas. Last year the Council funded a successful project which, for a large study area in the south-east of South Australia, linked this database to aerial photography and GIS technology. Then the Council realised it could take the project a step further and create a GIS tool to help map and assess the value of scattered trees across the study area. This would allow for speedier assessments without compromising their environmental rigour.

The Native Vegetation R&D Program realised that the research might have wider implications and be relevant in other parts of Australia. It joined with the Council in funding a greatly expanded project, to be overseen by Mike Hodder from South Australia's Department of Land, Water and Biodiversity. The expanded project will run for three years and include a second study area in the south-east of South Australia. This region was chosen because the landscape is similar to that found over much of the Murray–Darling Basin.

Jann Williams, who coordinates the Native Vegetation R&D Program, says that even though until recently scattered trees have received less attention outside South Australia, they actually make up a major part of the national tree inventory and cover large areas of the Australian landscape, including the Murray–Darling Basin.

"There's estimated to be 20 billion scattered trees in rural Australia and often they are all there is", Dr Williams says.

"We need to know how to manage them.

"With saline water tables continuing to rise across the Basin, scattered trees are doubly important. As well as conserving native biodiversity their presence could have major implications for soil water.

"The South Australian project is developing guidelines which will be useful in the Murray–Darling Basin and elsewhere in Australia. That is why we included the second site in a landscape that is indicative of the Murray–Darling Basin."

The Native Vegetation Council has accumulated a sizeable database of information about the ecological value of individual trees.


Mike Hodder
Photo by D Mussared

Scattered trees surround irrigation development in South Australia.
Photo courtesy of the Department for Water, Land and Biodiversity Conservation

More information

A fact sheet (PF020201) is available on this project from the Program—see back page for details.

Contact

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Thinking big about biodiversity

Jim Radford (left), Lindy Banks and Andrew Bennett—a research team looking at biodiversity on a landscape scale. Photo by M Saunders

By Mark Saunders

A collaborative research effort in Victoria has started some groundbreaking work on the relationship between vegetative cover and biodiversity on a landscape scale.

The research is the first of its kind in both methodology and scale and hopes to provide some answers to concerns about loss of biodiversity in rural environments.

This research project aims to fill a large information gap, according to Dr Andrew Bennett from Deakin University, who is principal investigator.

"Little is known about the interaction of native vegetation and biodiversity at the whole landscape level, compared to what is known about smaller-scale areas.

"At smaller scales, there is a growing amount of information about the value of individual patches of bushland of different sizes and shapes, and this knowledge is being used in various community projects, such as by Landcare groups.

At smaller scales, there is a growing amount of information about the value of individual patches of bushland ... but there is very limited understanding at the whole landscape level.

Dandenongs, Victoria

"But there is very limited understanding at the whole landscape level, which takes into account the amount and pattern of native vegetation cover and whether it is enough for species of plants and animals to persist in the long term. Some international research suggests that between 10 and 30 per cent is the critical amount, while some work in Australia suggests we should aim for at least 30 per cent cover across the landscape."

The project commenced in August 2001, with funding through the Native Vegetation R&D Program, and will be conducted by Deakin University, with support from the Catchment and Water, and Parks, Flora and Fauna Divisions of the Victorian Department of Natural Resources and Environment (DNRE).

According to Jim Radford, a Research Fellow based with the DNRE Flora and Fauna Group in Bendigo, one of the main outcomes of the work will be to determine if there is a threshold level of cover below which there is a

disproportionate decline in species diversity or the abundance of a particular species (birds for example).

"We expect that a particular species' numbers will decline in proportion to the amount of habitat, but we need to know if there is a threshold below which the drop-off in numbers is much greater", Mr Radford said.

When complete, it is hoped the threshold results of the project can be used in two ways: to set limits on the amount of vegetation that can be lost from a landscape and to aid in the restoration and rebuilding of the landscape. One outcome may be that, for example, to restore 80 per cent of the bird species in a landscape, the level of native vegetation cover needs to be restored to 15 per cent.

"Importantly, we should be able to say it's not just an extra 10 per cent of habitat required, but here's how that habitat should be arranged", Mr Radford said.

The research work is currently focused on data gathering, the first phase of which is to match GIS information on native vegetation cover with data gathered from the Birds Australia Atlas—a huge reference that contains information collected by thousands of volunteer observers throughout Australia.

The GIS information has been generated for three bio-regions in Victoria—Gippsland Plains, Goldfields and Victorian Riverina—which were chosen because the Victorian DNRE has active plans for landscape restoration already under way. The standard unit of measurement for phase one data gathering equates to about 270 square kilometres. The landscapes contained in the bio-regions include a range of land uses, from open irrigation country through heavily forested areas to city and urban landscapes.

Phase two of the data gathering will be for the project's researchers to collect quantitative information on particular

landscapes that are slightly smaller in size (100 sq km) and that vary from very low native vegetation cover to 50 per cent cover. Mr Radford said the phase two data collection will provide the team with its own rigorous data on species and ecological processes within landscapes.

"This will not only help us with the establishment of threshold levels of vegetation for animal species, it will also include studies on plant–animal interactions, for example, tree dieback and mistletoe, which are quite complex."

According to Dr Bennett, "The decline and level of biodiversity in different landscapes is an issue that people are grappling with all around the world.

"What we are working on here is highly relevant in a practical sense to land managers and also represents cutting edge theory and ideas. It's the study of the interface between applied and conceptual or theoretical knowledge that particularly excites me about the project. No doubt it will prove both satisfying and challenging."

What we are working on here is highly relevant in a practical sense to land managers and also represents cutting edge theory and ideas.

More information

A fact sheet (PF020199) is available on this project from the Program—see back page for details.

Contact

Jim Radford, Research Fellow, Department of Natural Resources and Environment Flora and Fauna Group, Bendigo, Lindy Banks, PhD student at Deakin University, Burwood Campus and Dr Andrew Bennett, principal investigator and Senior Lecturer, School of Ecology and Environment at Deakin University, Burwood Campus. Dr Bennett, Mr Radford and Ms Banks are part of some groundbreaking research being conducted in Victoria.

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