Bush Matters

Newsletter of the Conservation Partners Program
of the Office of Environment and Heritage NSW

No. 15

Conservation PARTNERS PROGRAM

Heavy rains in northern NSW earlier in the year charged the waterfalls on Stephanie and Julian Lymburner's property, Crystal Hill, near Ballina. The Lymburners entered into a Conservation Agreement in 1998 to protect in perpetuity 7.3 hectares. As well as the creek and waterfalls, the property has three distinct native vegetation types — dry rainforest, subtropical rainforest and moist sclerophyll forest — plus a small colony of koalas. Crystal Hill featured in the first issue of *Bush Matters* in Autumn 2002. You can find it at *www.environment.nsw.gov.au/cpp/BushMatters.htm*.

Photo: S Lymburner

NSW GOVERNMENT Office of Environment & Heritage

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Conservation Partners Program

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Contributions: we welcome landholder stories, case studies and photographs for possible inclusion in *Bush Matters*. Please contact Louise.

From the Chief Executive

It is a privilege to take on my new role this year as the Chief Executive of the Office of Environment and Heritage (OEH). I look forward to working across the organisation and with a wide range of community stakeholders. Our aim over the next decade is to strengthen our local environment and communities.

I am very familiar with the OEH Conservation Agreements and Wildlife Refuges. In 2000 I was involved in establising the services to bring together and support landholders with Conservation Agreements and Wildlife Refuges, and to work with partners to encourage and support voluntary conservation. I am pleased to see the ever-increasing number of private and public landholders engaged and managing their land for conservation through this program.

In early September, the Minister for the Environment and Minister for Heritage, the Hon. Robyn Parker MP, launched the Conservation Partners Welcome Folder, providing information and advice on monitoring and managing land for conservation. It includes the recently prepared Conservation Management Notes. The folder will be provided to existing Conservation Agreement landholders, and all new Conservation Agreement and Wildlife Refuge landholders. The information will also be accessible on the OEH website.

The annual Private Land Conservation Grants program administered by the Foundation for National Parks and Wildlife offers financial support for on-ground works on Conservation Agreements, Registered Property Agreements and Wildlife Refuges. This program has recently been expanded through a financial boost from the NSW Environmental Trust.

This edition of *Bush Matters* presents a range of interesting articles and information on monitoring and management. It is great to see conservation partners contributing to this newsletter, and I encourage you all to get involved.

SALLY BARNES
Chief Executive
Office of Environment and Heritage

Conservation Management Notes

The Office of Environment and Heritage has produced a series of information sheets for landholders to assist with planning and management of land for conservation. These new *Conservation Management Notes* provide advice and suggestions for protecting and improving native vegetation and wildlife habitat. They are intended as an introduction or a refresher, and include an overview of the topic and an outline of current best practice.

Under the theme of **Wildlife on your property** there are five notes to assist in identifying and managing land for wildlife. The topics covered are:

- Watching and surveying wildlife
- Assessing wildlife habitat
- The NSW Atlas of Wildlife
- Corridors and connectivity
- Integrating wildlife conservation and farm management.

The theme **Managing bushland and wildlife habitat** deals with native vegetation and includes:

- Restoring native vegetation: regenerate or revegetate?
- Natural regeneration
- Revegetation
- Seed collecting.

The notes are available on the website *www.environment.nsw.gov.au/cpp/ConservationManagementNotes.htm*

For hard copies, call Bruce at the Conservation Partners Program on 02 9995 6763.

More notes are currently in preparation.

Funding applications — improving your chance of success

One way of obtaining funding for management works on your conservation area is to apply for funding whenever suitable grants are announced.

Put yourself in the assessors' shoes and make it easy for them to understand what you intend to achieve and how you propose to go about it.

Allow plenty of time, and consider questions carefully. A properly completed application will be viewed more favourably than one which does not supply the information requested.

Fenced woodland on the Conservation Agreement property, Edala, near Nimmitabel. Fencing to manage stock is one of the most effective ways to protect native vegetation, so can be a good choice for a grant-funded project. Future photos from this point may show differences in vegetation on each side of the fence. Photos are also useful for showing that grant-funded work has been completed. Photo: R Wynan

Monitoring and grants

To support your application, document the management issue in the particular area on your property. Creating your wish list can be fun. However, ensure that this is based on sound information gained through monitoring your area. Ideally use the results of an existing monitoring program. If you don't already have a monitoring program, now is the time to start — this initial monitoring assessment can form the basis for your application.

OEH Conservation Partners use a standard monitoring procedure and form. Landholders can contact the Conservation Partners Program to obtain a copy of the form. OEH staff or contractors may have done a monitoring visit recently using this standard form. Their report will document management issues to be addressed, will include suggested management actions, provide a baseline for future monitoring and for the development of work plans.

You will want to work out how to deal with the management issue(s) in the most effective way. A work plan with aims, timeframe and expected outcomes should be clearly set out in your application.

The management problems and intended treatments need to be clearly described in the text and, as far as possible, marked on a map.

Monitoring tips

- monitoring should be regular and consistent
- monitoring does not have to be time-consuming or detailed — noting vegetation condition and presence or absence of weeds, evidence of erosion, etc, and taking photos at marked monitoring points is the ideal way to document environmental changes
- take regular (yearly may be appropriate) monitoring photos of a range of locations on your property, especially if you identify emerging management issues such as weeds

Maps

- clearly show the extent of any management problems (such as erosion) and of the work area, relative to the rest of the property
- if you have a Conservation Agreement, you can use the maps and/or airphotos from your signed agreement as a base
- the application form may only allow for one map, up to A4 size — If it is difficult to fit all the information on your map, concentrate on showing the work area, and ensure that its location on the property is carefully and accurately described elsewhere in the application.

Work plans

- if you are unsure how best to tackle the problems or estimate costs, local contractors may be able to assist with quotations and advice
- if applying for multi-year funding, the work plan might be more achievable if divided into stages — for example, if a grant has a three-year time frame, it is best to plan work such as weed control as a three-year program within the funding limit for each year
- depending on costs or the number of participants required, the size of the work area may need to be adjusted so that the cost of work fits with grant funding limits
- ensure your goals are practical and achievable — as an example, a weed-control program using one contractor for a week every month for six months may be more sustainable and therefore have a better chance of obtaining funding, than a program requiring six contractors for a week, in an area where there are very few weed control contractors available
- ongoing maintenance should be considered an integral part of the project — clearly explain how you will achieve this once work under the grant funding has been completed.

In summary, to improve your chances of success, you need to demonstrate that you understand the nature of the problem to be addressed, you need to describe the work, describe what the project will achieve and demonstrate that you have a realistic timeframe.

Good luck with your next application!

A Conservation Agreement allows the birds to breed in peace, in perpetuity

Michael and Sarah Guppy

Michael and Sarah Guppy entered into a Conservation Agreement for their property Ballara in April 2012. The property, where Sarah's father began a long-term monitoring project, had been proclaimed as a Wildlife Refuge in October 1982. They tell their story about continuing this project.

Michael and Sarah on the site with the obligatory binoculars and walkie-talkies. Photo: OEH/B Walters

We live on a 20-hectare property called Ballara on the south coast of NSW, near the town of Moruya. A Conservation Agreement for the site was finalised in 2012. Half of the property (10 hectares) was bought in 1973 by Stephen Marchant, Sarah's father. Stephen was an amateur ornithologist and bought the property with the intention of doing a long-term study of the resident birds. He surveyed and cleared about 2.5 kilometres of narrow tracks for a 50-metre grid on the site, and did a meticulous and comprehensive study on the breeding biology of the birds covering the years 1975–1984. The data were subsequently published as *Occasional Publication No.1* (1992) under the auspices of the Eurobodalla Natural History Society, a society that Stephen founded in 1986. The other half of the property was bought in the 1980s, but was not included in Stephen's study. Stephen's wife Mary died in 1994, and Stephen in 2003, and the property (comprising two separate titles) was rented and/or empty from 1998 to 2004.

Although we lived elsewhere during Sarah's parents' tenure of the property, we were well acquainted with it, as we spent numerous Christmases there. Both of us have always been interested in birds, and we used to help Stephen during the latter stages of his study. So we developed a particular fondness for the property, we liked the local community and town, and we found the combination of bush and sea a moderate and varied environment. But even so, retiring to the property wasn't really on the agenda. We were looking for warmer, or more exotic locations, and we even tried to sell the property at one stage. Luckily, it gradually became obvious that Ballara had a long list of good points, and upon Michael's retirement we decided to move here permanently, and arrived in March 2004. We spent the first year adjusting to retirement, travelling, assessing the state of the property and its various dams and water tanks, and consolidating the two 10-hectare blocks. At this stage, the idea of studying the birds in any capacity was simply not on the radar.

In that first year we spent a lot of time in the bush on all sections of the property. When we were on Stephen's old bird study site, we kept coming across the bits of reinforcing rod that Stephen had used to mark the intersections of his tracks, 30 years before. There were originally 55 of them, and for some reason we started trying to find them all, perhaps it was because they represented a significant bit of history associated with the site. The site was completely overgrown, and some could only be found using a compass and stepping out distances from another marker. But we eventually found most of them, and checked them all for orientation and distance. So having essentially re-surveyed the site used for the original study, we gradually started thinking about perhaps repeating the study, 30 years later. This was an unexpected turn of events, and one that promised to be onerous in terms of time, and the skills that would have to be developed. Not really what we had had in mind for retirement. But the more we thought about it, and the more we walked around the tracks and cleared and re-surveyed them, the more we were persuaded that we had been presented with a unique opportunity. We had the site, we had a rigorous study done 30 years earlier, and, as far as the bird population was concerned, the property has remained essentially undisturbed since Stephen finished his study in 1984. So in the 2005–2006 breeding season we experimented with techniques for walking the grid, finding birds and finding nests. What we found was that one had to spend every available minute on the site, that it really helped to use the two observers to walk at 25-metre intervals instead of only on the 50-metre grid, and that the birds would have to be individually colour-banded in order to make sense of the observations. Naturally enough, Stephen had come to the same conclusions, but he stuck to 50-metre intervals in order to cover the site in a reasonable period with only one observer. What we also found was

how bad we were at finding the nests that are the backbone of the study. We found about 50 nests that first season, whereas Stephen was finding between 100 and 200! Nevertheless in 2006 we began the mammoth task of attempting to repeat Stephen's study, in the same area, using the same grid (re-discovered and re-cleared), 30 years later. Our skills improved exponentially, and it was fascinating to find that many of the relevant bird behaviours pointed out by Stephen when we used to help him were still there, buried away in our brains but ready to come to the surface to give us clues as to what the birds were doing. In order to colour-band the birds, one of us (Michael) started the training course for a banders licence in 2006 and progressed through a Restricted to an A-class licence by 2011.

We have now completed our sixth season (2011–2012). We spend about 450 hours on the site between August and January (inclusive), and most of our time is spent finding nests, assigning banded pairs to each nest, and assigning territories to each pair. We cover the site about every four days, and find about 150 nests a year representing 29 species. We band individual birds throughout the breeding season, but a group of banders from Canberra comes down twice a year, and we catch and band about 200 birds over two days, with the result that 70 to 90% of the nesting pairs comprise at least one colour-banded bird. The data are distilled into nests per year (total and for each species), nesting period for each species, minimum number of breeding pairs for each species, percentage of nests judged successful for each species, and maximum nesting attempts per pair for each species.

A summary of the 2010–11 season shows how intimately we have come to know the birds that breed on the site:

- we found 176 nests and identified 85 breeding pairs, 57 of which had at least one colour-banded bird
- the pairs comprised 27 species
- 141 of the 176 nests progressed to the stage of at least one egg
- 84 of these 141 nests fledged young birds
- assuming (conservatively) an average clutch size of two, the 10 hectares produced at least 168 fledglings
- for individual species, the production was known to be as high as 50 (superb fairy-wren), 30 (yellow-faced honeyeater) and 45 (brown thornbill) in a season
- we estimate (based on sightings over the season) that we missed approximately 20 nests, and therefore underestimated the number of breeding pairs by about 20, and the number of species involved by five.

It has been serendipitous that the study has coincided with, initially, four years of worsening drought, followed by a dramatic breaking of the drought and two wet seasons.

The data are showing many interesting things, but two stand out. First, there are very few differences, in terms of numbers of breeding pairs and breeding period, between Stephen's study and ours. The numbers are remarkably similar, which is heartening after 30 years and a generally pessimistic view of the state of the environment countrywide. Second, our data enables us to show that in this sort of habitat, the breaking of a severe drought results in a doubling of the number of fledglings produced on the site. This was mainly due to more young birds being produced by the same number of breeding pairs.

We are continuing the study to get a more accurate picture of the breeding ecology during wet years. But it is reassuring to know that this avian ecosystem, which has been in existence for at least hundreds of years, and studied over 30 to 40 years, will continue undisturbed in the future, protected under the *National Parks and Wildlife Act* by the Conservation Agreement we have with the Minister for the Environment.

Peering at a particularly high and difficult grey fantail nest; neck massages are required by the end of the season. Photo: OEH/B Walters

A rainforest love affair

Tony Parkes

Tony Parkes tells the story of his sea change and 20 years of restoration work in the Big Scrub in northern NSW.

This is the story of my 20-year love affair with rainforest. It embraces restoring beautiful lowland subtropical rainforest on our property and, via Big Scrub Landcare, at more than 100 sites in the Northern Rivers region in North East NSW. It involves planning, monitoring and evaluation, partnership building, landholder and community engagement and education. The restoration has involved an incredible amount of on-ground work by professional rainforest regenerators and by landholders, including my family and me.

The story starts in 1986 with my family's purchase of an eight-hectare block that was part of a 42-hectare degraded ex-dairy farm at Binna Burra, 10 kilometres from the coast in the Byron Bay hinterland. We were living in Sydney and I was planning early retirement from a long career in corporate finance. The purchase was the tangible expression of a sea change dream. The dream turned to reality three years later when we moved into a new house on the property, which was once covered by lush rainforest of the Big Scrub. In 1994 we purchased the remainder of the 42-hectare ex-dairy farm.

The Big Scrub

The Big Scrub was the largest area of lowland subtropical rainforest in Australia, covering an area of 75,000 hectares between Byron Bay, Ballina and Lismore. This once magnificent rainforest with its incredibly rich biodiversity has been 99 percent cleared. All that remains are some 60 significant remnants with a total area of less than 800 hectares. Clearing began around the 1840s with the arrival of the cedar getters who sought the timber of the Australian red cedar *Toona cilliata*.

Shortly after, the NSW government gave allotments to potential farmers on the basis that they cleared it of rainforest and use the land for agricultural purposes. By 1900 most of the Big Scrub was cleared.

The surviving Bundjalung, who were the Aboriginal people of the Big Scrub, were placed into reservations.

Initially, many of the selections were small and used for intensive agricultural activity, but the red basaltic soils did not support long-term cropping. Dairying became the significant rural industry until its decline in the mid 1900s.

Restoring our property

We soon became aware of the history and significance of the Big Scrub and were delighted when in 1991 Mark Dunphy and John Nagle, then young rainforest regenerators and nursery proprietors, identified 28 locally indigenous rainforest trees in a small 100-metre patch of roadside vegetation on our property. I was even more delighted when, with the aid of a recently-purchased copy of a subtropical rainforest plant ID bible, I identified an onion cedar *Owenia cepiodora* — listed as a rare species — that they had missed! We readily agreed with Mark and John's suggestion that we should clear the mass of weeds engulfing our tiny rainforest patch and undertake an enhancement planting.

Thus began an incredible journey that over the ensuing twenty-one years has involved the planting of more than 35,000 trees on our property and the rehabilitation of three small remnants. This enabled us to restore rainforest on 15 hectares or 35 percent of the property, including two kilometres of riparian zone. The restored rainforest is protected by a Registered Property Agreement and we are currently strengthening its protection through a Conservation Agreement with the Minister for the Environment. We have rich biodiversity, with 258 locally indigenous plant species, including 13 threatened species, and a bird list of 119, including the wampoo fruit dove. The dove is Big Scrub Landcare's logo because it is a good indicator of a large patch of the lowland subtropical rainforest in good condition.

The ongoing journey has also involved active participation in the formation of Big Scrub Landcare (BSL) in 1992 and in its development into one of the largest and most successful landcare groups in NSW. BSL has achieved outstanding outcomes in promoting, facilitating and engaging

Tony with a blue quandong Elaeocarpus grandis *from the first planting 20 years ago. Photo: T Parkes*

in the restoration of lowland subtropical rainforest, and in the advocacy of its extremely high conservation value and the need to manage threats to its biodiversity, condition and resilience.

After the enhancement planting of our small roadside patch of rainforest vegetation we decided to embark on a more ambitious plan to revegetate about one third of our then eight-hectare property. In 1992 we planted up a small, degraded, largely buffalo grass paddock about half a hectare in area that was surrounded by a wall of weeds — camphor laurel, coral tree, privet, lantana and many more. We sprayed out all of the paddock weeds and grass, hand-dug holes and planted about 2500 trees (comprising 110 species) at 1.5 metre spacing using the accelerated succession approach that comprised about 35 percent of pioneer species, 35 percent secondary-phase species and 30 percent mature-phase species. The whole area was mulched with straw and watered regularly with spray irrigation that, together with the protection provided by the wall of weeds surrounding the site, resulted in spectacular growth. We had canopy closure in 30 months. The progress was so striking that BSL decided to hold a field day to illustrate what could be achieved. About 50 people attended and many were inspired to start planting. However, this was an expensive planting model because of the close tree spacing, total mulching of the whole site and the irrigation set-up costs.

Big Scrub Landcare

Big Scrub Landcare has been an integral part of my 20-year and continuing love affair with lowland subtropical rainforest. I have been its president since 1993, gaining immense pleasure from my involvement and great satisfaction from its outstanding achievements over the past 20 years.

Planning is a big issue for Big Scrub Landcare. We implement priority actions identified in the Border Ranges Rainforest Biodiversity Management Plan. We work in accordance with comprehensive management plans or weed action plans for each site. We use a detailed work and funding plan for up to 89 sites as a key management tool in developing project grant applications, planning and monitoring on-ground work, planning and monitoring on-ground expenditures and in reporting back to grantors. It can be complicated as we can have three grants running simultaneously as well as several other funding sources.

BSL's achievements were recognised by NSW Landcare's Gold Award for Nature Conservation in 2001. Benefitting from the reflected glory of this award I received the National Landcare Program Individual NSW Landcarer of the Year Gold Award.

For more information on the Big Scrub Landcare and the Big Scrub Rainforest Days visit *www.bigscrubrainforest.org.au*

Achievements to date include:

Rehabilitation work at more than 90 of the most significant lowland subtropical rainforest remnants in the Big Scrub area and surrounding region, extending from the Clarence River to the Queensland border. The sites include the largest remaining remnant of lowland subtropical rainforest (in Nightcap National Park), eight NPWS Nature Reserves and 30 remnants on public land. This has involved strategic planning at a landscape scale, preparation of management or weed control plans for individual sites, and comprehensive monitoring and evaluation of on-ground outcomes.

Facilitating the revegetation of 250 hectares of ex-rainforest land in the Big Scrub area.

Raising, over the past 15 years, more than $2 million in grants for on-ground work from the NSW Environmental Trust (our leading supporter), the Commonwealth's Caring for our Country, and previous Commonwealth natural resource management grant programs.

Developing a strong ongoing partnership of 11 stakeholder organisations and more than 60 landholders in BSL's long-term Endangered Lowland Subtropical Rainforest Restoration Program. Partners include EnviTE Environment, NSW NPWS, Rous Water, Ballina, Lismore and Tweed Councils, Rainforest Rescue and Richmond, Brunswick Valley and Tweed Landcares.

The listing in 2011 of Lowland Rainforest of Subtropical Australia as a critically endangered ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. BSL and its team of volunteer scientific advisors prepared the nomination and contributed to its assessment. BSL also lodged the nomination under the NSW *Threatened Species Conservation Act 1995*, which led to the listing in 2006 of Lowland Rainforest of the North-eastern NSW and Sydney Bioregions as an endangered ecological community.

Presenting, with the help of many supporters, volunteers and sponsors, 13 consecutive Big Scrub Rainforest Days — one of the largest annual landcare community engagement and education events in Australia.

Publishing comprehensive manuals on subtropical rainforest restoration and weed identification and control in the subtropical rainforests of Eastern Australia.

Publishing a highly regarded newsletter.

Trialling methods of restoration

We continued our revegetation program in 1993 and 1994 using minor variations of the initial planting model. By that time I and my fellow members of Big Scrub Landcare Committee had decided that we needed to undertake a properly designed trial of alternative planting models to determine the most cost-effective method. We enlisted the help of Southern Cross University people to help design a random-plot trial of three commonly used tree spacings and three surface treatments. The trial was carried out on our property in 1995 adjacent to the 1992 and 1994 plantings. I monitored establishment and maintenance costs and survival rates and the SCU students measured tree growth. After three years we established that the most cost-effective planting model for this typical degraded pasture /soft weed site was 1.8-metre spacing and surface treatment comprising prior spot spraying a 600-centimetre diameter area around where each tree was to be planted, and heavily mulching the sprayed area with straw after planting.

We purchased the remaining 34 hectares of the original 42-hectare dairy farm at the end of 1994 and had an excellent management plan prepared for the rehabilitation of the main remnant. By the end of 1995 we had fenced off the remnant to exclude cattle, which had destroyed the understory and ground cover, and had made good progress in dealing with the massive weed invasion. We also developed a revegetation plan to link the remnant with our earlier plantings and create a 10-hectare patch of restored rainforest that would provide valuable habitat and another link in the stepping stone corridors that criss-cross the Big Scrub area and facilitate the east-west and north-south seasonal movement of rainforest-dependent birds and bats.

During our monitoring of the first planting trial we noted the death rate for the planted trees averaged 12 percent, which was unacceptable. We thought this might be related to the fertiliser regime, which was half a kilo of dynamic lifter applied to the bottom of the hole before planting. The BSL Committee therefore resolved to do a fertiliser trial to compare this treatment with two other commonly used treatments. We agreed to host the trial and cleared a suitable site that would form part of the planned link between the remnant and our earlier plantings. The fertiliser trial, which was conducted in 1996, showed that by far the lowest death rate (two percent) and comparable growth was achieved with a mixture of 40 grams of high analysis NPK fertiliser, plus 10 grams of triple superphosphate to match the amount of phosphorous in the two other treatments, placed just under the surface of the soil about 15 centimetres from the planted tree stem.

The 1995 planting trial today and, top right, in 1995. Lower right: Tony with two other founders of Big Scrub Landcare, Mark Dunphy and Hank Bower, and the planting rig he developed to reduce the arduous labour involved. It contains a 450-litre water tank and pump, plus space for over 100 trees, six bales of straw mulch and a bag of fertiliser. A hydraulic auger is mounted at the front. Photos: T Parkes

During the next four years we continued planting and completed the planned link between the remnant and our earlier plantings. We also completed primary and follow up control of the extremely heavy infestation of weeds in the remnant. We were amazed by its response to removal of the threats to its survival posed by cattle and weeds: vigorous recruitment of an array of native species and a big improvement in the vegetation condition. This has provided the many subsequent visitors to our property with an excellent demonstration of the resilience of lowland subtropical rainforest and how even a small and heavily degraded remnant can be rehabilitated to good health.

In 2000 we developed an ambitious plan to continue our restoration work by fencing and revegetating two kilometres of creek bank and revegetating one hectare of paddock adjoining the earlier plantings, the creek and the remnant. We were fortunate enough to receive funding for this project under a Registered Property Agreement that included permanent protection on a third of our property. We started work in 2001 and made great progress in the first three years. However we were then hit by the most severe frosts in living memory. Temperatures as low as minus eight degrees were recorded on creek banks in our area, compared to the normal minus two degrees. We lost most of the thousands of trees we had planted in the riparian zone and the bottom of the one-hectare planting. Species previously classified as frost-tolerant that would withstand minus two degrees could not survive the much lower temperatures we were experiencing. Several floods also caused significant tree losses, adding to our problems.

We had to develop a new planting model to cope with the heavier frosts. This involved 'capturing the site' with the widely spaced framework planting using the four locally indigenous rainforest species plus a couple of non-rainforest species that could cope with severe frost and would provide sufficient protection after several years to enable us to do infill planting of rainforest species that could handle less severe frost. This is a labour-intensive and long, drawn-out process that requires a lot of ongoing weed control. The last two years of high rainfall and very light frosts have had a dramatic effect and the riparian zone and adjoining site are at last looking quite good. However we have more work to do.

Best practice

Our evolution towards scientific best practice in our revegetation plantings is interesting and mirrors that of Big Scrub Landcare and the community generally in our area. When we started our planting, we like most people at that time were not overly concerned with species selection or provenance. The aim was to get rainforest trees and shrubs in the ground. Although we used largely locally indigenous species, a few Queenslanders were in the mix. We also sourced some planting stock from outside the Big Scrub area. However, ecologists soon pointed out that we should be using only locally indigenous species and local provenance planting stock and we followed their advice. We also took into account site suitability: you do not plant riparian species on the top of a hill. BSL then sought advice from Dr Julia Playford, a well-known plant geneticist who at the time was Professor of Botany at the University of Queensland. She drew our attention to the risks of inbreeding resulting from the practice of nurseries to source their seed year in and year out from a few favourite trees. She re-emphasised the importance of local provenance and recommended that seed should be collected from no less than 10 trees and well mixed prior to propagation. BSL urged local rainforest nurseries to follow this advice.

The Great Eastern Ranges Initiative is planning for expansion

Gary Howling
Great Eastern Ranges Initiative,
OEH Conservation Programs Delivery

A funding increase will allow the Great Eastern Ranges Initiative to expand into new regions.

In December 2011, the NSW Environment Minister, Robyn Parker, announced a $4.4-million funding boost to continue the GER's growth. In addition to on-going work with existing partnerships, the funding will establish two new partnerships in the Illawarra-Shoalhaven and Dorrigo-Bellingen-Coffs Harbour areas (Jaliigirr Biodiversity Alliance).

The Great Eastern Ranges Initiative (GER) is one of six continental-scale connectivity conservation initiatives recognised in the draft National Wildlife Corridors Plan. The GER is a collaborative project between OEH and four NGOs (Greening Australia NSW, Nature Conservation Trust of NSW, OzGREEN and National Parks Association). *www.greateasternranges.org.au*

The GER has concentrated on establishing or working with community-led partnerships in five regions where there are significant gaps in the GER corridor: the Border Ranges, the Hunter Valley, the Southern Highlands, Kosciuszko to Coast and the Slopes to Summit (being Kosciuszko National Park to Albury.)

Work has resulted in protection of bushland areas through Conservation Agreements and Wildlife Refuges, and has involved landholders in workshops and in on-ground actions to fill the gaps.

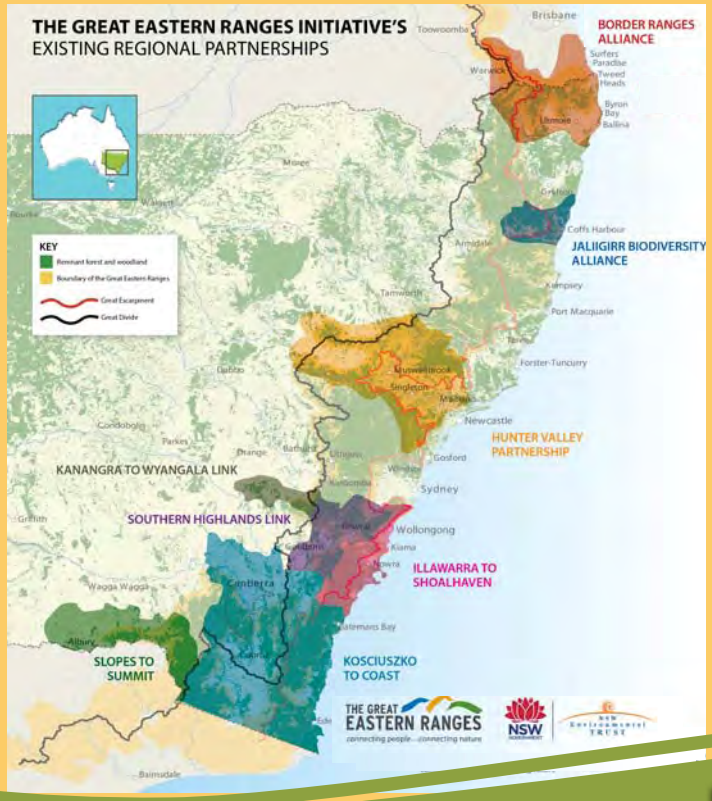
The model for implementing the GER initiative is also evolving. National parks and reserves are recognised as building blocks for connectivity, that can be built on by efforts on other lands. There is an increased emphasis on managing weeds, pests and fire in a connected landscape, and partcipating in ecosystem services markets such as carbon sequestration.

Kanangra Boyd to Wyangala link

With funding from the Australian Government's Carbon Biodiversity Fund, the GER initiative is set to expand into a third new area — the Kanangra Boyd to Wyangala (K2W) Link in the upper Lachlan.

K2W is an important landscape linkage that contributes significantly to the conservation of the GER corridor as a whole:

- **Bird migration patterns.** BirdLife Australia mapping of species distribution records shows the GER and woodlands of the inland slopes are a vital network of habitats for seasonal bird migrations, nomadic movement and dispersal of juveniles. The K2W forms an east-west connection between the main range and the 'western woodlands way'.



- **Drought refuge.** Seasonal movement patterns observed over a number of years highlight the important role of drought refuge areas as core areas allowing birds to move under a range of seasonal conditions.
- **Habitat connectivity.** Potential habitat connectivity has been modelled by OEH at continental, state and regional scales. This highlights networks of linked habitats used by birds to move within and between core habitat areas (national parks, vegetated ridgeline systems and drought refuge areas) and shows where work is needed to protect and strengthen the network. Connections between the ranges and inland woodlands, combined with the north-south network formed by western woodlands, are significant and need to be maintained and improved.
- **Vegetation condition.** Modelling demonstrates the potential for protected areas and major habitat remnants to become increasingly isolated over time, with loss of connectivity resulting in 'islands'.

The K2W project aims to strengthen these values by supporting pest species control and revegetation to reconnect and improve the quality of core habitats. In addition, instruments such as Conservation Agreements will enable core habitat to be protected in perpetuity.

Initial work will emphasise project planning to ensure links with existing activities, for example the Lachlan Catchment Action Plan. Planning will identify where conservation and connectivity can be best achieved, when incentive funding for landholder agreements, revegetation and invasive species management is made available in later years.

Landholders will have opportunities to be involved through workshops, field days and support for pest species control and revegetation. Landholders are encouraged to become involved and to talk to others in their area about protecting any high conservation value land through Conservation Agreements.

Reference: The National Wildlife Corridors Plan (Draft) found at *www.environment.gov.au/biodiversity/wildlife-corridors/index.html*

Land for Wildlife in NSW

Narelle Leite and Rob Seuss, Community Environment Network

The Land for Wildlife (LFW) program is a voluntary property registration scheme for landowners who wish to manage areas for biodiversity and wildlife habitat.

Landholders with Conservation Agreements and Wildlife Refuges often join LWF to network with like-minded people in their local area. The Community Environment Network (CEN) coordinates LWF in NSW, and the Office of Environment and Heritage (OEH) is a major supporter.

National conference

The National Land for Wildlife conference was held in March near Melbourne. The conference celebrated 30 years of Land for Wildlife, which was established in Victoria. All participating states attended and NSW was represented by John Asquith and Rob Suesse from the CEN, and Dr Lynn Webber from OEH. A paper on LFW in NSW was presented by the NSW team. It demonstrated that NSW has a very coordinated approach across the private land conservation programs.

Full proceedings of the conference are to be available on the web — watch *www.dse.vic.gov.au/plants-and-animals/native-plants-and-animals/land-for-wildlife*

Funding for expansion

In NSW the latest exciting news is that CEN has received funding from the NSW Environmental Trust to build Land for Wildlife along the Great Eastern Ranges corridor. This welcome support will provide a boost over the next two years.

New regional providers

At the local level, LFW is implemented through regional providers such as a Landcare group, local council, or other community group. New providers are regularly added. The list is available on the CEN webpage at *www.cen.org.au/landforwildlife/regionalproviders/*

Richmond Landcare School Group. Photo: CEN
Jenny Barnes of Peel, one of the first landholders to join LFW in Bathurst LGA. Photo: CEN

Southern Tablelands. The Palerang Local Action Network for Sustainability (PLANS) has recently taken on the role as regional provider and is starting to organise the rollout of LFW in Palarang Local Government Area. In 2011 a pilot scheme was initiated in Wamboin and Bywong (rural and rural-residential areas just south of Lake George) and 15 landowners were signed up, assessed and presented with their signs.

Far North Coast. Land for Wildlife NSW is very pleased to welcome a new regional provider, Richmond Landcare Incorporated (RLI). RLI is an incorporated non-profit group formed to support community Landcare groups and natural resource management projects on the Far North Coast of NSW. RLI represents Dunecare, Rivercare, Landcare, Coastcare and farming groups, and is managed by volunteers.

Workshops for landholders

The Private Land Conservation Grants Program, delivered through the Foundation for National Parks and Wildlife, offers small grants for landholders managing their land for biodiversity. Funding for regional providers to run workshops and training days supporting Land for Wildlife was made available in June 2012. Recipients were Western Murray Catchment Management Area, Gosford Local Government Area, Cessnock Local Government Area, Clarence Valley Local Government Area, Palerang Local Government Area, Kyogle Local Government Area, Wingecaribee Local Government Area. The next round of funding will open in early 2013, see *www.fnpw.org.au*

Regional roundup

Central West

Apart from delivering LFW in the Central Coast region, in June 2012 the Community Environment Network also started LFW in the Bathurst Local Government area. So far six landholders have signed up, adding 182 hectares of native bushland to the register. Much of this bushland provides valuable habitat for many threatened flora and fauna species. During the site assessments, the threatened gang-gang cockatoo was observed on one property. Another landholder has koalas on the property.

LFW attended the Bathurst Lifestyle Expo in March. Ten expressions of Interest were received from locals. These total over 1000 hectares, and assessments have been undertaken.

Central Coast

In June 2012 CEN held a threatened species workshop through the LFW program in the Lake Macquarie LGA. The main focus of this workshop was to assist landholders to identify whether they have the threatened flora species *Angophora inopina* on their properties. Information on other threatened species in the local area was also provided by Lake Macquarie Council. In total 10 LFW members attended the workshop.

Far North Coast

Byron Council has produced an excellent publication titled 'Bush Regeneration Guidelines'. It contains excellent photos and is clearly laid out. The material is relevant to most coastal areas north of Sydney. Look for it on the publications section of the council website *www.byron.nsw.gov.au/publications/b*

South West

The first property in the Riverina is being assessed for Land for Wildlife in co-operation with Wagga Wagga Council.

North Coast

Hastings Landcare have received a grant to build Land for Wildlife over the next three years.

Volunteer assessors are needed ...

... in several areas where there is curently no regional provider. Please contact CEN on *lfwnsw@cen.org.au* if you have some time to donate and the vegetation skills to help out. Training and petrol money is available.

Live in Sydney and manage land elsewhere? Landcare can help

Angela Maier, Regional Landcare Facilitator — Sydney Metro Region

Simon Rowe, Program Manager — Environment, Ocean Watch Australia Ltd

The Sydney Metro Regional Landcare Facilitator (RLF) program recently hosted two workshops about managing pest animals on rural properties.

Matt Priestly from MGP Wildlife Management Services, with a selection of trapping equipment at the recent pest animals workshops run by the Regional Landcare Facilitator program. Photo: A Maier

Presented by Matt Priestly of MGP Wildlife Management Services, the workshop covered feral animal control utilising the latest methods, thinking and tools, with an emphasis on humane trapping and euthanasing pest animals. Management of native wildlife was also covered, including the importance of checking regulations and legislation. A total of 38 people attended the workshops — one was held at Calmsley Hill City Farm for farmers and landholders in the peri-urban areas of Sydney, and one was held at Observatory Hill for residents who live in Sydney but have a rural property elsewhere.

'URRLs' or Urban Resident / Rural Landholder is a term that has been coined to represent the large and growing number of people living in Sydney and managing lands outside the urban zone. The RLF program recognises that learning new land management skills and keeping up-to-date with best practices can be difficult if you are distant from your land and local support services. The RLF program provides up-to-date information on sustainable land management practices and assist URRLs through events, such as workshops and the quarterly *Landcare Links* newsletter.

The RLF program will be holding more events over the next year. If you'd like to find out more and join the *Landcare Links* newsletter mailing list, send an email to *landcaresydney@cma.nsw.gov.au* or call Simon Rowe on (02) 9660 2262.

The Regional Landcare Facilitator program in the Sydney Metro region is a partnership between Hawkesbury-Nepean Catchment Management Authority and OceanWatch Australia and funded by the Australian Government.

The Hog Hopper — a new tool for feral pig control

The hog hopper in action, captured by movement sensitive camera. Photo: OEH

The Hog Hopper® is an Australian-designed system of serving up baits to feral pigs.

Feral pigs cost Australian agriculture at least $100 million a year.

The Hog Hopper was developed as a partnership between the Australian Government, the Invasive Animals Co-operative Research Centre (CRC) and industry. It was devised by scientists at the Invasive Animals CRC's Adelaide node. The CRC entered it in The Australian Innovation Challenge 2011, and it was selected by a panel of judges as one of five finalists in the category of Agriculture and Food.

The Hog Hopper is a container that delivers bait to feral pigs without causing collateral damage to livestock and wildlife. The research team led by scientists Steven Lapidge and Jason Wishart have exploited the pig's physique to ensure that the device is specific for pigs. To enter the hopper, the animal has to lift a low, heavy bar. Pigs have a disc at the end of their snouts which can hook into things while cattle and sheep can't get their heads low enough to lift the bar. In trials in central NSW, the entire local feral pig population was wiped out without stock or wildlife losses.

NPWS officers demonstrating the Hog Hopper. Photo: OEH/L Brodie

Traditional feral pig baiting can be labour intensive, as bait stations must be checked daily. The hopper holds enough bait to eliminate daily operator maintenance, so is low-maintenance and target-specific. This means it is good for the control of feral pigs at a population level and for use in remote areas.

Trials in national parks

Trials have been carried out in national parks in the far west. Initially, five units were purchased and a non-toxic trial was started. A number of locations were selected including the old irrigation bays of Toorale Station west of Bourke. Initial concerns over the feral pigs' interest in the old silo grain in the Hog Hopper® over self-sown sorghum, was soon over.

Remote, movement-sensitive cameras revealed that feral pigs took approximately 14 days to find the unit, and after that they virtually lived around it.

The following month saw the side doors lifted over 650 times with access achieved by a range of pig sizes and up to four pigs a side pushing for access. Other sites around the Far West Region had similar results, although with ample feed and low numbers of pigs the bait station saw less activity.

The real benefit of these devices is that they allow access by feral pigs and restrict access to bait by all other species. Following the results of non-toxic trials, toxic baiting will commence at a number of sites, adhering to current Pest Control Orders for 1080 use.

Hog Hoppers® are being used as part of a coordinated control program with other methods including regular aerial shoots. For example, in the Bourke area during April and May, a program involving the National Parks and Wildlife Service, the Darling Livestock Health and Pest Authority, Western Catchment Management Authority and local landholders, removed 2652 pigs and 39 foxes from the national parks estate, along with 772 pigs and 16 foxes on neighbouring properties.

Use of the Hog Hopper is subject to the normal rules which apply for use of toxic baits. Refer to *Standard Operating Procedure PIG005: Poisoning of feral pigs with 1080*, NSW Department of Primary Industries: *www.feral.org.au/tag/SOP/page/2/*

A brochure with guidelines for the use of the Hog Hopper can be found at *www.animalcontrol.com.au/pdf/Hoghopper_Brochure.pdf*

You can also watch the assembly and use of the Hog Hopper on *www.youtube.com/watch?v=KpafwuZENcY*

A new-look website for endangered plants and animals

The Office of Environment and Heritage threatened species website provides information to assist with the management of endangered plants and animals.

Almost 900 species are threatened with extinction in NSW. With effective management by individuals and organisations working together, we make a real difference.

Successful programs

There are a number of programs which are successfully conserving threatened species, including the examples below.

Habitat management — the Illawarra greenhood orchid

The largest known population of the Illawarra greenhood orchid is now protected under a Conservation Agreement with Shellharbour City Council. This population has grown due to active management of the habitat through weed control, track closures and rehabilitation.

Breeding and reintroduction — *Persoonia pauciflora*

The Royal Botanic Gardens Trust has worked successfully on the propagation of the nationally endangered *Persoonia pauciflora*. This species is restricted to North Rothbury in the Hunter Valley with one population protected by a Conservation Agreement.

Securing habitat through partnerships— Grassy Box Woodlands

The Grassy Box Woodlands Conservation Management Network *www.gbwcmn.net.au* provides support and on-ground assistance to landholders for the management of the endangered ecological community White Box Yellow Box Blakely's Red Gum Grassy Woodland. Many landholders have protected their patches of this plant community through Conservation Agreements, and have obtained funding to assist in management by entering into a Stewardship contract with the Commonwealth Government.

How do I find out more about threatened species?

The updated threatened species section on the OEH website can be accessed at *www.environment.nsw.gov.au/threatenedspecies*.

You can search for threatened wildlife (both plants and animals) in your area by using the search criteria or using the link to the NSW Wildlife Atlas. The website has details of more than 1000 threatened plants, animals, populations and ecological communities found in NSW.

For each species, there is a detailed profile, with photos and a map showing its distribution. Recordings of animal calls are also included.

Conservation actions which can be carried out on your property or at a local site, are listed in the section titled 'Activities to assist this species'. There may be opportunities to apply for funding to cover the costs of these actions.

Website feedback

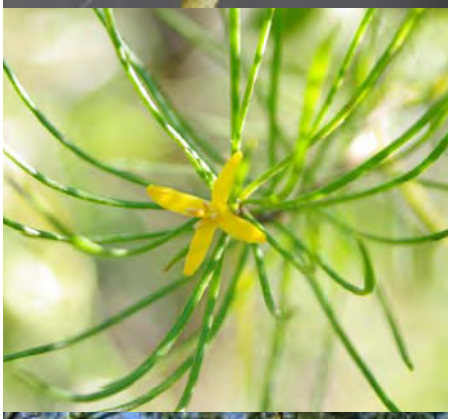
To ensure a user-friendly site, OEH is seeking feedback on the Threatened Species website. Send an email to *conservation.partners@environment.nsw.gov.au* with any comments.

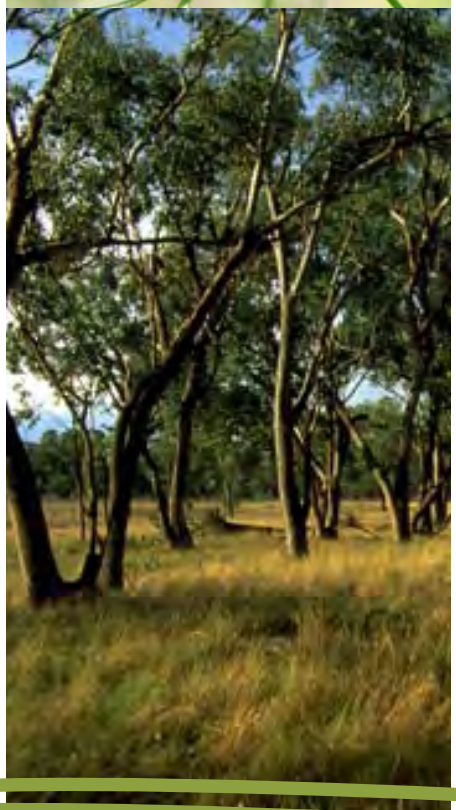
New Initiatives

OEH is reviewing past work, and is developing new initiatives to improve the way we manage threatened species. Greater involvement of landholders will be encouraged through increased support and opportunities to work with others to manage threatened species. Work will be monitored so that participants can see the contribution their work has made to the species at their local site and follow the progress of projects in other areas.

Keep your eye out for future developments.

Top *the Illawarra greenhood orchid* Pterostylis gibbosa *Photo : G Steenbeeke,*
Centre Persoonia pauciflora *Photo R Gibson,*
Bottom *White Box Woodland Dunedoo Photo: D Eddy*





Fungi offer biological control hope for mistflower and crofton weed

An exotic smut fungus that attacks mistflower recently arrived in Australia via unknown means. Meanwhile researchers are investigating a Mexican rust fungus that damages crofton weed.

Mistflower, watch out!

Dr Louise Morin
CSIRO Ecosystem Sciences, Canberra

Mistflower *Ageratina riparia* is a perennial herbaceous alien plant that invades wet habitats, particularly riparian areas and moist cliff faces, in eastern Australia. It is primarily a problem in mid to high-elevation rainforest areas where it creates a canopy over headwater streams and displaces native riparian plant species. It is also a problem in wet meadows where it reduces forage quality for livestock.

In Hawaii, South Africa and New Zealand, a biological control agent, the white-smut fungus *Entyloma ageratinae*, originating from Jamaica has been highly effective in reducing populations of mistflower. In October 2010, the fungus, was found near Lamington National Park, Queensland. The pathway of introduction is unknown.

Field surveys carried out from October to July 2011 confirmed that the white-smut fungus was widespread in Southeast Queensland and NSW North Coast, and present in the Coffs Harbour region. It was not found further south in NSW.

To infect plants, the white-smut fungus requires moisture and optimal temperatures between 16°C and 20°C. It can only grow on its host and thus cannot be cultured on artificial media.

In overseas studies, the fungus had been shown to be highly specific towards mistflower. CSIRO's additional tests on closely related plant species, including two Australian native *Adenostemma* species, further support claims that it does not pose a risk to other plants.

In May 2011, after confirmation that there were no restrictions on distributing the fungus in NSW, it was released at a series of non-infected mistflower sites on the Central and South Coasts. Within six months, major defoliation of mistflower was observed at release sites on the South Coast and in the Blue Mountains.

Visits to other mistflower-infested sites in the region revealed that the fungus was already widespread and causing severe damage. Long-distance dispersal of spores has most likely occurred, probably assisted by last year's wet winter combined with some periods of high wind. While mistflower was severely defoliated at many sites, regrowth from roots and stems was observed in spring 2011. The regrowth was readily infected, and by winter 2012 the disease was again causing major defoliation of mistflower.

Monitoring transects have been established at eight mistflower-infested sites in NSW and three in Queensland to assess the impact on populations of mistflower, and on the recovery of associated plant communities. Vegetation data were collected at all sites in 2011 (prior to releases if applicable) to provide a baseline for future comparison. A significant reduction in mistflower cover and an increase in other plants was recorded in early winter 2012

This project has been assisted by the New South Wales Government through its Environmental Trust. We are thankful to all our collaborators in NSW and Queensland.

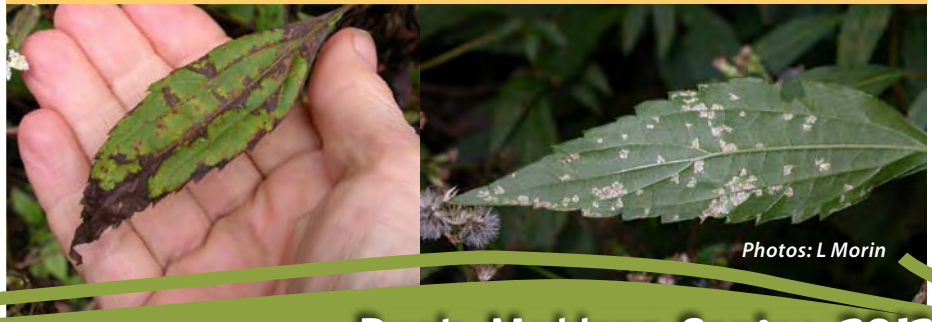
For more information or to report sightings contact:

Dr Louise Morin
CSIRO Ecosystem Sciences
GPO Box 1700, Canberra, ACT 2601.
02 6246 4355 *Louise.Morin@csiro.au*

Keep an eye out for the white-smut fungus on mistflower and let us know if it occurs in your area

The white-smut fungus produces angular-reddish brown lesions with yellow margins on the upper surface of mistflower leaves. Spores produced on the underside of lesions give them a woolly white appearance.

The first clue that the fungus is present is a die-off of the leaves and stems of mistflower, usually starting at the bottom of the plant and moving upwards. On closer inspection the upper surface of leaves have brown spots and some leaves may be brown at the tips. The key trait indicating that the damage is caused by the white-smut fungus are white patches on the underside of the leaves.



Photos: L Morin

Can a rust save Lord Howe Island from crofton weed?

Dr Louise Morin
CSIRO Ecosystem Sciences, Canberra

Sue Bower
Lord Howe Island Board, NSW

Setting up monitoring plots in an infestation of crofton weed on Mount Lidgbird. Photo: S Bower

Biological control of crofton weed *Ageratina adenophora* on Lord Howe Island (LHI) may be possible through introduction of a rust fungus that is showing promise in research trials.

Crofton weed is one of the two dominant weeds on the island. It has an extensive distribution — mainly in non-accessible areas where manual removal and herbicide control are impractical.

Since 2004 the LHI Board has been implementing a weed eradication program, mostly for woody and scrambling weed species. Crofton weed has not been included because eradication was considered impossible.

Crofton weed spreads readily by wind-dispersed seed, and poses a significant threat to native plant communities on the island. It readily colonises large-scale natural landslip disturbances, preventing native flora regeneration and succession — particularly in the southern mountains of LHI.

It threatens intact plant communities such as the Mixed Fern and Herbfield Community, which is one of the most significant vegetation communities on the island. The critically endangered twiner *Calystegia affinis* is also threatened by crofton weed invasion.

CSIRO, with in-kind support from the LHI Board and financial support from the Rural Industries Research and Development Corporation (RIRDC), has been exploring options for a self-sustaining, environmentally friendly biological control program for crofton weed on the island.

Research at the CSIRO quarantine facility in Canberra shows that the rust fungus, *Baeodromus eupatorii*, which originates from Mexico, has potential to cause severe damage on crofton weed but not affect other plant species in the environment.

The rust would reduce crofton weed's vigour and competitiveness against other plants, and its spread into agricultural and natural areas of LHI.

Before permission can be obtained to release the fungus in the Australian environment, it is essential to demonstrate that it does not pose a threat to non-target plants. Results so far are very promising. Initial testing on 35 species closely related to crofton weed in the family Asteraceae (including a few species endemic to LHI) demonstrated that the fungus is highly specific towards crofton weed. So far the rust has infected only one other species, mistflower *Ageratina riparia*, also an introduced weed.

Monitoring plots have already been established at five sites on LHI. Baseline demographic data on crofton weed and associated plants have been collected to enable comparison with future data and assess the impact of the fungus once it is released.

Unfortunately, host testing could not be completed by the current project's 31 May 2012 end date. Researchers are hoping to secure additional funding from other sources to complete remaining tests, and ensure a robust case exists before applying to release the rust in Australia.

If relevant authorities grant permission, the rust would be first released on mainland NSW and initial damage on crofton weed would be measured in the following year. These initial data would then be presented to the LHI Board in a submission seeking approval to release the rust on the island.

Crofton weed infected by the rust fungus. Photo: L Morin

Bush Matters is the newsletter for the OEH Conservation Partners Program which provides ongoing support for landholders with Conservation Agreements, Wildlife Refuges, Registered Property Agreements and Land for Wildlife.

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Past issues can be found at *www.environment.nsw.gov.au/cpp/BushMatters.htm*

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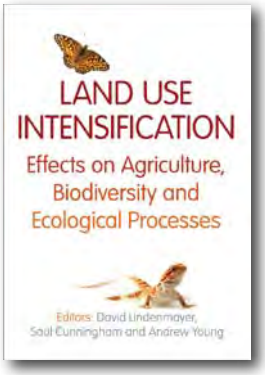
Design and Layout: Little Gecko (Virginia Bear)

New publications

Land use intensification

Effects on agriculture, biodiversity and ecological processes



Edited by: David Lindenmayer, Saul Cunningham and Andrew Young

One of the great challenges the world faces is trying to fulfil the increasing demand for food, fibre and energy without loss of biodiversity and undermining of the ecosystem processes on which we all depend. Rapid changes in climate are an additional complication.

In this book, contributors from various parts of the word have provided different viewpoints on the best ways to deal with the issues and how science can help reduce conflicts between different landuses. Contributors were asked to discuss the five or six most important lessons from their work.

This book is fascinating reading for those who are interested in how best we will meet this challenge. Specific case studies from around the world are given.

CSIRO Publishing July 2012 ISBN: 9780643104075 $49.95.
An eBook version is available from *www.ebooks.com*

Living and working on a riverbank

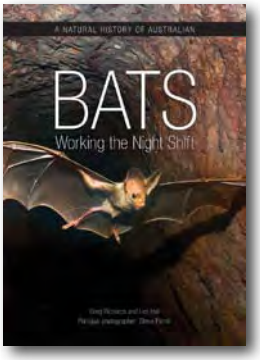
The Department of Primary Industries NSW has produced new advisory brochures for landholders whose properties include riverbanks, who manage livestock accessing waterways or who undertake works on riverbanks.

There are two brochures, one for coastal riverbanks and one for inland riverbanks. The brochures outline best practice for protecting riverbanks and fish habitat to comply with the *Fisheries Management Act 1994* and associated regulations.

The brochures can be found at *www.dpi.nsw.gov.au/fisheries/habitat/rehabilitating/living-and-working-on-a-riverbank*

A natural history of Australian bats

Working the night shift



Greg Richards, Les Hall and Steve Parish Principal photographer

Most people have a limited knowledge of bats. They are often portrayed in a negative light. This is a shame because they are fascinating creatures with immense ecological value — insectivorous bats, for example, consume large numbers of insects, and flying foxes are major pollinators of our forests, both natural and commercial.

This book will delight bat enthusiasts, and is quite likely to convert bat sceptics. It is illustrated by amazing colour photos and full of interesting bat anecdotes and ecological information. There are descriptions of each species found in Australia, plus information about bats in different regions and in the eight capital cities.

CSIRO Publishing June 2012 ISBN: 9780643103740 $79.95.
An eBook version is available from *www.ebooks.com*

Flood country *An environmental history of the Murray-Darling Basin*

Emily O'Gorman, University of Wollongong

Stories of the land and its rivers are important in increasing our understanding of how these systems work. The use of water in the Murray-Darling Basin is a subject of current national debate about competing access to water for livelihoods, industries and ecosystems. This book contributes valuable historical knowledge. It looks at the different ways in which floods have been understood and managed, and the long term consequences this has had for the river, for people and for the basin's ecology.

Tensions over the river basin range from early exchanges between Aboriginal people and settlers about the dangers of floods, through to long running disputes between graziers and irrigators over damming floodwater, and conflicts between residents and colonial governments over whose responsibility it was to protect townships from floods.

CSIRO Publishing August 2012 ISBN: 9780643101586 $49.95.
An eBook version is available from *www.ebooks.com*