Dryland Intermediate Outcome Newsletter #7
May 2009

We are almost (but not quite) finished fieldwork for the financial year and snow is on the ground as I write this almost-winter update. Since our last newsletter, the SARB OBI has survived its 4th year FRST review, and the dryland team received particular praise. The panel scored our performance good or strong in all areas, and considered we had 'good evidence of definition of challenges, clear characterization of the research strands, strong publishing record from the IO team, robust well planned engagement with communities/end-users and excellent strategic leadership'. Our funding was increased, although only modestly (and not enough to keep in line with inflation). However, this is better than no increase, and the stability provided by this long term funding is important. We greatly appreciate DOC's commitment to maintaining their cofunding for the work in the face of competing priorities, and synergies with aligned projects and funding sources continue to add value.

Last newsletter highlighted our experimental work. This one has a focus on progress in Strand 2 (Biodiversity of dryland woody communities), and also describes some key aligned projects, including the dryland 'Multiple Pest Dynamics' project, and investigations of post-pastoral ecosystem consequences in the South Island high country.

Strand 2: Biodiversity of dryland woody communities

What types of dryland communities could develop with help from low-intensity management, and how do they enhance under-represented or regionally threatened dryland biodiversity? To lay the foundation for addressing these questions, we piloted sampling methodologies for lizards and vegetation at Macraes Flat with DOC's GAOS programme in 2005/06. At the same time, this work provided baseline data on the abundance of the small lizard species shortly after implementation of different predator management treatments[1].

Are ACO counts of small lizards affected by habitat?

The chance of detecting lizards in ACOs (artificial cover objects) is likely to vary between different habitats because the use of artificial refuges by lizards could depend on the availability of natural refuges. For example, lizards might ignore ACOs if natural refuges are abundant. Alternatively, where refuges are rarer, they might defend 'their' ACO against other lizards. If the habitat in different management treatments supplied different amounts of natural refuge, this could affect lizard detection and obscure the effects of treatments on lizards.

To test this, Deb Wilson and a large field team recently compared population estimates from counts of lizards in ACOs against those from captures in pitfall traps (which are less likely to be affected by habitat differences than artificial refuges). Preliminary results showed captures of small lizards (mainly common skinks, McCann's skinks, cryptic skinks, and common geckos) in ACOs did not correlate very well with pitfall trap captures. Also, the degree of correlation varied with the time of day that ACOs were checked. These results seem consistent with different habitats affecting the use of ACOs by lizards (though analyses are still underway).

[1] Published and available in Deborah J. Wilson, Robin L. Mulvey and Ryan D. Clark 2007. Sampling skinks and geckos in artificial cover objects in a dry mixed grassland-shrubland with mammalian predator control. New Zealand Journal of Ecology 31: 169–185.


Does predator removal for endangered lizards benefit other, smaller lizards?
Removing predatory mammals to protect endangered wildlife is commonplace in conservation management in New Zealand. Responses of endangered species are often measured, but – because this adds to cost – the collateral benefits for other more common 'non-target' native species are seldom recorded, and are generally poorly understood.

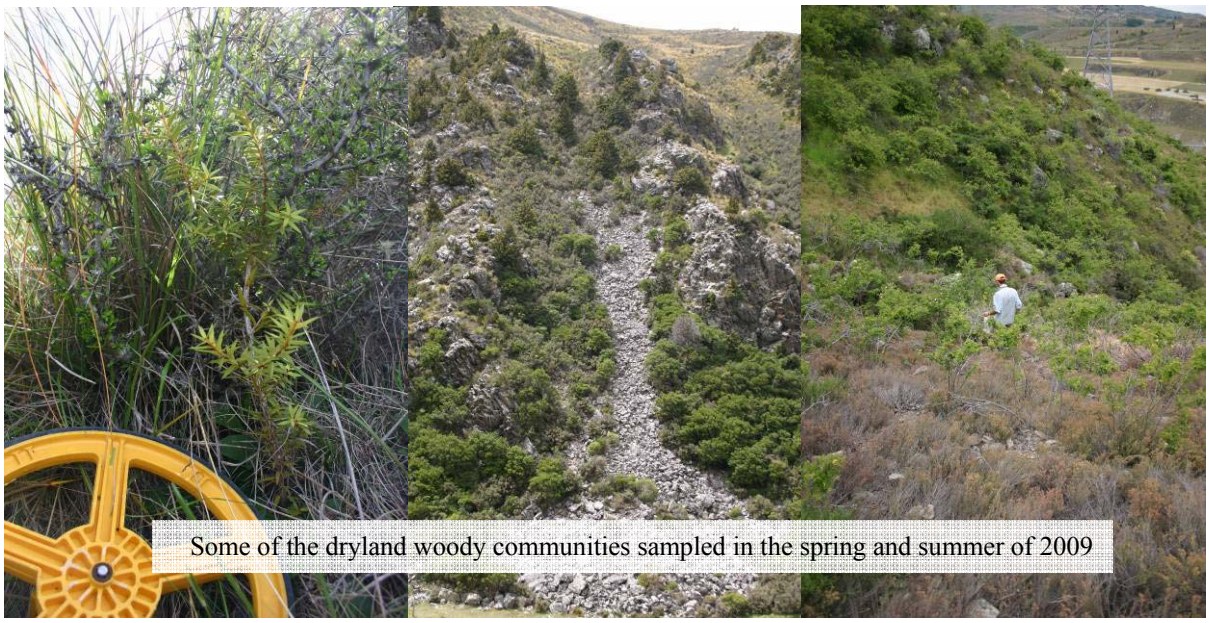
Our comparison of ACO and pitfall captures (above) was also an opportunity to measure these collateral benefits for the more common native lizards of Macraes Flat. We used the experiment to compare small lizard abundance between DOC's experimental treatments that were primarily intended to understand the benefits of predator removal to the large, endangered grand and Otago skinks, and have been in place since 2005/06.

Some field team members (pictured above) have now checked thousands of pitfall traps and ACOs and handled thousands of lizards in the course of the dryland programme. But this time it was a huge thrill to capture a very few gorgeous glittery juveniles of grand and Otago skinks (not pictured above – that's a McCann's skink!). Corny jokes were made about pianos ('baby grands'). Again, analyses are underway, and the results of this study are likely to attract a lot of interest – we look forward to the paper, and will keep you posted.

What do dryland woody (and grassy) dryland communities contribute to biodiversity?
We can't answer this question quite yet, but our efforts will be assisted by a complementary project. We've just started to merge our field sampling of dryland biodiversity with an aligned project funded by the givernment's Cross Departmental Research Pool (CDRP) that is intended to help the interpretation of national biodiversity indicators.

This CDRP's project's question is 'How much indigenous biodiversity remains on "land under indigenous cover"?'. 'Land under indigenous cover' is a national indicator of biodiversity status and change, based on a simple split of the Land Cover Database (LCDB) classes into two categories: indigenous and exotic. However, most LCDB classes contain both native and exotic species; they are neither solely exotic nor purely native. Three especially mixed and variable classes are widespread in drylands (i.e. Mixed Exotic Shrubland, Low Producing Grassland, and Depleted Grassland), and are being rapidly cleared for more intensive use currently (and could also be targeted for exotic afforestation in future).

The goal of the CDRP project for the next 2 to 3 years is to build the know-how to sample and interpret the biodiversity of cover classes more widely across New Zealand, while focusing on a few classes in a limited area. Work will examine the three mixed cover classes within the dryland zone, which will be especially valuable for interpreting the biodiversity indicator, while also improving understanding of how land clearance for intensive use, and/or increases in woody cover, affect the status of biodiversity in New Zealand overall. To capitalise on obvious synergies with Strand 2 of the Dryland IO, we are planning to integrate field sampling to meet the goals of both projects.



Some of the dryland woody communities sampled in the spring and summer of 2009

Integrating the Dryland IO and CDRP biodiversity surveys

This spring, after we finished our third 'intensive' dryland biodiversity survey (see Newsletter #5), we designed and carried out a somewhat different survey of vegetation, lizards and birds, intended to meet the aims of both (dryland and CDRP) studies. A key departure from our three earlier surveys was in the different design: we used grid stratified sampling (GSS) of targeted land cover classes as mapped in the LCDB (wherever they occur within a chosen dryland landscape) instead of sampling three 1 km^2 megaplots chosen for their different observed woodiness. We also scaled down the sampling methodology, especially for birds and lizards, but also for vegetation, to enable more rapid survey.

Benefits and costs of sampling fauna as well as flora

Plot-based information on the fauna of New Zealand's plant communities is strikingly absent both nationally and regionally[2]. But recently, a number of different initiatives (including ours) have started to tackle the challenge of systematic, plot-based sampling of multiple biotic groups. Those others we're aware of include DOC's Inventory and Monitoring programme, ARGOS (based at Otago University), and the 'multipest' and 'ecosystem consequences' projects (described below).

We're learning from these surveys that collecting data on lizards, birds and invertebrates can be far more time-consuming than collecting vegetation data. Take lizards for example: a minimum of three site visits is required to dig in pitfall traps, set and bait traps, and then to record captures… and multiple days recording with mark–recapture techniques are needed to collect robust abundance data for population estimates.

There is benefit in sampling multiple groups: lizards and birds have huge public appeal, and more robust arguments for protection (*vs* intensification) can be made if we can more completely quantify and articulate what is at stake. But there are also tradeoffs: given

[2] For example, see Ellen Cieraad's report on her systematic search in 2007 of existing terrestrial biodiversity data (Cieraad E 2008. How much indigenous biodiversity remains in land under indigenous cover? Landcare Research Contract Report LC0708/145). Ellen looked for plot-based data recording, at a minimum, both presences and absences of species in the South Island. For vascular plants, she uncovered about 26,500 plots sampled since 1980, though with a strong bias towards forest, and most >20 years old (sampled in the early 1980s). Plot data for fungi, birds and herpetofauna (lizards) were extremely scarce or absent. And among land invertebrates, Ellen found significant plot records only for land snails…again mostly from forest, with few plots in drylands.

finite resources for survey, if we sample lizards, birds and other groups in drylands, we are able to collect data from fewer places than if only vegetation is sampled.

This winter, Jake Overton will use the field data we've collected so far to analyse the costs and the benefits of slower, more expensive sampling for a broad suite of biota *vs* less costly vegetation-only sampling. He will ask questions like: How much 'biodiversity information' is added and at what cost? How much information about other biodiversity is captured in vegetation data alone? Jake will also compare the biodiversity information lost in a cost-saving design (like our spatially patchy surveys that gathered data from multiple relatively closely-spaced plots in a few areas) as opposed to more time-consuming widespread systematic sampling, which would collect data from fewer plots. The findings will inform the ultimate design of our combined dryland and CDRP biodiversity sampling.

Strand 3: Community and agency awareness

Some on-the-ground community initiatives to protect and enhance dryland biodiversity are bearing fruit. It's excellent news that COET have raised funding for a predator fence at Aldinga (near Alexandra) and will introduce Otago skinks back into the wild there this coming spring (see their recent newsletter http://www.coet.org.nz/newsletters.html). In this strand, we continue to build our links with key people (staff and councillors) in regional and district councils around drylands. It is encouraging that the national Biodiversity Advice Fund (part of 'Biofunds') is continuing its strategic financial support for biodiversity co-ordinators to work within or alongside dryland councils (the newest 'Biodiversity Ambassador' is in Hurunui District). This is an important and challenging place to work: big gains for biodiversity protection can potentially be made through small changes in councils' understanding and consequent rules and policy, but many councils are struggling to reconcile their dual development and biodiversity maintenance roles. Consequently, staff with a vision of improving natural heritage protection may become frustrated and move on after a short tenure. Where we can, the Dryland IO has also been providing advice to help the development of the second generation of conservation management strategies (CMSs) in DOC's dryland conservancies. These statutory documents set the direction and focus of public conservation work in the next decade, and can potentially assist communities and DOC to achieve substantive dryland biodiversity outcomes.

Strand 1: Succession to native woody communities

Much happened this summer in the experimental strand of our work. Heather Tiffin (a student from Otago University) worked with Adrian Monks over the summer conducting some impressive and innovative experiments on the seed ecology of dryland woody plants. In fact, Heather's work proved so useful that we persuaded her to stay on a bit longer! We hope we are soon to welcome Cailin Roe to the team (an MSc student, supervised by Professor Bastow Wilson at Otago University, and Adrian) to work on seedling growth rates & morphology how these affect establishment success. Meanwhile, experiments at Bendigo, Ealing Springs, and beyond are yielding some interesting early results. A more comprehensive update on all this will appear in our next newsletter.

Aligned projects

The dryland 'Multiple Pest Dynamics' project

New Zealand drylands support a diverse suite of invasive species that interact with each other, and with native fauna and flora, in complex ways. This 4-year Landcare Research 'dryland multipest' project focuses on those interactions and their often non-intuitive outcomes. In conjunction with DOC's (GAOS) management experiments at Macraes Flat, it is pushing forward understanding about cost-effective management approaches for restoring the biodiversity of dryland ecosystems.

The dryland multipest project is led by Grant Norbury, Andrea Byrom and Roger Pech, and started at the same time as the Dryland IO in 2005. It established ambitious large-scale, control experiments to understand how pests interact in drylands and what drives their ecology. Preliminary results are starting to emerge, although some ecosystem components may be slow to respond, and we hope the experiments will continue for some more years.

Control of top predators (cats, ferrets and stoats) is one of the most common conservation management approaches in New Zealand. But already, the multipest work shows control of one or a few pests in drylands results in 'ecological release' of non-target pest species. Mice seem to increase in dryland sites when top predators are removed. And more mice may mean similar or more predation on native lizards and invertebrates. Also, removing top predators in drylands might sometimes lead to an increase in numbers of rabbits – another undesirable outcome with complex flow-on effects.

Ongoing monitoring will show whether and how native lizards and invertebrates respond when top predators are controlled. Interestingly, the 'fuzzy logic' modelling used to generate hypotheses for the project predicted native lizard and invertebrate responses to top-predator control would be minor… because of just the complex indirect effects observed above. In other words, in managing pests, it should always be considered that our enemy's enemy can be a friend!

Pests, woody vegetation, carbon and land use change

Eastern South Island grasslands have a strong tendency to go woody when land use changes from primary production of pastoral commodities to management for services (carbon storage, water, biodiversity maintenance and restoration, cultural and historic heritage, tourism, recreation, landscape etc). The change demands a different management approach – fire is inimical to succession and the recovery of healthy native ecosystems, and grazing hinders build-up of native biomass and carbon. Further, many woody species that were traditionally regarded as pastoral weeds can now be seen as indicators of ecological recovery.

The switch to low-intensity management is perceived as neglect by some sectors. In particular, conservation managers often come under pressure to demonstrate that they're not generating a pest and weed problem for farming neighbours. So to gather some data, the 2-year 'ecosystem consequences of land reform' research project (led by Andrea Byrom and Roger Pech[3]) has begun to measure some of the effects of 'retirement' from pastoral use on vegetation and animal pests. The project is studying eight sites with contrasting management histories across fencelines, where one side has been retired from pastoral use for >15 years. In approximately 1 ha 'plots' on either side, they measured vascular plant composition, shrub cover and structure and age, and also sampled animal pests using a combination of chew cards, tracking tunnels, snap traps and pellet counts.

The 'ecosystem consequences' project bites off a small chunk of the bigger question (also tackled by the dryland multipest project) which is 'what, if anything, should be managed or controlled to maximise native biodiversity and other ecosystem services and

[3] See http://www.landcareresearch.co.nz/research/research_details.asp?Research_Content_ID=235

where?'. We are aware of a fairly urgent need to find more funding to study other benefits and drawbacks of different management choices for native ecosystems. Effects on native fauna and carbon sequestration remain two obvious gaping knowledge-holes.

A recent Sustainable Farming Fund application promises to start to fill that carbon knowledge-hole. The bid, led by farmer Jim Morris, proposes to quantify potential carbon sequestration by native vegetation (both shrubby and non-woody) and soils across a spectrum of high country land uses. Larry Burrows, Fiona Carswell and Susan Walker assisted with scoping the proposed work and writing the application. The project team includes high country land managers and Environment Canterbury, and a key goal is to help high country land managers to realise monetary returns from the ecological services provided by low intensity management, which will incentivise and reward these practices. Fingers crossed.

We are still seeking students to work with us! We are still looking for more help with seed ecology, and we're also keen to hear from prospective PhD student who would consider working with us on succession pathways in drylands after primary shrub establishment (a really fun project with heaps of fieldwork!). So if you know of a keen and thoughtful ecology student looking for a challenge (and preferably thinking of an MSc or PhD in one of these areas) in the next few years, please put them in touch or let us know. We are able to contribute co-supervision, fees and resources for the right student. Contact Adrian Monks (monksa@landcareresearch.co.nz) or Susan Walker (walkers@landcareresearch.co.nz)

Forthcoming events:

1. Biosecurity Institute National Seminar. A field trip to the 'dryland multipest' study sites on the weekend of 17–18 October) will be part of a national seminar in Queenstown (NETS: http://www.biosecurity.org.nz/ and navigate to NETS Conference 2009) on 14-16 October.
2. Grant Norbury, Andrea Byrom and Roger Pech are planning a **public workshop** later in the year, to canvass ideas on new research that could be done on **dryland pests and their impacts on biodiversity**. Contact Andrea (byroma@landcareresearch.co.nz) or Grant (norburyg@landcareresearch.co.nz) directly to get on their notification list!

Thanks! A very warm thank you to Andy Hutcheon who supported our recent lizard mark–recapture study at Macraes Flat by hiring Sean LeMoine to help in the field at all stages of the project. We also thank Sean for hard work in the field and voluntary help with data analysis and literature searches back in the office, and Nathan McNally (Macraes Flat Field Base Supervisor) for facilitating the study and our other ongoing research at Macraes Flat. Catriona MacLeod and Andrea Byrom (Landcare Research) again gave ready advice and kept us abreast of developments in other, related projects. Thanks also again to Nick Ledgard (Ensis) for his help with logistics and accommodation at Mt Barker, and to Katharina Schulz, who will be greatly missed, for hard work in the field. We also thank Heather Tiffin for her sterling work on seed ecology, and Allan Colligan who has completed heaps of data entry to an exceptional standard. Nick Head and Helen Braithwaite from DOC helped with the Ealing Springs initial measurement. Special thanks to Hugh Wilson, Hinewai, and the new piano, for hosting a memorable March research catch-up and planning meeting (right).