Dryland Intermediate Outcome Newsletter #6
October 2008

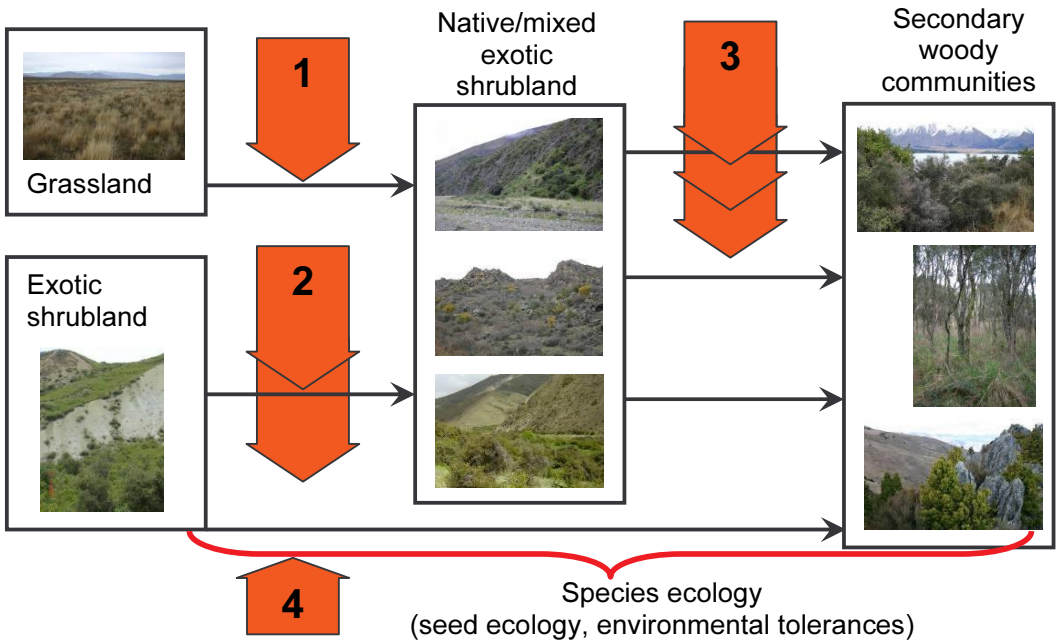
Spring has sprung, bringing lots of rain and producing green and verdant 'drylands' in the south, and there has been much activity – apologies for the late arrival of this newsletter!

Four experiments have gone in at new sites this spring, and we've been maintaining and monitoring those we established in earlier years. We'll highlight some of this new work in this newsletter – what we're doing and what we're trying to discover.

Meanwhile the more desk-bound of us have been compiling 'evidence portfolios' for a FRST review that is currently underway. FRST (and our end-users!) want to know what progress we've made towards the milestones and outcomes we promised when they gave us our funding nearly 4 years ago. They also want to know what our strategy is for the next (and last) 4 ½ years of the Dryland IO for research, 'end-user engagement', and co-funding. Since 'review' is top of mind, we'll reiterate briefly in this newsletter what we're aiming for in each strand of work, and say a little about where we started and where we're up to now.

Strand 1: Succession to native woody communities

The major goal of this work is to develop technical know-how to achieve dryland restoration at large scales. We started with collation of existing data (species distributions, environmental data, plant traits) and two pilot experiments, which provided the base for planning a comprehensive experimental programme. As detailed in our last newsletter, we are focusing our effort on understanding limiting factors of indigenous woody species *establishment* in drylands – what these constraints are, where they occur, and how they can be overcome. The diagram below shows the three types of transitions we'll be looking at (red arrows 1 to 3), with the greatest emphasis on the first (grassland to native/mixed exotic shrublands). The fourth red arrow indicates research to address the thorny challenge of building understanding of the species we're dealing with, and is relevant in all three field contexts. The timeline on the next page shows the current schedule and suite of experiments for the remainder of the programme from our 'live' working plan.



Proposed timeline for experiments

Experiment	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012
Bendigo herbivory and competition expts.						
Sward density through time trial						
Sward density glasshouse expt.						
Artificial physical shelter expt.						
Coarse woody debris shelter expt.						
Native establishment into exotic weeds expts.						
Succession pathways - age/size calibrations						
Succession pathways - field survey						
Seed ecology trials						
Soil nutrients - glasshouse soils expt.						
Soil nutrients - potassium fertilization expt.						

Some background on (and pictures of) five areas of experimental work follows:

1. Ealing Springs: native woody establishment into exotic woody weeds

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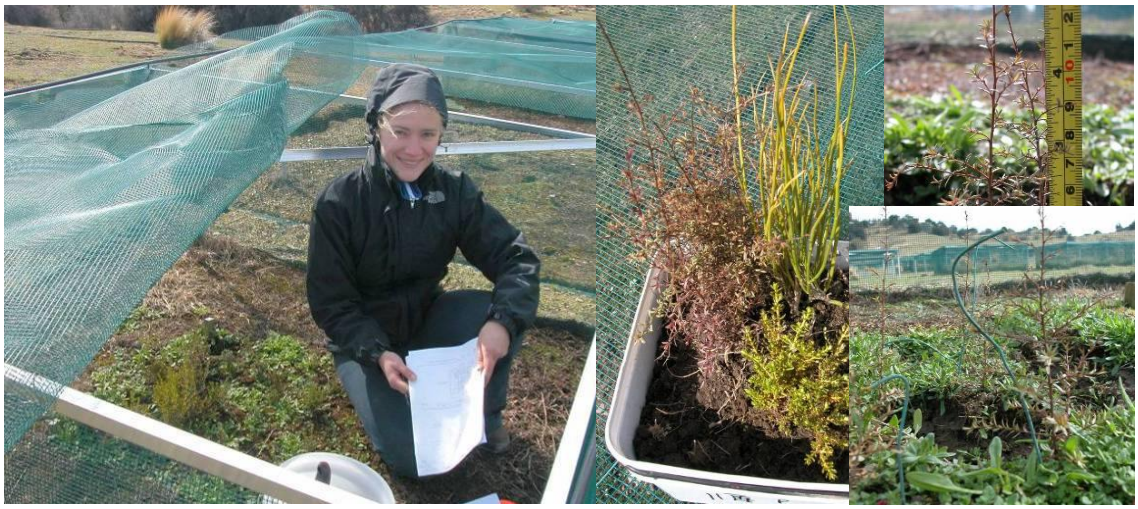
DOC's Raukapuka Area Office and Canterbury Conservancy initiated this restoration trial on the Rangitata floodplain at Ealing Springs and sought our collaboration. It fits within our strategy and we had few objections! In late September, seedlings and seeds (under bird covers, see pics below) of six native woody species were planted in plots of exotic broom that had been variously manipulated. Fieldwork on the project really commenced last June, when plots were marked out (three replicates each of five treatments: control, spray, crush, mulch, rootrake) and the machines went in (to crush, mulch and rootrake!). Spraying took place 6 weeks before planting; this treatment yielded noticeably more moist soils than others at planting time. The trial species are *Coprosma robusta* (karamū), *Kunzea ericoides* (kānuka), *Pittosporum tenuifolium* (kohukohu, kōhūhū, or black matipou), *Plagianthus regius* (mānatu or lowland ribbonwood), *Sophora microphylla* (kōwhai) and *Cordyline australis* (tī, tī kōuka, or cabbage tree). The weather was magical for planting and very undrylandish – the sun shone on each of the three days and it rained each night. We'll be following the fate of the seeds and seedlings in each treatment: measurement No. 1 is scheduled for late October.

Left & lower right: Peter Keller and Dave Anderson sow mulched and rootraked plots at Ealing Springs. Upper right: Friday team: Nick Head, Jacqui van Hal, Meredith Mackay, Helen Braithwaite, Steve Harraway, Peter (Opuha Nurseries) and Dave (Larry Burrows was holding the camera).

2. Bendigo: competition and herbivory in dryland woody seedling establishment

We've just harvested and measured woody seedlings a year on from planting out in the Bendigo plots (see pictures below). *Kunzea ericoides* (kānuka), *Carmichaelia compacta* (Cromwell broom), and *Ozothamnus leptophyllus* (tauhinu) grew well in the enclosed, weeded plots. Few, if any, woody seedlings survived without fencing, without weeding, or without either. This spring (indeed this very week!) at the Bendigo experiment (and its sons and daughters, see 4. below) we're planting seedlings of kānuka and tauhinu (again – they're the easy ones) along with those *Olearia odorata* (scented tree daisy) and *Discaria toumatou* (matagouri) we've managed to coax into life (see seedling ecology, 3. below). We're also planning to start testing effects of potassium fertiliser on seedling drought tolerance at Bendigo this summer.

Katharina Schulz about to measure and harvest *Ozothamnus* (tauhinu) in an ungrazed, weeded plot at Bendigo in mid-September. Note the bright green, early-spring flush of sheeps sorrel, which was later hand-weeded out!



3. Ecology of dryland woody seedling germination and establishment

Poor understanding of the seed ecology of dryland native woody species is a big barrier for our research, and ultimately for developing low-intensity methods to encourage native woody species back into dryland landscapes. This summer, with the help of a student summer fellowship, we're kicking off a suite of experiments to better understand what controls the germination and early establishment of native woody plants in drylands. We plan to investigate dormancy, and to measure germination rates in response to environmental gradients (water, temperature, light), relating these to what happens at and below the soil surface seasonally. We also plan to study rates of root growth and maximum root length, to determine species' ability to access retreating soil moisture, and to learn how seedling shoot and root growth affects species survival in different litter depths.

4. Offspring of the Bendigo experiment: competition and herbivory in different dryland sites

The Bendigo experiment has multiplied. We've just set up two scaled-down replicas – at Tekapo Scientific Reserve and at Mt Barker, both in Canterbury.

Right: Experimental plots in evening light, Mt Barker.

Above: Setting up in a gusty norwester: Dean, Katharina and Adrian, and plots and competition trenches, at Tekapo Scientific Reserve.

At each site, we'll be measuring the growth of woody seedlings with and without competition (trenching, spraying and hand-weeding). Replication in different dryland environments will help us generalise and predict outcomes from extreme to relatively benign dryland sites, informing the general model we are working towards (and described in the last newsletter).

Below: Establishing the Mt Barker experiment in balmier weather: Kate, Adrian, Dean and Katharina lined up.

5: Can boosting fertility overcome thyme allelopathy?

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Thyme (*Thymus vulgaris)* dominates many of the driest sites in Central Otago. 'Monoterpenes' in its foliage give thyme its rich aromatic properties and deter herbivores. They can also inhibit seed germination, potentially obstructing establishment of native woody plants into thyme-dominated communities… *and* low-intensity restoration efforts. Rapidly growing plants often produce fewer secondary metabolites like monoterpenes, so adding fertiliser to boost growth rates could reduce the potency of inhibition. Coupled with seed addition, fertiliser might help with restoring native woody plants back into thyme-invaded systems. To test this, we've set up fertilised and unfertilised field plots on Flat Top Hill (see pic on p. 5). Next autumn, we'll collect thyme foliage and duff (litter), and study in the lab how it affects native shrub germination (we'll also note potential species for restoring thyme-dominated habitats). If results look promising, we'll then conduct a field trial, sowing seed and/or planting seedlings into fertilised and unfertilised plots.

Below: Dean, Katharina and Adrian setting up field plots for the thyme fertiliser experiment on Flat Top Hill

Also in Strand 1, we've just submitted a (very) multi-authored manuscript predicting potential distributions of woody species and succession pathways in seral woody communities across South Island drylands (see 'Which species where?' in Dryland Newsletter #4). The paper combines the Dryland Woody Species Distributions Database, preliminary analysis of the Dryland Woody Traits Database (see Dryland Newsletter #2 for descriptions of both) and environmental data. We await reviewers' verdicts…

Strand 2: Biodiversity of dryland woody communities

In this work, we are trying to understand the types of communities that could develop (with help from low-intensity management), and how they could enhance under-represented or regionally threatened dryland biodiversity. In 2005/06, we started work trialling sampling methodologies at Macraes Flat with DOC's GAOS programme, which we're continuing this summer (testing habitat effects on skink counts in ACOs). In 2006/07, we moved on to a field sampling programme. Vegetation sampling on Cambrian Hills & Cambrian stations this spring will complete collection of abundance data at three dryland sites for lizards, invertebrates, birds, rodents and vegetation. Each site comprises three 1-km-square 'megaplots' with smaller (10 × 10 m) grids, representing three stages across a woodiness gradient. We'll start analysis and write-up for publication this year, discovering what different plant communities contribute to the indigenous biodiversity of drylands. At the same time, we're collaborating with CDRP Project 1 (described in Newsletter #5) to pilot a future survey of lizards, birds and vegetation of woody and non-woody vegetation cover classes. We're also working with an Australian research group (AEDA; www.aeda.edu.au/) to develop a species–area approach to assessing biodiversity contributions of cover classes.

Strand 3: Community and agency awareness

Grant Norbury and others have been working strategically at three levels (central government agencies, territorial authorities, and community groups, trusts, and business) to raise public consciousness of dryland biodiversity protection needs, and to encourage and support protection and restoration initiatives. There are hints that awareness and activity are growing. For example, with help from Biofunds, biodiversity coordinators have been appointed to give more impetus and co-ordination among biodiversity protection initiatives in needy dryland districts – Masterton, Carterton and South Wairarapa share a coordinator, and Canterbury has another to help implement their new Biodiversity Strategy (with a special focus on working alongside district councils). Biodiversity was one of five key areas for sustainability in a draft Sustainability Strategy circulated for public comment in Central Otago District. Lizards are

proving great flagships for dryland conservation projects, as Alexandra Museum's sign and the cute Alexandra Blossom Festival float show (see left picture). Another example is the initiative led by Marieke Lettink to protect jewelled gecko habitat with the help of landowners in Canterbury.

Projects aligned to the IO

We've run out of space to describe (as promised last time) aligned Landcare Research projects: the dryland 'Multiple Pest Dynamics' project and a new project investigating ecosystem consequences of South Island high country land reform. We'll try next time!

DOC's 2004–2008 management trial in the GAOS (Grand and Otago Skink) recovery programme has yielded fascinating experimental results that will have a major influence on dryland conservation; in August, we took part in a peer review and future-planning session with the team and recovery group. It's worth checking out the talks about these and other projects from the recent drylands workshop in Dunedin (29 May) at www.landcareresearch.co.nz/research/research_pubs.asp?Research_Content_ID=235.

On the subject of Web stuff, last newsletter we highlighted the recently launched NZBRN portal (www.nzbrn.org.nz) for recording lizard sightings – which you all ignored!! NZBRN now has a grand 30,947 dryland data entries (but mainly for birds and plants!). Tony Jewell's just gorgeous photographic guide (right) is highly recommended for herpetological contributors.

People

Ellen Cieraad won an international PhD scholarship and has taken a break from the programme – happily, she'll be based at Lincoln and continuing to contribute to the IO! Congratulations Ellen, and thanks for all the work and brainpower you've put in. We'll sorely miss James Reardon who's moved to the Zoological Society of London after 4 years leading DOC's GAOS recovery programme. James put dryland biodiversity conservation firmly on the map, combining science, vision, and advocacy with great tenacity. And finally:

*****We are STILL looking for students to work with us on seed ecology!*****

We'd like to support one or more MSc (or PhD) students in this area in the next few years, contributing co-supervision, fees and resources. If you know of a keen and energetic ecology student looking for a challenge, please let us know! Adrian Monks would love to hear from you (monksa@landcareresearch.co.nz).

Thanks! First, thanks to all who attended and made a success of the May dryland workshop in Dunedin. Yet again we thank many DOC people for their help, this time especially Craig Wilson (Central Otago), Joy Comrie and Sally Jones (Twizel). Kennedy Lange, Dave Anderson, Nick Head, Nick Ledgard (Ensis) and Peter Keller (Opuha Nursery) made Ealing Springs happen, while most of Raukapuka Area Office laboured on it, along with Meredith Mackay (Landcare Research) and superb fencing and machine contractors. Thanks to Nick Ledgard (Ensis) also for his help with logistics and accommodation at Mt Barker, and many thanks to Katharina Schulz and Jens von dem Bussche for hard work in the field. For advice we thank Marieke Lettink, Nathan Whitmore (DOC), Catriona MacLeod (Landcare Research), and Yolanda van Heezik (Otago University).