

Dryland Intermediate Outcome Newsletter #10

May 2012

Hello everyone. Since our last newsletter in November 2010 a series of natural (earthquake, fire) and unnatural (restructurings) adversities has intervened and affected many (if not most) of us. The Dryland IO is still going strong, however, and here at last is an update from us.

We are nearing the end of our 8-year programme, with just 14 months to go. We want to highlight in this newsletter that **we are hoping to host a “New findings from drylands research” symposium at the upcoming New Zealand Ecological Society annual conference at Lincoln this November**. We plan this as a substantial symposium of recent, management-relevant findings from dryland biodiversity and invasive species research in two Landcare Research programmes (IMI¹ in drylands, and the Dryland IO²) and from our research partners and students. So we hope you will pencil the dates 26–29 November 2012 in your diaries now (and if necessary signal to your managers that you would like to be there!). We’ll provide more detail once we know whether our proposal to the convenors has been accepted.

As usual, this newsletter ranges across our three strands of work and highlights some of each: activities to raise community and agency awareness and get good decisions and implementation (Strand 3); discoveries about the biodiversity of dryland woody and grassy vegetation (Strand 2); and progress with our experiments (Strand 1). Though all our results aren’t in yet, we have been doing some early thinking about dryland indigenous biodiversity research priorities after the June 2013 ‘end’ of the Dryland IO research programme, taking into account what we have learned to date. We hope to discuss these ideas with many of you in person as the programme winds up next year.

Strand 3: Community and agency awareness

Many of our partners have been active in raising awareness and appreciation of wider biodiversity issues in dryland environments. For example, a ‘Drylands Place’ chapter has been drafted for the Otago conservation management strategy (CMS), which will go out for consultation in due course. In September 2011, the Otago Conservancy launched a major awareness programme ‘Project Gold’³ to raise the profile of this ‘iconic’ dryland tree (and with it, we hope, a host of other dryland biodiversity treasures). Tragically, Barry Lawrence died in December, as many of you will know. Barry had long been a vital force for dryland conservation in the Wakatipu basin, as well as a key champion of Project Gold. In some of his last days, Barry and Sue Maturin put together this marvellous video about the value of grey shrublands for falcon (& falcon-tucker; www.youtube.com/watch?v=1X_T7AZeBuU).

Using lizards as flagship species for achieving wider dryland conservation benefit is gaining traction. In Timaru, Hermann Frank is raising awareness of the importance of stone rows (right) on the Canterbury plains as residual lizard habitat, and bringing Fonterra’s attention to the ways that



¹ Invasive Mammal Impacts (http://www.landcareresearch.co.nz/research/programme.asp?Proj_Collab_ID=51)

² http://www.landcareresearch.co.nz/research/obi.asp?Proj_Collab_ID=28

³ <http://www.doc.govt.nz/getting-involved/partnerships-and-donations/regional-partnerships/project-gold/about-project-gold/>

dairy developments can work to minimise their impacts on these. Also thanks to Hermann's sterling efforts, Timaru District Council has approved a recommendation to turn a 23-ha gravel pit near Geraldine into a sanctuary for lizards⁴. And COET⁵'s Mokomoko Dryland Sanctuary near Alexandra goes from strength to strength, and has recently been on TV – again!⁶ COET received two major awards last year. It was the regional winner of the TrustPower Community Award for Heritage and Environment, and the Otago Conservation Award from the Department of Conservation.

SRARNZ⁷ has recently launched this wonderfully informative Lizards Conservation Toolkit for the conservation management of the lizards of New Zealand (right) to further help lizard-awareness and protection of their habitats. The Toolkit includes detailed information on the legislation in place for lizards and their habitats; surveying and monitoring methodologies; predator control, habitat management and translocation practices; funding options for the benefits of lizards; and a range of further resources (www.srarnz.org.nz/LizardToolkit.aspx)



Our researchers have continued to work to build understanding of some of conservation challenges and known solutions in dryland environments through talks, field tours, and other exchanges with NGOs, community groups, conservation boards, courts, commissions, councillors and agency staff. Grant's major focus has been on flagship species as a means of increasing awareness and appreciation of wider biodiversity issues in dryland environments, and Susan (pictured on a recent public field visit below) has been kept busy helping inform a stream of decision-making processes around species habitat protection the Mackenzie Basin that are being driven by current pressures for land development there.

Central Otago's first biodiversity forum (coordinated by Grant in November 2010), in partnership with the Central Otago District Council, the Department of Conservation, and the Central Otago Ecological Trust) resulted in a collation of talks circulated to all dryland councils. Last June a whole issue of Landcare Research's pest newsletter, Kararehe Kino, was devoted to dryland ecosystems, with 12 articles on dryland ecological research (www.landcareresearch.co.nz/publications/newsletters/possnews/kararehekino18.pdf). The OurFuture website coordinated by Landcare Research also posts articles on dryland research (www.ourfuture.net.nz/Collections/26). Our three talks at the International Congress for Conservation Biology in Auckland (December 2011) are also up on our web page.

This year, Grant is proposing to host workshops of dryland council biodiversity staff, to brainstorm and collate their collective wisdom and experience about what has worked and not worked to make a difference for dryland biodiversity on private land.



⁴ Described on <http://www.radionz.co.nz/national/programmes/afternoons/20110316>

⁵ Central Otago Ecological Trust (website www.coet.org.nz)

⁶ <http://tvnz.co.nz/national-news/locals-fight-save-endangered-skinks-video-4673752>

⁷ Society for research on amphibians and reptiles in New Zealand

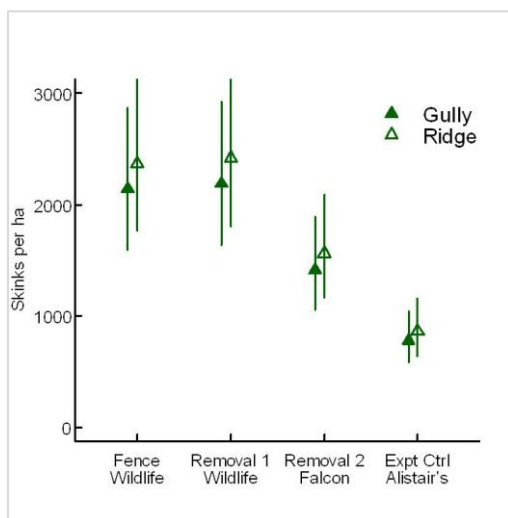
Strand 2: Biodiversity of dryland woody communities

Dryland plant, lizard, bird and invertebrate biodiversity across gradients of woodiness

Deb, Susan, Grant, Adrian and our Canadian research associate Andrew Tanentzap are making progress on papers reporting the results from our study of plants, birds, lizards and invertebrates across gradients of woodiness in Otago drylands.

Our analyses suggest ‘wood is good’ for indigenous plant, bird and invertebrate diversity at a range of spatial scales. For example, the overall woodiness of the wider landscape seems to be important for indigenous birds, but woodiness affects indigenous plants both locally and at landscape scales. Tall woody cover facilitated indigenous plant diversity at small (i.e. plot) scales, perhaps partly because woody canopies strongly suppress exotic grasses (exotic grasses emerge from our study as indigenous plant biodiversity enemy No.1). Woody communities also support more diverse suites of indigenous plants, birds and invertebrates grasslands at landscape scales. Notably, these species are complementary (i.e. indigenous taxa we did not find in grasslands). We’re very excited about these results!

Another interesting result is that ‘common’ dryland lizards (common and McCann’s skink, and common gecko) appeared not to care how woody the local vegetation was at our study sites. What seems to be most important for dryland lizards is that the vegetation is dominated by indigenous species. Taken together, our preliminary results suggest increases in secondary woody vegetation in dryland landscapes make an important positive and complementary contribution to dryland indigenous biodiversity, at least in central Otago. We’re working hard to get these papers submitted and presented as talks ASAP⁸.

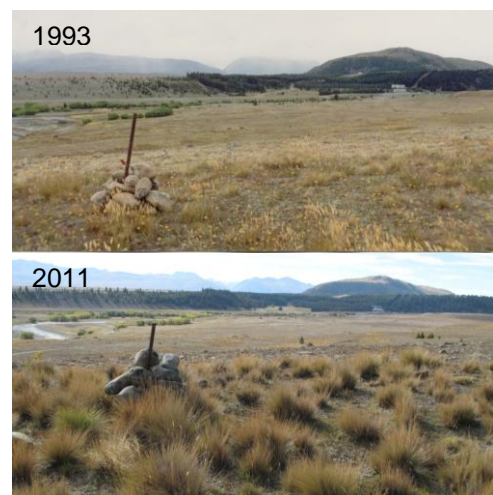


Common lizards respond to pest control

We are analysing skink density data from from mark-recapture monitoring in pitfall traps across a range of predator removal treatments at Macraes Flat. This work builds on our 2007 study based on Artificial Cover Objects. Deb Wilson’s preliminary density estimates (**left**) show estimated skink densities (number per hectare) decline markedly from the fully predator-fenced treatment at Wildlife (‘Fence’) to the ‘Expt Ctrl’ at Alistair’s Gully where no predator management was done. However, Deb notes that we have no density estimates from before predator control began, so we need to keep in mind that at least some of these differences could be due to habitat or other factors.

Life after hawkweed in the Mackenzie basin

Last January we partnered DOC in a resurvey of Lake Tekapo Scientific Reserve, establishing twelve extra plots to increase the power and reduce biases of the original monitoring design, and instigating additional sampling methods⁹. Susan presented some preliminary results of this re-measurement in her talk to the ‘Upper Waitaki Shared Vision Forum’ in January¹⁰. Indigenous



⁸ Susan has promised to ‘premiere’ these research findings at the Otago ‘Bot Soc’ meeting on 18 July 2012.

⁹ www.ourfuture.net.nz/Stories/149

¹⁰ available at www.ecologic.org.nz/?id=9 and on our webpage

dominance has increased markedly across the reserve's landforms since it was retired in 1992. Although mouse-ear hawkweed invasion has not been 'good' for indigenous plant biodiversity in drylands, both this work and our wider 'CDRP' study indicate that indigenous plants can survive severe hawkweed invasion, and have the potential to surprise even optimistic researchers with their recovery *if* given a break from grazing offtake, and time.

We have heard informally that the 'Shared Vision Forum' this week agreed to ask government for funding for a substantial area of new 'protective management' in the Basin. Of course the devil will be in the detail (and the proof in the pudding, to quote *Don Quixote*), but this agreement does signal a major step forward in across-the-board recognition of the significance of the dryland values there.

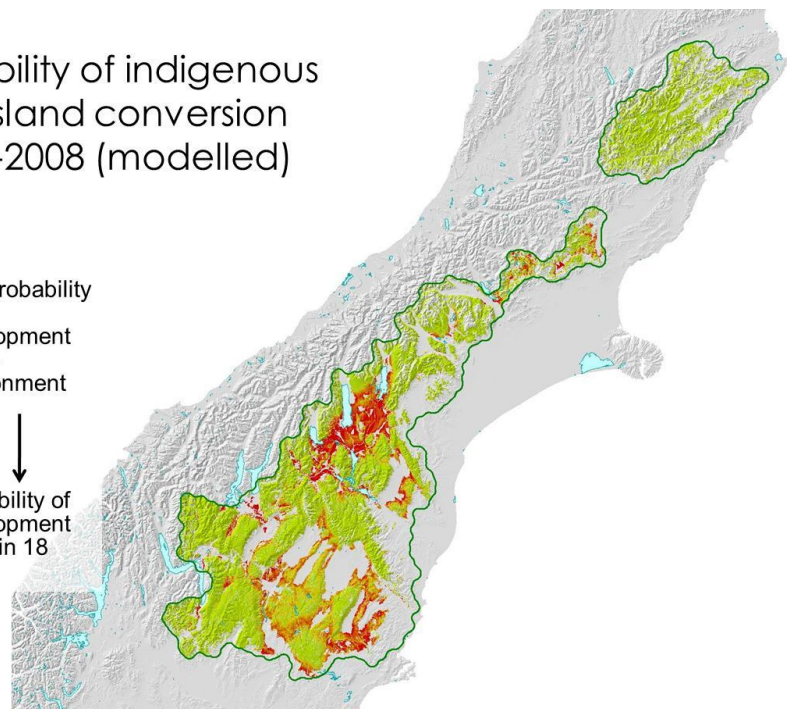
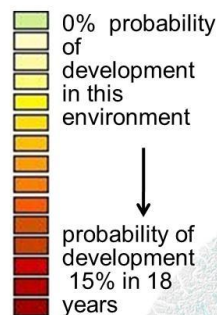
Vulnerability of dryland grasslands and shrublands to conversion

Emily Weeks' paper quantifying the loss of dryland grasslands to recent land-use change is in press in the *New Zealand Journal of Ecology*, and she is currently working with us to revise and finalise at least two other papers from her PhD thesis on recent indigenous grassland loss in eastern South Island¹¹.

Emily's study shows a marked increase in conversion of indigenous grasslands for agriculture in the last two decades, especially in the Mackenzie, Waitaki and Central Otago districts and in the most threatened environments. Her study confirms that most vulnerable grasslands continue to be poorly protected, and shows increased disparity between patterns of protection and patterns of conversion.

Her spatial models of recent conversion (shown **right**) provide clear steer for DOC, LINZ, and councils that the urgent priorities for protection in South Island grasslands lie in the drylands – especially on the Mackenzie Basin floor and the lower fringing range slopes of Central Otago.

Probability of indigenous grassland conversion 1990-2008 (modelled)



Strand 1: Succession to native woody communities

The importance of shelter, and life after woody weeds

Larry Burrows' and others' work with DOC at Ealing Springs clearly shows how desiccation and competition interact to cause dryland woody seedling mortality. Many native woody

¹¹ Emily's summary of her work to the International Congress for Conservation Biology in Auckland in December 2011 is available with the other newish talks on our web page. Click the 'OBI DOCUMENTS' tab at upper right on the page www.landcareresearch.co.nz/research/obi.asp?Proj_Collab_ID=28

seedlings have hung in within our untouched standing broom ‘control’ treatments, but they have ‘died like flies’ in plots that were first crushed, root raked, sprayed, and mulched. Much of the seedling death occurred after exotic grasses ‘took off’ in the year after disturbance treatments were applied. Most recently, broom has made a huge resurgence in the disturbed plots, no doubt helped by the relatively wet summer in Canterbury: plots that were bare 3 years ago – and then grew lush grass – are now 2 m deep in broom.

Overall, the Ealing Springs experiment provides convincing evidence that bowling and mulching ugly woody weed patches with blokey machines is exactly the wrong thing to do! It looks like the key to turning dryland woody weed patches into secondary indigenous forest is to introduce propagules within the canopy to gradually overtop the weeds.

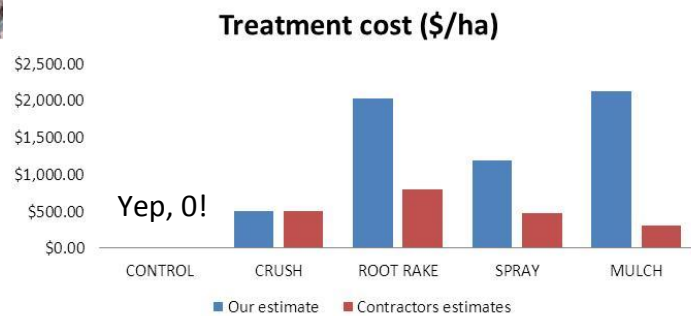
The big experiment at Ealing Springs is now almost over, bar the last two plots, some final plot measurements Larry wants to make (soil moisture, light, RECCE plot remeasures), and the write up. Larry and another nine or ten people have just put in a major effort



measuring and harvesting seedlings – in a great spell of balmy autumn weather for a change!

Left: Leave broom alone! Scenes from Ealing Springs. Clockwise from left: seed grids under an intact broom canopy, Elise Arnst searching for surviving seedlings in a post-clearance grass sward, and ribbonwood and *Coprosma* seedlings under intact broom.

We thought some of you might be also be interested in the cost estimates Larry put together (exclusive of seeds, seedlings and planting) for the different treatments (**right**)



A ‘goldilocks zone’ for dryland woody plant establishment?

Adrian Monks is currently awash with data from our various experiments. Fortunately he’s a great swimmer! First off the blocks is our ‘sward’ experiment (set up in 2006) that manipulated herbivory and fertility at 21 sites along a moisture gradient in the eastern South Island. While primarily designed to look at the longer term effects of the treatments on grass swards, in the spring of 2010 we also planted 3 species of woody seedlings (*Kunzea ericoides*, *Olearia odorata* and *Ozothamnus leptophyllus*) into these plots and followed their growth and survival through a growing season.

The experiment helps us understand how rainfall and nutrient gradients interact with grass swards and herbivory to affect seedling establishment. Causal mechanisms behind the effects of the physical environment on seedling survival are complex, with factors such as

rainfall being able to influence seedlings directly through drought, and indirectly through its effect on grass biomass and competition for light.

Adrian has been using a geeky method called ‘structural equation modelling’ to help us understand these pathways and their relative contributions to seedling survival. His preliminary results suggest a massive decline in woody seedling survival at sites that had low spring to early summer rainfall in 2010. (Remember the 2010 drought? And its opposite in 2011?) Effects of herbivory and competition with grasses (i.e. high grass biomass) on survival were also negative, but much smaller. Because high rainfall, low levels of herbivory, and higher fertility are key factors promoting grass biomass (i.e. competition), good woody seedling establishment seems to require a goldilocks middle ground of not too much or too little of anything!

The overwhelming effect of moisture on woody seedling survival gives added weight to our experiments designed to look at the role of shelter in seedling establishment. This month we will do the final harvest of an experiment designed to identify the mechanisms by which shelter affects seedling survival and growth in drylands, and another one testing whether coarse woody debris (in this case cut pine saplings) is effective in promoting seedling establishment. We look forward to the completing the data gathering phase in both these experiments and writing them up in the coming year.

Soils experiment findings published

A paper from the soils experiment has been published in the international journal *Plant and Soil*¹². “Higher relative performance at low soil nitrogen and moisture predicts field distribution of nitrogen-fixing plants” describes how soil nitrogen and moisture are key factors determining the relative success of N-fixing and non N-fixing species in drylands. Nitrogen-fixers (‘Nfixers’: native and exotic broom, gorse, matagouri, tree lupin, and kowhai) tend to outperform ‘non-Nfixers’ when both soil N and moisture levels are low. The result holds both experimentally (in the glasshouse) and in the field. This result is relevant to the choice of species for active woody restoration, and expectations of the outcomes of ‘passive’ restoration.

Many thanks!

We have had wonderful field and lab student and casual helpers again over this summer and last: thank you Aimee Pritchard, Alex Fergus, Alex Ghaemaghamy, Annike Korsten, Diego Uruitia Guevara, Maia Mistral, Max Crowe, Miriam Pieper, Nick Secker, Sarah Fisher, and Simon Shepherd. Many thanks also to Tim Boehnert (from Germany) and three Dutch interns temporarily domiciled in Alexandra – Wout Egging, Sohie Nietzel, and Michiel van Den Munckhof – for their willing hands. Alan Colligan again helped out with lots of data entry. Thanks again to Ben Todhunter of Cleardale Station for access and wilding pine Christmas trees for the shelter experiment – when Larry asked about getting another 30 wildings, Ben suggested we ‘take the lot...’. We have had lots of help from Joy Comrie, Chris Woolmore and Nick Head (DOC), with Mackenzie Basin field work and awareness-raising trips.

Upcoming events: 26–29 November NZ Ecological Society annual conference at Lincoln (with a Dryland symposium, we hope). Grant will also be hosting workshops directed at fostering greater awareness and conservation of drylands in the coming financial year.

¹² Adrian Monks, Ellen Cieraad, Larry Burrows and Susan Walker 2012. Higher relative performance at low soil nitrogen and moisture predicts field distribution of nitrogen-fixing plants. Available as 'Online First' on: <http://www.springerlink.com/openurl.asp?genre=article&id=doi:10.1007/s11104-012-1170-2>
If you have any trouble with this link, let us know and we'll send you a copy!