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NCCARF
National Climate Change Adaptation Research Facility
Adaptation Research Network TERRESTRIAL BIODIVERSITY

Terrestrial Research E-bulletin

Convener's Update

Update from Co-convenor Steve Williams on the IUCN climate change taskforce.

In December 2011 the IUCN established a climate change task force co-chaired by Dr James Watson and Prof Stephen Williams.

The key goals of this taskforce is to design strategies to help the Species Survival Commission (SSC) respond to climate change impacts; establish a global network of people and organisations to facilitate communication and knowledge sharing and develop a IUCN Best practice on Species Vulnerability Assessment and Adaptation.

The major challenge for this group will be to ensure co-ordination of climate change responses across a large and diverse global stakeholder community in the IUCN Species Survival commission (SSC), SSC Specialist Groups, SSC Partner Organisations and other program areas.

This taskforce is directly building on the work done within our network here in Australia and taking it to a global community. There are literally thousands of scientists, managers, policy-makers and conservation groups across the globe wanting to learn from what we have achieved in NCCARF in Australia.

To find out more about this go to: http://www.iucn.org/about/work/programmes/species/who_we_are/ssc_specialist_groups_and_red_list_authorities_directory/task_forces/

When the taskforce network has been established more information will be sent out to our network inviting people to join in this global initiative.

In this issue we also continue to review the Terrestrial Biodiversity NARP funded projects and provide a summary of 4 of these projects which are now underway. The final NARP funded project summaries will be in the next TRE-Bulletin in July.

We hope that you enjoy this issue, and please do not forget to contact us with ideas or submissions for articles for the TRE-Bulletin this year.

Steve Williams & Lesley Hughes

In this issue:

Meet the Steering Committee

Dr Colin Yates

Colin is a Principal Research Scientist with the Department of Environment and Conservation (DEC) in Western Australia.

He is primarily interested in the ecology and evolution of south-west Western Australia's plant diversity and using this knowledge to develop science based conservation strategies.

Colin has published widely on the conservation and management of south-western Australian biodiversity, including eucalypt woodland restoration, conserving threatened species and the impacts of landscape fragmentation, fire and climate change on biodiversity in the region.

NARP FUNDING

In 2011, funding outcomes were announced with respect to $4.2million for Climate Change Adaptation Reseach Grants. Applicants were asked to specifically address the National Adaptation Research Priorities (NARP's), as identified in NARP's for each NCCARF Network. Approximately $2million of this money was awarded to Terrestrial Biodiversity NARP research. In this issue, we present summaries of four more successful projects.

Management strategies to combat coextinction rates of plant-dwelling insects through global climate change

Melinda Moir, University of Melbourne; in collaboration with Peter Vesk, Mick McCarthy (Uni Melb.), Lesley Hughes (Macquarie Uni), David Coates, Karl Brennan (WA DEC) and David Keith (NSW National Parks & Wildlife)

Coextinction is the loss of a dependent species (e.g., insect herbivores that depend on plants) through the extinction or reduction in the population size of its host species. Approximately 30-40% of the earth's terrestrial biodiversity are dependent species, with many identified as essential for ecosystem function through services such as pollination. It is therefore surprising that loss of these dependent species through the process of coextinction has only been recognized relatively recently. Climate change will further exasperate the threat from coextinction as many hosts, particularly plant species, are at risk of extinction or range reduction through a drying climate. Our research aims to develop conservation strategies for identifying which plant-dwelling insects are at greatest risk of coextinction induced by climate change, and identify which management actions will be most cost-effective at reducing impacts.

We will achieve this by utilizing a large dataset of plants and insects (>26,000 insect individuals collected from 104 plant species) from an altitudinal gradient within the biodiversity hotspot of south-west Australia, as well as collecting environmental data along this gradient. Not only does the south-west contain one of the highest plant diversities in Australia, but it is predicted to be the most affected region in Australia from climate change, with rainfall decreasing by as much as 60% by the year 2070. From this dataset we will identify which insect species are at risk of climate-induced coextinction and subsequently attempt to develop general indicators of the degree to which insect species might be prone to climate change-induced coextinction across Australia. To combat climate change induced coextinction, we will identify the most cost-effective range of conservation strategies in consultation with our partner land managers and other stake-holders. Such strategies include reintroducing insects onto more populations of their host plant and trialling such insects on alternative host plant species. Ultimately we will construct a Climate Change Adaptation Decision framework, which we will test on the ground with several key insect species. Finally we will provide recommendations for revising Australian and State Government restoration and translocation policies which explicitly consider coextinction and projected climate change scenarios.

***Acizzia veski* or Vesk's plant-louse (3.5 mm long), the first insect to be conservation listed due to the threat of coextinction (WA State Government). (©Melinda Moir).**

To read the NARP for Terrestrial Biodiversity, please visit: http://www.nccarf.edu.au/national-adaptation-research-plan-terrestrial-biodiversity

To read more about the successful NARP funded projects, please visit: http://nccarf.jcu.edu.au/terrestrialbiodiversity/index.php/General/narp-funding.html

Determining high risk vegetation communities and plant species in relation to climate change in the Australian alpine region

Catherine Pickering, Griffith University, Queensland

The Australian Alps are one of the three most at risk ecosystems in Australia from climate change. The alpine areas within the mountains are particularly at risk due to the absence of high altitude refuges found in some other alpine regions of the world. With many endemic plants and some animals restricted to areas with long lasting snow, they are directly threatened by declining snow cover in winter and warmer summers. Unfortunately the climate is already changing with snow cover already 30% less than it was in the 1950's. As a result, rare short alpine herbfield and snowbank feldmark plant communities associated with areas with late lying snow have already started to be invaded by taller, more competitive species.

The main adaptation strategies by park agencies in the region revolve around increasing resilience by reducing threats from fire, grazing from livestock and feral animals, weeds and better management of winter and summer tourism. To assist in prioritising adaptation strategies for these threats, we are assessing their relative importance the potential success of proposed strategies to ameliorate their impacts. We are doing this by assessing the response of alpine vegetation to different stressors using existing long term datasets in combination with new data we are collecting on the functional traits of the plants. We have collected functional trait data for over 200 alpine, subalpine and invasive plants from the region including height, leaf area, leaf dry weight, specific leaf area, start and duration of flowering and lateral spread data.

This trait data will be used to identify those species better adapted to environments characterised by less snow cover (less stress), more invading subalpine and weed species (increased competition), and more frequent fires, trampling by tourists and grazing (more disturbance). That is, it will allow us to assign high, moderate and low risk values to specific species. By then performing a functional trait analysis on datasets already available to us on the response of species and communities to climate variables, fire, grazing, weeds, and tourism, we will also be able to compare the relative severity of different threats with and without adaptation, and hence identify which adaptation strategies should be prioritised by protected area agencies in the region. If successful, the approach taken could be applied to other ecosystems threatened by climate change to evaluate different stressors and adaptation strategies.

Climate resilient revegetation of multi-use landscapes: exploiting genetic variability of widespread species

Margaret Byrne, WA Department of Environment and Conservation; in collaboration with Suzanne Prober (CSIRO), Will Stock (Edith Cowan University), Brad Potts, Rene Vaillancourt, Dot Steane (University of Tasmania)

Our research investigates ways of improving the resilience of restored ecosystems to changing climate. Restoration of fragmented and degraded landscapes requires significant investment of resources and revegetation projects have traditionally aimed to use seeds that were sourced locally to the area in which they will be planted. However, much of southern Australia is predicted to become hotter and drier, and what this means for restoration efforts and for management of existing vegetation is still unclear.

We will examine adaptation to climate in several widespread species of Australia's dominant eucalypts to determine whether populations are adapted the climatic conditions of the site or have the genetic flexibility to adapt to changing climatic conditions. If they are adapted to the site conditions then revegetation should include seed from populations that are adapted to more arid conditions. If they have genetic flexibility then local seed sources will have the capacity for adapted genotypes to be selected when conditions change.

Establishing a plot in a *Eucalyptus loxophleba* ssp. *lissophloia* woodland.

Our research will be done on populations of York Gum (*Eucalyptus loxophleba*) in south west Australia, and Red Ironbark (*E. tricarpa*) in the south east. We will compare populations of these species along gradients of temperature and rainfall, and determine differences in genetic markers, and in physical traits that effect how plants cope with heat and drought, such as leaf size and shape. This will show whether the populations are each adapted to their specific climate, or whether they can adjust to a wider range of climates. The results will provide the basis for a framework to guide sourcing of plant propagules for revegetation in a changing climate, to ensure the long term success of investments in ecological restoration.

The results of the project will be available on the website of the partner organisations and will be disseminated through information sheets and guidelines with the assistance of our industry partners in our End-user Reference Group. We will publish the work in scientific publications to provide validation of the outcomes through peer review by the scientific community.

The role of refugia in ecosystem resilience and maintenance of terrestrial biodiversity in the face of global climate change

Stephen Williams, James Cook University.

During periods of past climate change, species have persisted despite inhospitable environments by retracting into pockets of suitable habitat. These pockets tend to have greater stability of climate compared to the surrounding areas and when surrounding conditions have improved, species have been able to move out and recolonise areas that were less stable.

Cool, climatically stable regions of forest can provide a refuge for species under rapid climate change.

These habitat pockets have provided refuge for species during periods of rapid and inhospitable change and were therefore critical for species long term survival. It is likely that many species will require similar refuges to persist during current and future climate change. Therefore, identifying and protecting such habitat pockets is important for species conservation into the future.

Our project will identify areas throughout Australia that have the best refugial potential in the face of future climate change. As a part of this process, we will identify areas that are predicted to be hotspots for biodiversity into the future, accounting for species dispersal abilities. We have begun this process by meeting with all the investigators on this project to review and assess the spectrum of definitions of refugia, and methods of identifying refugia. This enabled us to consolidate the project directions and methodology.

The project will now go on to examine:

- Environmental stability across Australia, for both past and future.
- Biodiversity hotspots using species distribution models.
- Refugial potential of areas using compositional turnover modeling.
- The existing potential of species to adapt by examining adaptive traits of individuals in populations that are peripheral to their core habitat.
- The impacts of extreme climatic events.

This project will also involve detailed regional case studies, in addition to the Australia-wide analyses. The regional case studies will be at fine-scale resolution so that micro-refugia can be identified. The findings of this study will be communicated through detailed reports and peer-reviewed papers, making them widely accessible.

Conference Update

NCCARF National Adaptation Conference. Melbourne, Australia, 26-28 June 2012. http://www.nccarf.edu.au/conference2012/

Society for Conservation Biology: Oceania 2012. Darwin, Australia, 21-23 September 2012. **Abstracts due 30 April 2012.** http://www.oscb2012.org/

8th International Conference on Global Climate. Dublin, Ireland. 6-10th August. http://www.icuc8.org/

About the Adaptation Research Network for Terrestrial Biodiversity

The Adaptation Research Network for Terrestrial Biodiversity is one of eight Research Networks administered by the National Climate Change Adaptation Research Facility - www.nccarf.edu.au.

It is hosted by James Cook University in Townsville.

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To subscribe to our Network - http://nccarf.jcu.edu.au/terrestrialbiodiversity/index.php/register

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TB Network Partners