National Environmental Research Program

Modelling and prioritising options for Matters of National Environmental Significance

The Environmental Decision Hub is undertaking a study to identify conservation priorities in the Lower Hunter Region and to help understand impacts of urban expansion on biodiversity.

This independent research is contributing to the regional sustainability planning for the Lower Hunter, jointly undertaken by the Australian Government and the Government of NSW. The research was funded by the Australian Government through the Sustainable Regional Development Program and National Environmental Research Program (NERP), which supports science that informs environmental policy and decision making.

Preliminary Research Outcomes

- **A decision support tool to assess and quantify the potential impacts of development on biodiversity in the Lower Hunter Region.**
- **Detailed conservation priority maps created using state-of-the-art tools and based on a wide range of biodiversity features.**
- **Preliminary results indicate that a significant number of protected species occur outside protected areas and are vulnerable to future development.**
- **The value of the formal conservation reserve network could be markedly increased with relatively small, targeted expansions to incorporate habitat for some poorly represented species.**

1. What are we doing?

The aim of the project is to identify the impacts and ecological trade-offs of planned and proposed urban development scenarios. We map the habitat suitability of a wide array of '*Matters of National Environmental Significance*' (MNES) and other protected species and identify areas of high conservation priority in the Lower Hunter Region.

We use state-of-the-art tools to identify the impacts of development scenarios to biodiversity, optimise areas for developments and offsetting and evaluate the long-term persistence of species of conservation concern. Our work provides a better understanding of what drives different biodiversity outcomes, and how ecological and economic trade-offs can be optimised to achieve required outcomes for Matters of National Environmental Significance and sustainable development in the Lower Hunter.

2. Why are we doing this study?

The approach used in this work ensures that the best data and science is available to inform the Lower Hunter Valley Regional Growth Plan, Regional Conservation Plan and Strategic Assessment, which are being undertaken by the NSW and Australian Governments.

The results will also assist the development of other strategic approaches to environmental impact assessment under the *Environment Protection and Biodiversity Conservation Act 1999*, as well as improve scenario-modelling tools to support future strategic assessments and regional sustainability plans.

National Environmental Research Program

3. How did we collect the data/information?

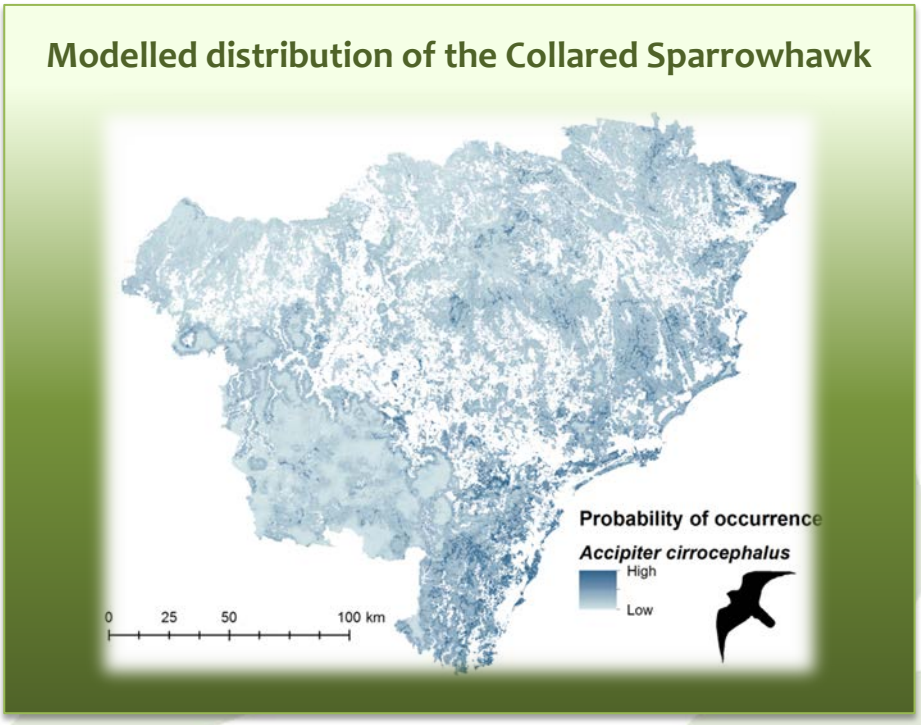
Occurrence records for all protected species in the Hunter Valley were downloaded from the Atlas of Living Australia and BioNet databases. We combined these data with ecologically relevant environmental variables, including climate, topography, vegetation and soils data, to produce a distribution model for each species. Species distributions were modelled at a 100-metre resolution across the entire Greater Hunter Region using the state-of-the-art software, MaxEnt.

Conservation priorities within the Lower Hunter Region were identified using the scientific software, Zonation. Zonation produces a spatial ranking of areas across a given landscape using information on species presences, habitat quality, connectivity and costs. Using the software, we identified high priority areas for biodiversity that best complement the existing protected area network.

Priority sites were then compared to a potential development scenario including some of the zoned and proposed urban expansion areas in the Lower Hunter Region to understand where conflicts between development and high priority areas for biodiversity are likely to occur. Finally, we quantified the potential losses to biodiversity assuming that all zoned and proposed urban expansion areas were indeed developed, measuring the losses in terms of proportions of species current distributions that would be lost if the development took place. Preliminary results are based on all species having equal importance in the analyses.

4. What have we found so far?

- In the Greater Hunter Region, records suggest there are 793 protected species of birds, mammals, reptiles, amphibians, arthropods and plants.



An example output - a species distribution model showing the modelled occurrence of the collared sparrowhawk in the Greater Hunter, with darker regions indicating areas where they are more likely to occur. Similar maps are available for 597 species in the Greater Hunter Region.

National Environmental Research Program

5. What have we found so far?

- Of the 793 protected species occurring in the Greater Hunter Region, there are 46 species listed as Matters of National Environmental Significance under the *Environment Protection and Biodiversity Conservation Act 1999*.
- We had sufficient data to model the likely distribution of 597 of these species across the Greater Hunter Region (see figure). These modelled distributions, as well as occurrence records for the remaining 196 species with little data, were used to identify priority areas for biodiversity conservation within the Lower Hunter.
- Comparison of species occurrences and the current protected areas showed that a significant number of species are currently without any protection in the Lower Hunter Region.
- We created a conservation priority map of biodiversity for the Lower Hunter Region and identified areas that would best complement existing protected areas. Protection of these sites would significantly increase the representativeness of the protected area network in the Lower Hunter Region.
- We evaluated a potential development scenario where approximately 9% of the remnant native vegetation would be cleared if the selected set of currently zoned and proposed urban expansion areas were fully developed. Clearing of these areas would cause on average a 14.3% reduction in species' current distributions. The impacts would vary substantially between species; some species would be affected only to minor extent, while others would lose all their known occurrences within the Lower Hunter Region.
- The majority of the top priority areas for biodiversity currently lie outside the potential urban expansion area. However, there are significant conflicts within certain expansion areas, where development actions would inevitably threaten the existence of species within the Lower Hunter Region. These conflicts were identified both on already zoned as well as on proposed development areas. If negative impacts are to be avoided, alternative development schemes should be considered on these areas.

6. Where to from here?

Over the coming months, we will finalise the modelling of biodiversity patterns to identify priority areas for conservation within the region. We will also continue to assess the potential impacts of a range of urban expansion scenarios and look at options for identifying potential offset strategies that could mitigate impacts of development. Increasing our understanding of suitable offsetting options and using coherent approaches that account for factors such as threats will be essential for effective mitigation.

Future work within the project will also include consideration of species-specific connectivity needs, as well as evaluating the likely long-term persistence of a subset of key species under different development scenarios.

The research will inform the Lower Hunter Regional Strategic Assessment and the final reports will be available in 2014.

National Environmental Research Program

7. Who are the researchers involved?

Dr Amy Whitehead

(University of Melbourne) is a Research Fellow in the Quantitative and Applied Ecology Group. She is an ecological modeller with interests in conservation planning and management across a wide range of taxa and ecosystems. Amy has developed the species distribution models for this research.

Dr Heini Kujala

(University of Melbourne) is a Research Fellow in the Quantitative and Applied Ecology Group. She has worked closely with spatial conservation tools to answer research questions from protected area effectiveness and resource optimisation to conservation resilience building under climate change. Heini has produced the spatial prioritisation for this work and assessed the development impacts.

Where can I find out more?

Dr Amy Whitehead	☎ 03 9035 6210	amy.whitehead@unimelb.edu.au
Dr Heini Kujala	☎ 03 8344 5422	heini.kujala@unimelb.edu.au

Further Reading:

Gordon A, Simondson D, White M, Moilanen A & Bekessy SA (2009) Integrating conservation planning and landuse planning in urban landscapes, *Landscape and Urban Planning*, 91(4): 183–194. www.sciencedirect.com/science/article/pii/S0169204609000024

Merow C, Smith MJ & Silander JA (2013) A practical guide to MaxEnt for modeling species' distributions: what it does, and why inputs and settings matter, *Ecography*, 36: 1058-1069. http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0587.2013.07872.x/abstract

About the NERP Environmental Decisions Hub

The Environmental Decisions Hub undertakes multi-disciplinary research on terrestrial biodiversity in a wide range of environments to assist government agencies to protect and restore Australia's biodiversity. The research includes new tools, data, models and authoritative syntheses that enable Australian governments to make evidence-based decisions that protect biodiversity.

The multi-disciplinary research collaboration is one of five national research hubs funded to study biodiversity conservation by the National Environmental Research Program (NERP) for four years (2011-2014).

www.nerpdecisions.edu.au

NERP Environmental Decisions Hub

Published October 2013