Australian Government
Department of the Environment, Water, Heritage and the Arts

Marine and Tropical Sciences Research Facility Milestone Report, December 2009

Program 2: **Status and trends of species and ecosystems in the Wet Tropics rainforests**

Project 1.2.1(b): Biodiversity monitoring for climate change

Project Leader: **Associate Professor Steve Williams, James Cook University (JCU)**

Summary

In this report, we provide current species distribution maps for rainforest fauna and maps of spatial patterns of biodiversity to the e-Atlas (MTSRF Project 1.1.5) and the Wet Tropics Management Authority.

We completed a case study testing the ability of species distribution models calibrated in the Wet Tropics to predict suitable environments further north on Cape York Peninsula. We found a moderate level of transferability for most models generated for test species, and that simple models (in terms of the number of parameters and complexity of functions) are generally more transferable than complex models. The result supports the idea that species distribution models have the capacity to provide meaningful predictions of species distributions under future climate change scenarios.

We used predictive impact modelling of climate change on rainforest fauna to model the distributions of 202 rainforest vertebrates and project these onto climate surfaces representing seven global climate models.

We reported on current results on physiological tolerances of microhylid frogs and arboreal mammals and document early maximum, minimum and preferred temperatures of microhylids, as well as other physiological parameters, that play a role in determining distribution. We found a pattern of response to high ambient temperature in arboreal mammals that is rapid and linear, meaning these species will be significantly impacted by climate change (increasing temperatures).

Project Results

Description of the results achieved for this milestone

The Centre for Tropical Biology and Climate Change, based at James Cook University, has continued biodiversity monitoring across altitudinal and latitudinal gradients within the Wet Tropics during the reporting period between December 2008 and December 2009.

Three separate rounds of sampling occurred during 2008 using the same standardised survey techniques employed over the past four years. Around 700 surveys were conducted during 2007; yielding over 13,000 individual records of species across 170 sites (see Table 1).

Table 1: Number of samples conducted and individuals located in 2009.

Survey Type	Surveys	Individuals
Bird	300	12,100
Reptile	15	160
Spotlight	70	620
Microhylid Frog	380	560

Monitoring was continued at sites located in the Spec, Atherton, Carbine and Windsor Uplands during the reporting period. Additionally, biodiversity and microclimate monitoring was expanded to include four high-elevation sites in the Lamb Range. The monitoring of these sites ensures a more complete evaluation of biodiversity within the entire climatic envelope of the Wet Tropics.

The data collected will be used to further develop species distribution models for all vertebrates within the Wet Tropics under current and a range of predicted future climatic scenarios. These models will be used to assess the biodiversity values of the Wet Tropics and how they might change in the future due to climate change.

Table 2: Number of samples conducted and individuals located in 2009.

Site Name	Easting	Northing	Site Name	Easting	Northing
LU11A0	353290	8109829	LU7B0	354432	8106598
LU11A1	353044	8109706	LU7B1	354314	8106267
LU11A2	353206	8109788	LU7B2	354381	8106419
LU11A3	353290	8109829	LU7B3	354432	8106598
LU11A4	353512	8109969	LU7B4	354501	8106790
LU11A5	353599	8110135	LU7B5	354491	8106935
LU11A6	353523	8110235	LU7B6	354310	8106996
LU7A0	354194	8106615	LU9A0	352136	8108757
LU7A1	354202	8106214	LU9A1	352301	8108459
LU7A2	354220	8106434	LU9A2	352302	8108598
LU7A3	354194	8106615	LU9A3	352136	8108757
LU7A4	354210	8106826	LU9A4	352304	8108817
LU7A5	354812	8107039	LU9A5	352123	8108919
LU7A6	354052	8107166	LU9A6	352224	8109015

The ongoing monthly monitoring of microclimate, NPP, and invertebrate data has been completed for most sites; it is, however, still in progress for four sites on Mt Bellenden-Ker. Microclimate data loggers remain in place at all sites, however, they are no longer monitored on a monthly basis. Data loggers will remain in place and collecting data, receiving opportunistic maintenance, until they cease to function.

A process which has already begun, and will continue through this latent phase of data collection, is the summary of the microclimate data. All data has been collated into one online database to facilitate its use among other MTSRF-funded projects. Provision of data to the e-Atlas will also be facilitated by this database. Finally, all microclimate data are currently being summarised to produce spatial surfaces of soil moisture, leaf wetness, relative humidity, and temperature for the entire Wet Tropics World Heritage Area, to be provided upon project completion.

Extension to coverage of formal sampling of rainforest birds – north to Cape York Peninsula (far North Queensland) and south to Eungella (mid-east Queensland)

Alex Anderson and Luke Shoo

Summary

We extended a substantial baseline dataset on rainforest bird diversity and abundance collected in the Australian Wet Tropics World Heritage Area to include almost the full altitudinal and latitudinal gradient of rainforests in north-eastern Australia. In eight separate expeditions, sites where surveyed using the same methodology from sea level to the highest peaks on Cape York in the McIlwraith and Iron Ranges, and in central eastern Queensland at the Clarke and Conway Ranges.

A total of 274 surveys were added to the database; 4,483 individual records of 163 species. Preliminary analyses of the data from extension of surveys to Cape York Peninsula and central eastern Queensland indicate that surveying has been sufficient to capture a snapshot of the patterns of diversity and abundance of the rainforest bird fauna across the altitudinal gradient of both regions. These will be combined with data from the Wet Tropics in future analyses to clarify our understanding of the influence of climate on rainforest bird community structure. In particular, these data will be used to improve our ability to predict the potential impacts of future climate change on these ecosystems.

Objectives

By extending the coverage of standardised bird surveys into rainforests in central eastern and Cape York Peninsula we will be collecting data on patterns of bird diversity and abundance from forests in climate envelopes not represented within the Wet Tropics. By understanding the impacts of the warmer and more seasonal climate of Cape York and the cooler, more stable climate in central eastern Queensland on patterns of bird abundance and diversity, we aim to expand our understanding of the role of climate as a driver of patterns of diversity and abundance in rainforest birds in general. In particular, an understanding of the role of climate in driving patterns of species distribution will be crucial in predicting and managing the impacts of future climate change due to global warming.

Methods

To extend our coverage, we established survey sites in rainforest at (a) 200 metre intervals across the altitudinal gradient in central eastern Queensland in the Clarke and Conway Ranges, (b) near Eungella, from 100-1,200m above sea level, and (c) on Cape York Peninsula at the McIlwraith and Iron Ranges near Coen, from 50-800m above sea level. At each site between four and six survey points were laid out along a 1km transect in primary rainforest. Each of these survey points was then surveyed a minimum of four times between April 2007 and May 2009, using the same methodology as that used to accumulate the baseline data set from the Wet Tropics.

Results

Central Eastern Queensland

Four expeditions have been undertaken to the south of the Wet Tropics targeting isolated blocks of rainforest in the vicinity Eungella (inland from Mackay) and Conway Range (approximately thirty kilometres east of Proserpine). We aimed to maximise environmental coverage of bird surveys by sampling across elevational gradients. Conway Range sites consist of a collection of lowland locations (~100-200m elevation). In the Eungella region, representative survey locations span the entire elevational gradient from 200-1,200m elevation. Conway Range sites were visited May 2008, July 2008 and July 2009. Eungella sites were visited during May 2007, June 2008, December 2008 and September 2009. In total, thirteen standardised bird surveys have been conducted at ten unique locations in Conway Range and 87 standardised bird surveys completed at 32 unique locations across the Eungella gradient.

During these expeditions, 1,248 records of 64 species were gathered. Highlights included substantial records of the endemic Eungella Honeyeater *Lichenstomus eungellensis*, found nowhere else, and of potential conservation significance due to threats from global warming. A year of detailed temperature and humidity data was also recorded at two-hourly intervals using Thermochron data loggers installed at the survey sites. Two repeat measures were also made of the circumferences of fifteen monitored trees at each site for the calculation of changes in basal area as an index of carbon sequestration.

Cape York Peninsula

Equivalent expeditions were undertaken to the McIlwraith and Iron Ranges on Cape York Peninsula in late July 2007, late April 2008, late November 2008 and mid-May 2009. Survey locations were concentrated in the lowlands at Iron Range (~100m elevation) but spanned an elevational gradient from near sea level to a summit elevation of 816m in the McIlwraith Range. Surveys in the McIlwraith Range covered the coastal lowlands of Silver Plains, the eastern foothills in the vicinity of Rocky River, and a western approach along Leo Creek Mine Track, extending from the Peninsula Development Road to Leo Creek itself and the summit of the range. In total, seventy standardised bird surveys have been conducted at 31 unique locations in Iron Range and 107 standardised bird surveys completed at 43 unique locations in McIlwraith Range.

In order to access these sites a Memorandum of Understanding was negotiated with the Traditional Owners of the research area, which lies on a newly created land tenure: Cape York Aboriginal Land. Surveys carried out across the altitudinal gradient yielded a total of 3,235 bird records of 99 species. Highlights included eight endemic species, among them the Eclectus Parrot *Eclectus roratus*, Yellow Billed Kingfisher *Syma torotoro* and Black-winged Monarch *Monarcha frater*. A total of 48 species were recorded in the Iron range, including fourteen endemics, among them the Yellow-legged Flycatcher *Microeca griseoceps*, Green-backed Honeyeater *Glycichaera fallax* and Frilled Monarch *Arses telescophthalmus*. In addition, five mammals where recorded, including the endemic *Antechinus leo* and Southern Common Cuscus *Phalanger mimicus*. Four frog species where recorded, including the endemic *Litoria longirostris* and *Litoria eucnemis*. Three reptile species were also recorded, including the regional endemic *Chondropython viridis*. A year of detailed temperature and humidity data was also recorded at two-hourly intervals using Thermochron data loggers installed at the survey sites. Two repeat measures were also made of the the circumferences of fifteen monitored trees at each site for the calculation of changes in basal area as an index of carbon sequestration.

Conclusions

These comparative datasets have already yielded valuable insights into factors regulating rainforest bird distributions. Preliminary analyses of the data from extension of surveys to Cape York Peninsula and central eastern Queensland indicate that surveying has been sufficient to capture a snapshot of the patterns of diversity and abundance of the rainforest bird fauna across the altitudinal gradient of both regions. The Cape York dataset is particularly noteworthy as it includes estimates of bird abundance in environments that are warmer and drier than those previously sampled in our formal surveys. These environments can be regarded as important analogues of conditions expected within the Wet Tropics under projected climate change scenarios. The first manuscript arising from the project detailing the abundance and distribution of the endemic subspecies of Lewin's Honeyeater *Meliphaga Lewinii amphochlora* has already been accepted for publication. Results from a broader

analysis of elevational patterns of abundance across the full latitudinal gradient (i.e. mid-east Queensland, Wet Tropics and Cape York) will be presented at the Australasian Ornithological Conference in Armidale. A corresponding manuscript is currently in preparation.

Journal articles

Shoo, L. P., Anderson, A. and Williams, S. E. (Accepted) On the isolated Lewin's Honeyeater population (*Meliphaga lewinii amphochlora*) from the McIlwraith Range uplands, Cape York Peninsula, Australia: Estimates of population size and distribution. *EMU-Austral Ornithology* (Accepted 4/9/09)

Conference presentations

Anderson, A., Shoo, L. and Williams, S. E. (2009) *Latitudinal shifts in optimum elevation of rainforest birds in eastern Queensland and their relevance to predicting the impacts of climate change*. Australasian Ornithological Conference, Armidale, 29 November – 4 December.