



Australian Government

Department of the Environment and Water Resources

**Marine and Tropical Sciences Research Facility (MTSRF)
March 2007 Milestone Report**

Project 2.5ii.4: Impacts of Climate change on Biodiversity

Project Leader: Associate Professor Stephen Williams, James Cook University

Summary

This project is currently on track for meeting all milestones. A draft report of assessment of extinction risk based on extensive life history and ecological data of Wet Tropics Vertebrates has been compiled and a full version is inserted below.

Field based data collection is on going and has been carried out on a monthly basis. We have had some difficulties with reaching three of the permanent field sites due to road maintenance by EPA and cable car maintenance at the Bellenden-Ker Cable Car and extensive wet weather. Intensive fauna sampling will occur at these sites in March as well as the normal monthly monitoring.

Dr L. Shoo has arrived and is currently commencing the project on ecological plasticity and potential adaptation in Wet Tropics fauna. Dr Shoo will start the field component of the project in March to commence identification of potential study sites to examine refugial dynamics and adaptation.

A formal project team meeting was held at James Cook University in Townsville the 19th of February in which progress of the project to date and future milestones and directs of the project was discussed.

The next milestone report will see:

- Transfer of GIS layers to CSIRO.

For reference: Milestone extracted from Project Schedule

Description

- Draft report of desk top analysis on the links between the ecological characteristics of species and their relative extinction proneness using collation of existing data and literature (obj a)
- Progress and status report associated with objectives b- e (above)
- Summary of any communication activities undertaken to date, including minutes of meetings/workshops if applicable.

Project Results

DESCRIPTION OF THE RESULTS ACHIEVED FOR THIS MILESTONE

- 1. Draft report of desk top analysis on the links between the ecological characteristics of species and their relative extinction proneness using collation of existing data and literature (obj a)**

Extinction Risk in Wet Tropics Vertebrates Draft Report:

Preliminary results from 2007:

Work on this project so far has focused on compiling a database of life history traits for all species of vertebrates within the Wet Tropics Bioregion. Data has been collated from a variety of sources, including the primary and secondary literature and actual species records from the existing Wet Tropics Database here at the Centre for Tropical Biodiversity and Climate Change.

Preliminary analyses have been conducted in order to categorize species according to their predicted extinction risk based on their life history and ecology. An extensive review of the literature identified four factors, consistent throughout vertebrate groups, which are commonly linked to a high extinction risk - high ecological specialization, geographical rarity, large body size and a slow life history. Thus, species were placed within a two dimensional 'extinction' space based on these attributes. In all species examined so far, an ecological specialization index was calculated from their estimated core area, distribution and extent of rainforest specialization. The life history index was calculated based on estimated lifetime reproductive output and body size (for explanation see Figure 1).

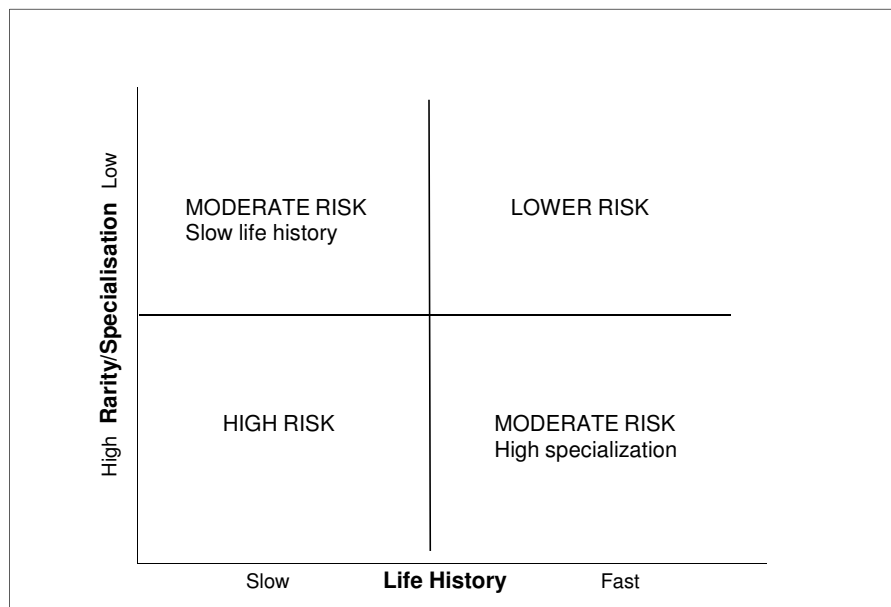


Figure 1: The predictions of the model, with species placed into one of 4 categories of extinction risk. Species with slow life history and high specialization will fall in the bottom left of the 'extinction space', and are predicted to be at high risk of extinction. Those with a fast life history and low specialization are predicted to be at lower risk. Species which fall at high risk on one axis, but low risk on the other, are classed as at moderate risk.

The preliminary results for each of the four main vertebrate groups follow. Species labelled with an 'e' are endemic to the region. Those species listed under the Nature Conservation Act are labelled as follows: 1 = Endangered; 2 = Vulnerable; 3 = Rare.

Mammals:

Results demonstrate that 46% of the Wet Tropics mammals included in the analysis are predicted to be at high risk of extinction. A further 33% are predicted to be at moderate risk. Out of the 15 endemic species included, 75% (10) fall into the high risk category. Of the 11 species listed under the NC Act, 8 fell into the high risk category and the remaining 3 species fell into one of the moderate risk categories.



Figure 2: Extinction risk in Wet Tropics mammals (excluding bats) based on life

Frogs:

The results of our preliminary analysis demonstrate that 38% of all species included are at high risk of extinction, while a further 23% are at moderate risk. Of the endemic frogs, 45% fall in the high risk category, and 69% of the 16 species currently listed under the NC Act also fall into the high risk category.

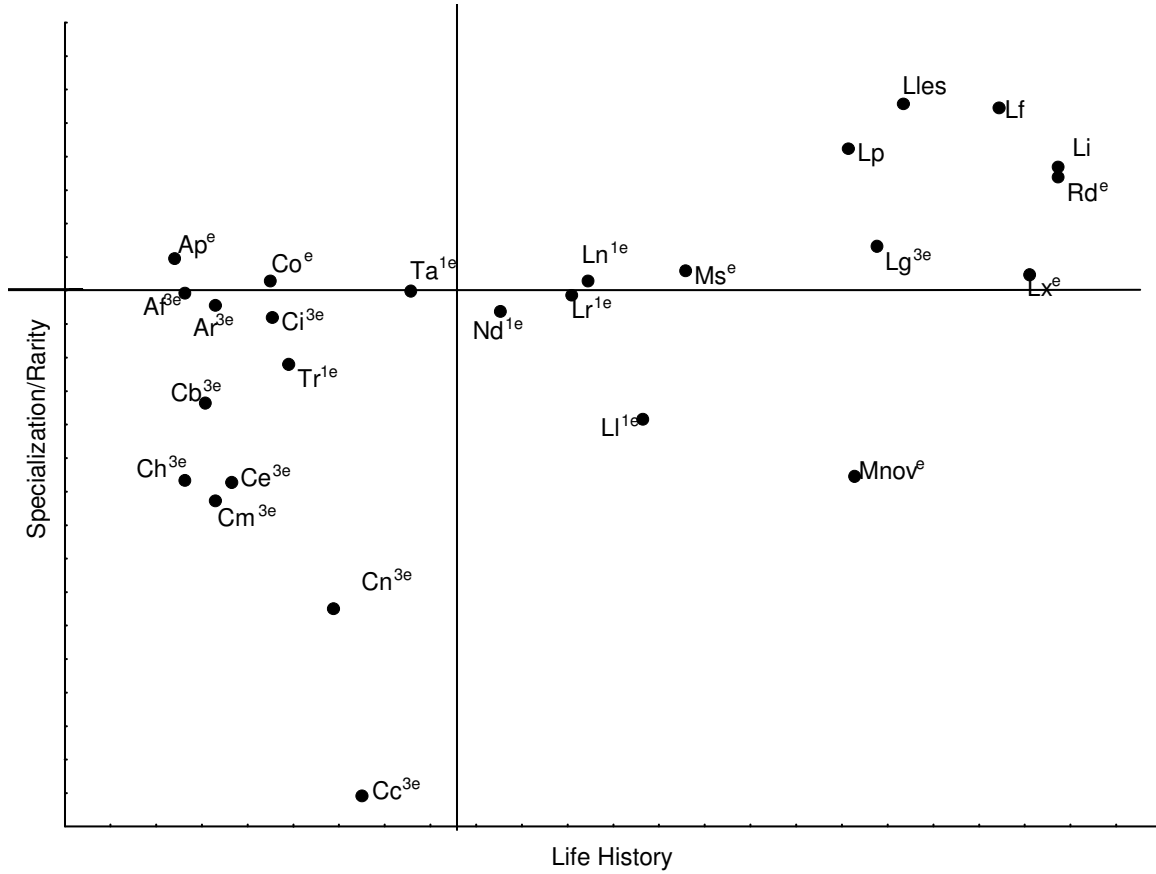


Figure 3: Extinction risk in Wet Tropics frogs based on life history and ecology. For species names, see Appendix I.

Reptiles:

Preliminary results indicate that among the reptiles of the Wet Tropics, only 15% of included species are likely to be at high risk of extinction based solely on their life history and ecology. However, 67% fall into one of the moderate risk categories – many reptiles appear to demonstrate a slow life history, while being relatively ecologically generalist. None of the reptiles in the Wet Tropics are currently listed as Endangered or Vulnerable on the NC Act, and of the 6 species listed as Rare, only 1 falls into the high risk category (16%). Of the 16 endemic species, 26% fall into the high risk category.

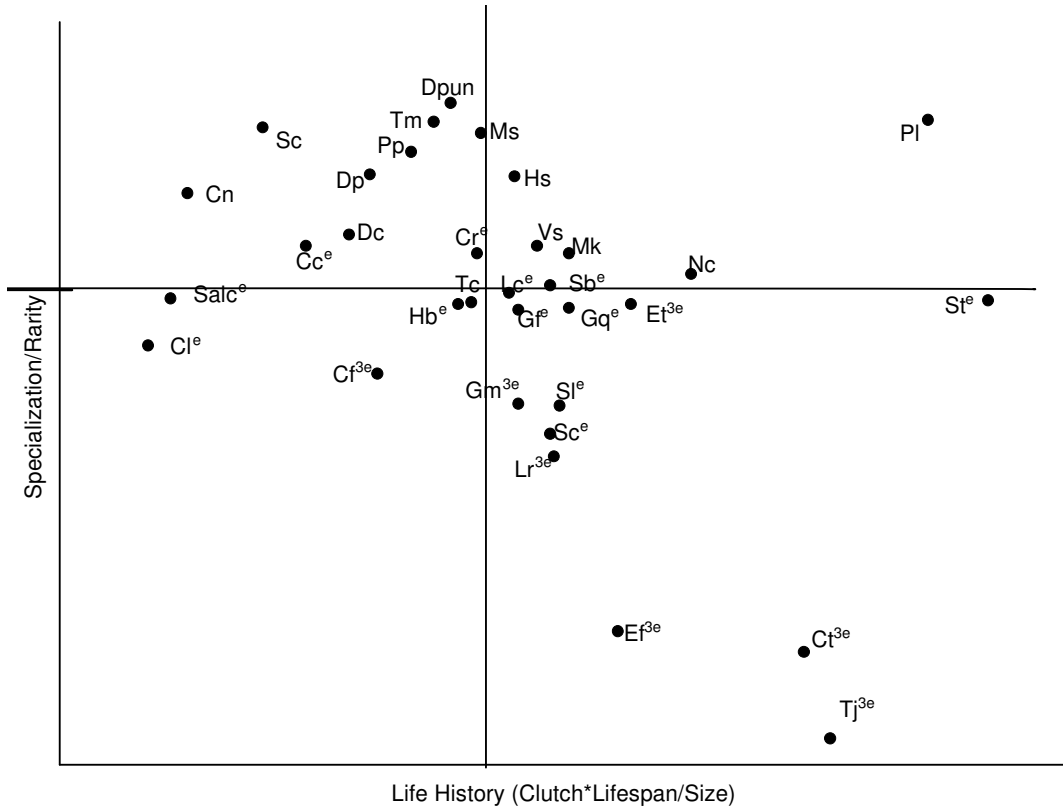


Figure 4: Extinction risk in Wet Tropics reptiles based on life history and ecology. For species names, see Appendix I.

Birds:

The model suggests that 20% of Wet Tropics bird species are likely to be at high risk of extinction, including 43% of the 23 endemic species. A further 62% are likely to be at moderate risk of extinction given their life history and ecology. Of the 5 species listed under the NC Act, 1 (20%) falls into the high risk category, and 2 (40%) into the moderate risk category.

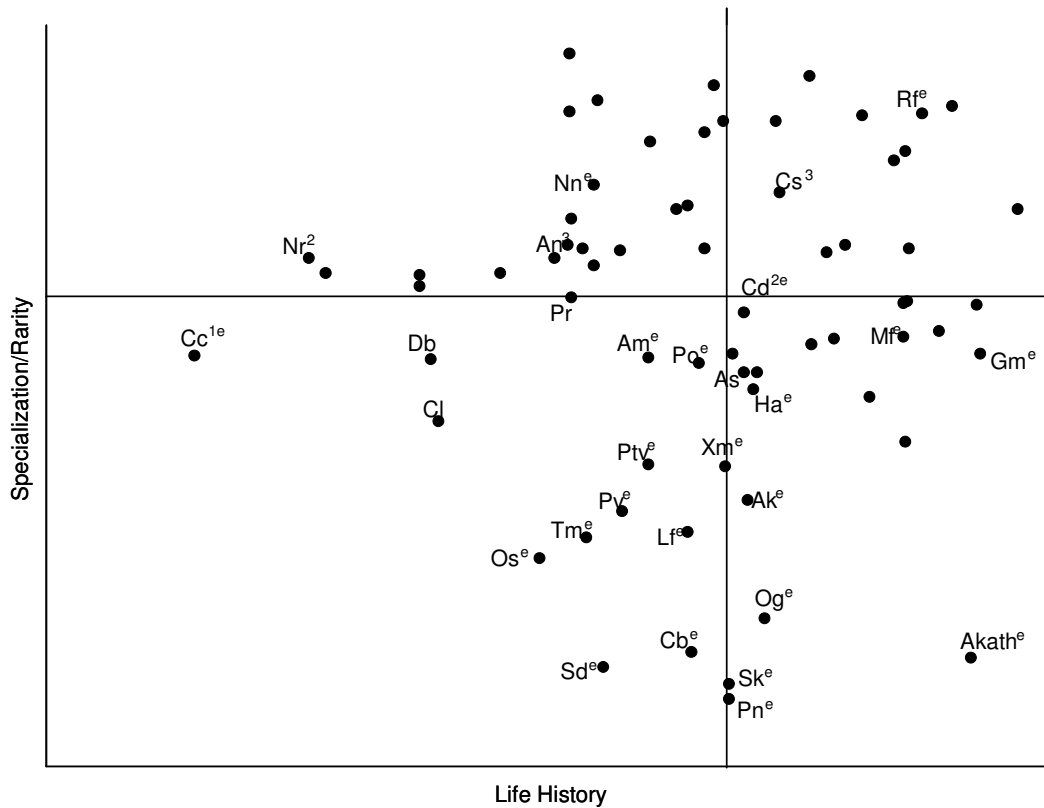


Figure 5: Extinction risk in Wet Tropics birds based on life history and ecology. For species names, see Appendix I; only those species at high risk, which are endemic, or which are listed under the NC Act are labeled due to the large number of bird species included.

Summary:

Although preliminary, these analyses reveal that a high percentage of Wet Tropics vertebrates, particularly within the mammals and frogs, are likely to be at high risk of extinction based upon their life history and ecology. The models demonstrate relatively high concordance with the existing conservation status of listed species; of the species currently listed under the NC Act, approximately 45% fall in the high risk category and the majority of others into the moderate risk category. Importantly, more than 50% of endemic Wet Tropics vertebrates fall into the high risk category – indicating that as well as having a relatively small range size, many endemics also display traits indicative of a slow life history, thereby increasing their risk of extinction.

Projected outputs:

These results will work as a foundation on which to build more complex models of extinction risk in this vertebrate assemblage for which a complete report will be compiled for June 2008. We will expand on this initial analysis using updated estimates of range size, relative abundance and population density. Other ecological parameters will also be included in the models including relative specialization in diet and vegetation use, and preferred range of altitude, temperature and precipitation. We will also include estimates of dispersal and movement capacity. Using these variables, we will develop a model in order to predict extinction risk in all Wet Tropics vertebrate. Following this, we will use RAMAS GIS software to conduct population viability analysis for key species highlighted as highly susceptible to extinction in our models. Using RAMAS GIS, we will be able to model time to extinction for populations under varying predicted climate change scenarios.

Appendix I: Species Names and Codes

Mammal Code	Mammal Species	Frog Code	Frog Species
Aa	<i>Antechinus adustus</i>	Af	<i>Austrochaperina fryi</i>
Af	<i>Antechinus flavipes</i>	Ap	<i>Austrochaperina pluvialis</i>
Ag	<i>Antechinus godmani</i>	Ar	<i>Austrochaperina robusta</i>
Bt	<i>Bettongia tropica</i>	Cb	<i>Cophixalus bombiens</i>
Cc	<i>Cercartetus caudatus</i>	Cc	<i>Cophixalus concinnus</i>
Dt	<i>Dactylopsila trivirgata</i>	Ce	<i>Cophixalus exiguus</i>
Dh	<i>Dasyurus hallucatus</i>	Ch	<i>Cophixalus hosmeri</i>
Dm	<i>Dasyurus maculatus</i>	Co	<i>Cophixalus infacetus</i>
Db	<i>Dendrolagus bennettianus</i>	Cm	<i>Cophixalus monticola</i>
DI	<i>Dendrolagus lumholtzi</i>	Cn	<i>Cophixalus neglectus</i>
HI	<i>Hemibelideus lemuroides</i>	Co	<i>Cophixalus ornatus</i>
Hm	<i>Hypsiprymnodon moschatus</i>	Lp	<i>Limnodynastes peronii</i>
Mv	<i>Melomys cervinipes</i>	Lf	<i>Litoria fallax</i>
Pn	<i>Perameles nasuta</i>	Lg	<i>Litoria genimaculata</i>
Pau	<i>Petaurus australis</i>	Li	<i>Litoria infrafronata</i>
Pg	<i>Petaurus gracilis</i>	Lles	<i>Litoria lesueuri</i>
Pau	<i>Pseudochirops archeri</i>	LI	<i>Litoria lorica</i>
Pc	<i>Pseudochirulus cinereus</i>	Ln	<i>Litoria nannotis</i>
Ph	<i>Pseudochirulus herbertensis</i>	Lr	<i>Litoria rheocola</i>
Rf	<i>Rattus fuscipes</i>	Lx	<i>Litoria xanthomera</i>
RI	<i>Rattus leucopus</i>	Ms	<i>Mixophyes schevilli</i>
Ts	<i>Thylogale stigmatica</i>	Mnov	<i>Mixophyes species A</i>

Tvj	<i>Trichosurus vulpecula johnstonii</i>	Nd	<i>Nyctimystes dayi</i>
Uh	<i>Uromys hadrourus</i>	Rd	<i>Rana daemeli</i>
		Ta	<i>Taudactylus acutirostris</i>
		Tr	<i>Taudactylus rheophilus</i>
Reptile Code	Reptile Species	Bird Code	Bird Species
Cc	<i>Cacophis churchilli</i>	Ak	<i>Arses kaupi</i>
Ct	<i>Calyptotis thornstonensis</i>	Akath	<i>Acanthiza katherina</i>
Cr	<i>Carlia rubrigularis</i>	Am	<i>Ailuroedus melanotis</i>
Cl	<i>Carphodactylus laevis</i>	An	<i>Accipiter novaehollandiae</i>
Cf	<i>Coeranoscincus frontalis</i>	As	<i>Alisterus scapularis</i>
Cn	<i>Cryptophis nigrescens</i>	Cb	<i>Colluricincla boweri</i>
Dp	<i>Demansia psammophis</i>	Cc	<i>Casuarius casuarius</i>
Dc	<i>Dendrelaphis calligastra</i>	Cd	<i>Cyclopsitta diophthalma</i>
Dpun	<i>Dendrelaphis punctulata</i>	Ci	<i>Chalcophaps indica</i>
Ef	<i>Eulamprus freerei</i>	Cs	<i>Collocalia spodiopygius</i>
Et	<i>Eulamprus tigrinus</i>	Db	<i>Dicrurus bracteatus</i>
Gf	<i>Glaphyromorphus fuscicaudis</i>	Gm	<i>Gerygone mouki</i>
Gm	<i>Glaphyromorphus mjobergi</i>	Ha	<i>Heteromyias albispecularis</i>
Gq	<i>Gnypetoscincus queenslandiae</i>	Lf	<i>Lichenostomus frenatus</i>
Hs	<i>Hemiaspis signata</i>	Mf	<i>Machaerirhynchus flaviventer</i>
Hb	<i>Hypsilurus boydii</i>	Nn	<i>Ninox novaeseelandiae</i>
Lc	<i>Lampropholis coggeri</i>	Nr	<i>Ninox rufa</i>
Lr	<i>Lampropholis robertsi</i>	Og	<i>Oreoscopus gutturalis</i>
Mk	<i>Morelia kinghorni</i>	Os	<i>Orthonyx spaldingii</i>
Ms	<i>Morelia spilota</i>	Pn	<i>Prionodura newtoniana</i>
Nc	<i>Nactus cheverti</i>	Po	<i>Psophodes olivaceus</i>
Pl	<i>Physignathus lesueurii</i>	Pr	<i>Ptilinopus regina</i>
Pp	<i>Pseudechis porphyriacus</i>	Ptv	<i>Ptilonorhynchus violaceus</i>
Salc	<i>Saltuarius cornutus</i>	Pv	<i>Ptiloris victoriae</i>
Sb	<i>Saproscincus basiliscus</i>	Rf	<i>Rhipidura fuliginosa</i>
Sc	<i>Saproscincus czechurai</i>	Sd	<i>Scenopoeetes dentirostris</i>
Sl	<i>Saproscincus lewisi</i>	Sk	<i>Sericornis kerri</i>
St	<i>Saproscincus tetradactylus</i>	Tm	<i>Tyto multipunctata</i>
Sc	<i>Stegonotus cucullatus</i>	Xm	<i>Xanthotis macleayana</i>
Tj	<i>Techmarscincus jigurru</i>		
Tc	<i>Tropidechis carinatus</i>		
Tm	<i>Tropidonophis mairii</i>		
Vs	<i>Varanus scalaris</i>		

Progress and status report associated with objectives b- e (above)

b) Collection of faunal data and species distribution modelling

- Apart from the sites in which access has been restricted by EPA (due to extreme wet road conditions), all other data logger and leaf-litter sampling has occurred each month. Faunal sampling is ongoing and progressing satisfactorily within the limitations of the wet season and EPA road restrictions.
- An initial round of species distribution modelling has occurred for all Wet Tropic vertebrate species using a new program (MAXENT) which is meant to produce more accurate distribution models. These models are currently being checked. The next generation of distribution modelling will include the latest vegetation maps being developed currently via a collaboration with Jeanette Kemp (QLD Herbarium, EPA).

c) Identify and collect micro climate data in potential refugia

- The collection of microclimate data in potential refugia has begun. Targeted microclimate stations have been installed on Thorntons Peak to monitor the habitat of the critically endangered Thornton Peak Nursery Frog. Further analysis and field work will need to occur to identify other refugia areas.

d) Production of GIS maps

- Production of enhanced climatic and species distribution models is ongoing. Microclimate information is being collected at 27 locations for calibration against macroclimate information
- Initial species distribution models have been created; the procedure and environmental data are still being refined such that these models may continue to be improved.

e) Net Primary Productivity

- At present initial rough estimates of Net Primary Productivity (NPP) GIS layers for each season and month have been produced. The ongoing measurements of NPP, i.e leaf litter collection, dendrometer bands and basal measurement of different tree size classes will continue to more accurately quantify and measure NPP within the Wet Tropics region.

Summary of any communication activities undertaken to date, including minutes of meetings/workshops if applicable.

- A/Prof Williams gave a presentation on climate change impacts on biodiversity at a public forum in Ayr organised by the Burdekin Dry Tropics NRM.
- A project team meeting was held at James Cook University, Townsville on the 19th of February 2007 for this MTSRF project 2.5ii. A/Prof Steve Williams also met with Cairns team members that were unable to attend on the 23rd of Feb.
- The following people were in attendance A/Prof Steve Williams, Dr Jeremy Vanderwal, Prof Chris Johnson, Dr Joanne Isaac and Yvette Williams.
- Prof Steve Turton, A/Prof Andrew Krockenburger, Dr Luke Shoo and Prof Nigel Stork were unable to attend.
- A/Prof Steve Williams presented an overview of the MTSRF project and our progress to date. Reviewed the team milestones and outputs for the last year.

- Dr Jeremy Vanderwal presented the data base improvements which had been made and the preliminary data analysis and GIS layers which have been aligned and generated for this project.
- Suggestions on sampling design or other possible sampling was asked for:
- Suggestion included – carry out bat fauna surveys, measuring topography at leaf litter collection sites, include vegetation structure surveys at each site
- Post doctoral fellowship position was discussed and suggestions that gullies may be important refugia as both vertebrate and invertebrate fauna have been found to occur at lower altitudes in these areas.
- Web based protocol for entry of data on to database was asked for so that quality control of data entry occurred.
- Improvement of communication/engagement within group was suggested by more regular meetings and bi monthly presentations of research.
- Ideas for further funding possibilities was asked for and suggestions of CERF funding for western edge of rainforest into rangelands area to be applied for in March 2007 and ARC funding to be asked for in Feb 2008. Yvette to follow up.
- Other possible projects were suggested on baseline species distribution and altitudinal range of rainforest micro-bats (no overlap with CSIRO group), Palms and Co2 concentrations and Plant decomposition.
- Agreed to meet again in late April

Explanation of Activity changes

No substantive changes have occurred in planning, personnel or execution of the project over this reporting quarter.

Problems and opportunities

Over the past three months access to three of the permanent monitoring sites (Mt Lewis, Mt Winsor, Mt Bellenden Ker) has been temporarily restricted (by EPA) due to the wet season, road works and cable car maintenance being carried out. We do not feel this will influence long term deliveries for this project. This is not a regular occurrence and regular monitoring will continue when roads are reopened. The extensive rain through this period has been the main reason these works have taken longer than predicted. There is no alternative to these sites so we simply have to be patient and wait for these areas to reopen.

Communications, major activities or events

During milestone reporting period

A joint meeting of progress to date occurred on 19 February. Minutes of the meeting are place in Summary of milestones.

During next milestone reporting period

The next joint meeting will occur in mid April to discuss progress of the project thus far and to ensure all parties are informed of progress and have opportunities to have input into project.