



National Environmental
Research Program

TROPICAL ECOSYSTEMS *hub*

What is at risk?

Identifying rainforest refugia and hotspots of plant genetic
diversity in the Wet Tropics and Cape York Peninsula

REPORT ON NERP TE HUB PROJECT 3.2

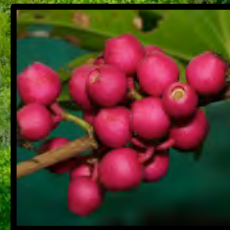
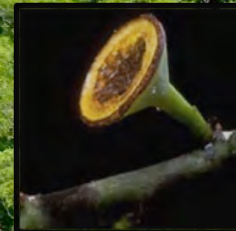
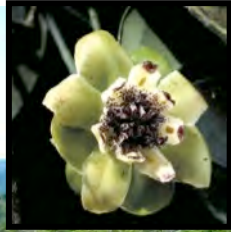
Darren Crayn

Australian Tropical Herbarium





NE Queensland is renowned
for its biodiversity





WHAT IS BIODIVERSITY?

Species...?

Convention on Biological Diversity:

“Biological diversity” means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part;

this includes diversity within species, between species and of ecosystems

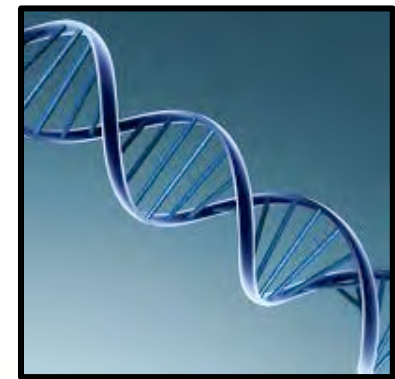
ecosystems,



species,



genes.





CONSERVATION OF BIODIVERSITY



ecosystems



species

GENETIC DIVERSITY IS IMPORTANT



WHY IS *GENETIC* DIVERSITY IMPORTANT?



promotes effective long term conservation



PURPOSE AND INTENT OF RESEARCH

To better characterise biodiversity refugia in NE Queensland rainforests and the threats to them.

Two case studies:

- broad scale analysis of patterns of deep genetic diversity across the NE Qld rainforests
- modelling diversity under future environmental change scenarios in one restricted rainforest ecosystem – mountain-top rainforest

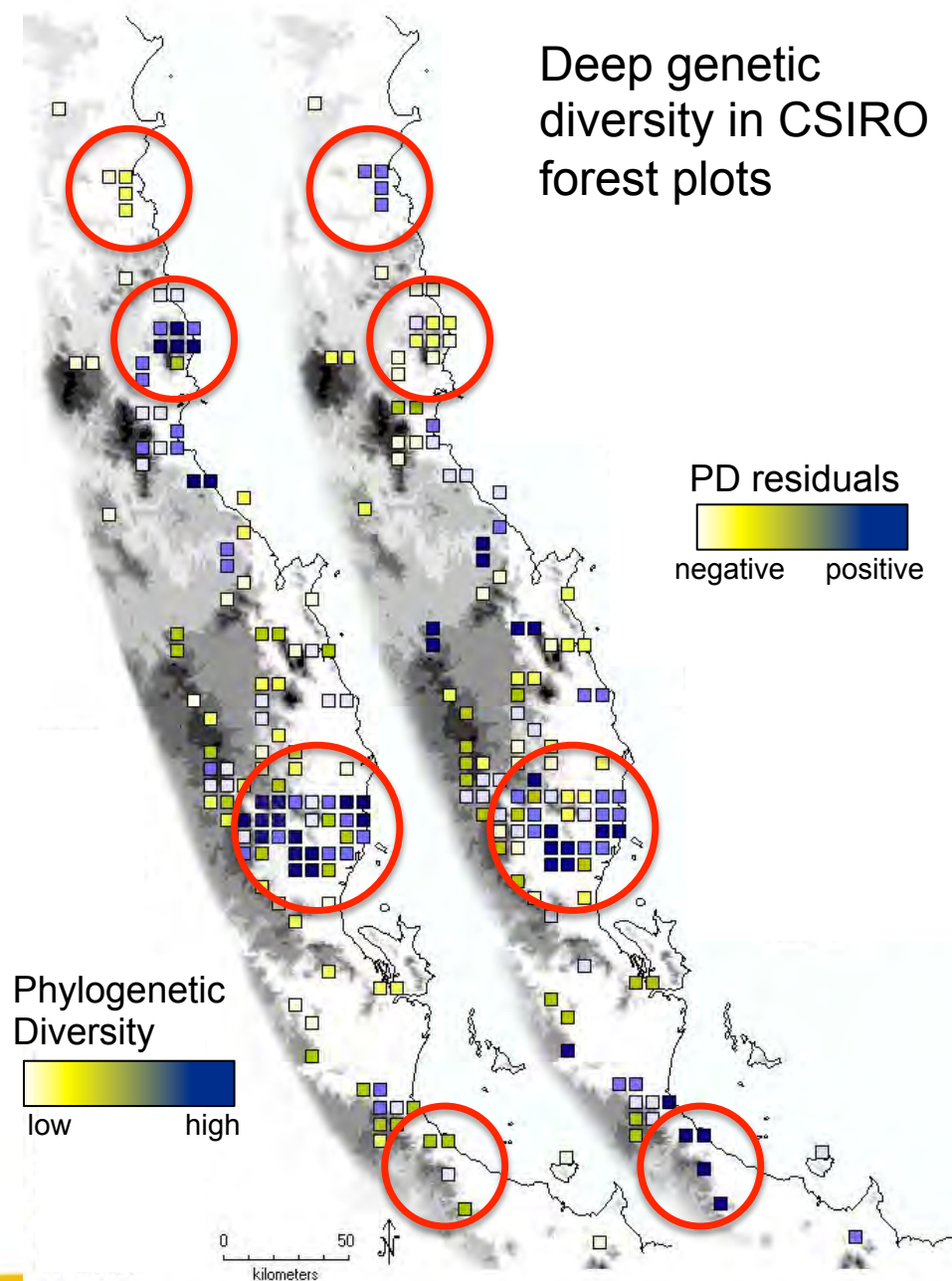


CASE STUDY 1

Broad scale analysis of patterns of deep genetic (phylogenetic) diversity in plants across the NE Qld rainforests.

- high diversity concentrated in Mossman-Daintree and Tully headwaters-Mission Beach areas
- But Daintree has *lower than expected* diversity, and Tully *higher than expected*
- Cooktown and southern Paluma Range have low overall diversity, but much higher than expected!

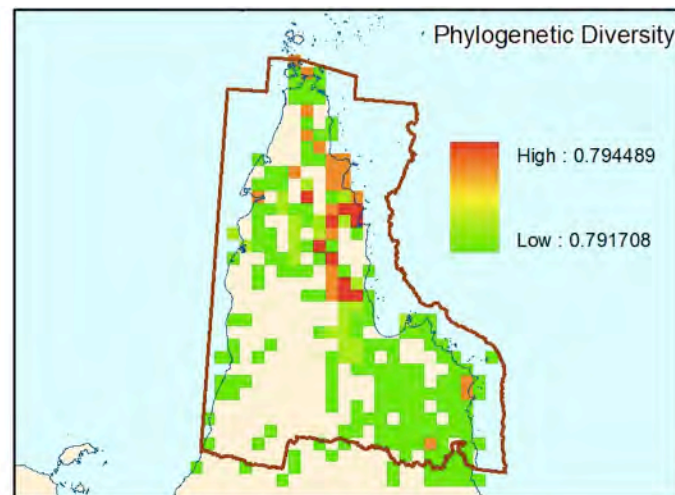
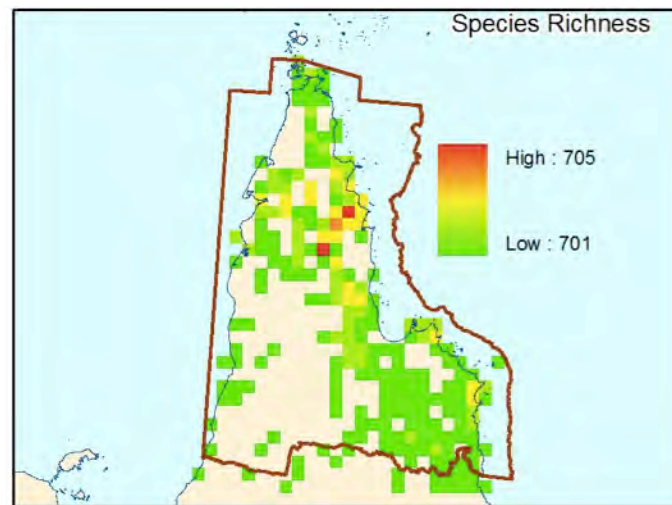
Deep genetic
diversity in CSIRO
forest plots





PRACTICAL APPLICATION OF APPROACH

- Preliminary assessments of phylogenetic diversity on Cape York
- DSEWPAC-convened workshop aimed at bringing together researchers and research users to develop methods and analyses on the application of PD to real world conservation assessment.
- Hotspots of species richness and phylogenetic diversity are not the same – choices!



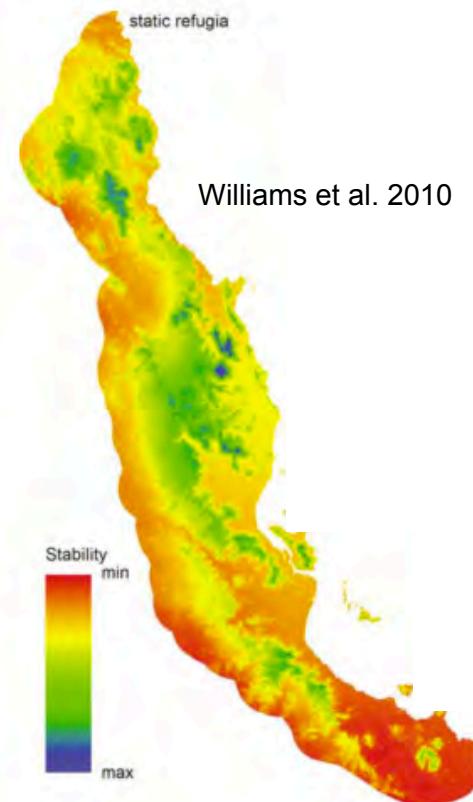
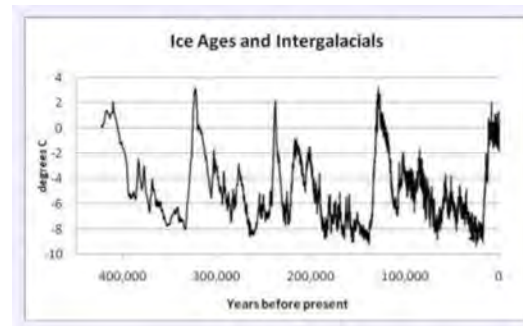
Data and results from expert workshop convened by DSEWPAC, funded by Australian Centre for Ecological Analysis, Brisbane 2012



CASE STUDY 2

Modelling upland endemic plant
distributions under future climate
scenarios

- Upland areas of Wet Tropics
have been relatively stable
through glacial cycles



This case study:
Craig Costion, Lalita Simpson, Petina Pert, Darren
Crayn, unpublished data



Significant climatic shifts expected for Queensland's upland forests

Montane rainforests are predicted to experience:

- Upward shift in cloud cover
- Significant reduction in cloud interception
- Decline in moisture inputs from mist, and outputs through stream flow





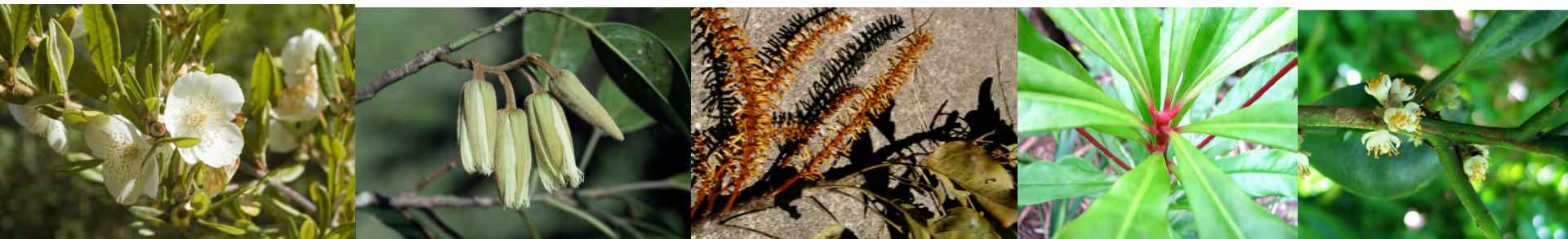
What is at risk?

What is the distribution of a species current climatic niche under predicted future climates?

How will niche changes impact species' ranges and richness?

- Occurrence data: Australia's Virtual Herbarium
- Climatic environmental layers: Tropical data hub
- Species distribution modelling: MaxEnt

Suitable data available for 19 of the 33 mountain top (>1000m) endemic plant species





© A. Ford

Symplocos graniticola

Diospyros sp. Mt. Spurgeon



© A. Ford

Phalaria biflora



Austromuellera valida



Eucryphia wilkiei



Elaeocarpus linsmithii



Tasmannia sp. Mt Bellenden Ker

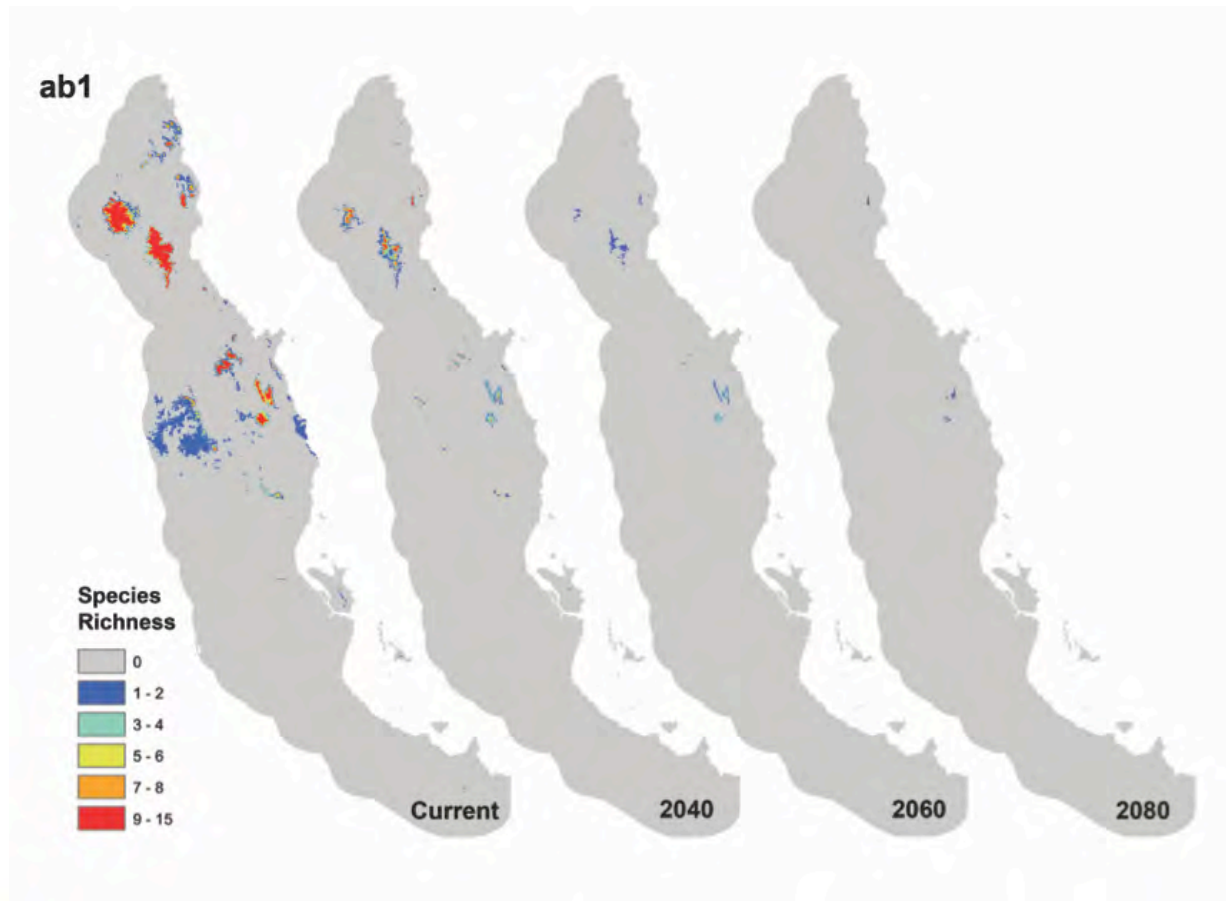


7 important mountain top habitats for plants

Locality	Elevation (m)	Regional Endemics	Local Endemics
Mt. Lewis	1,383	13	5
Bartle Frere	1,622	8	2
Bellenden Ker	1,590	7	1
Thornton Peak	1,338	4	0
Mt. Finnigan	1,148	4	0
Lamb Ranges	1,308	2	0
Windsor Tableland	1,356	2	0

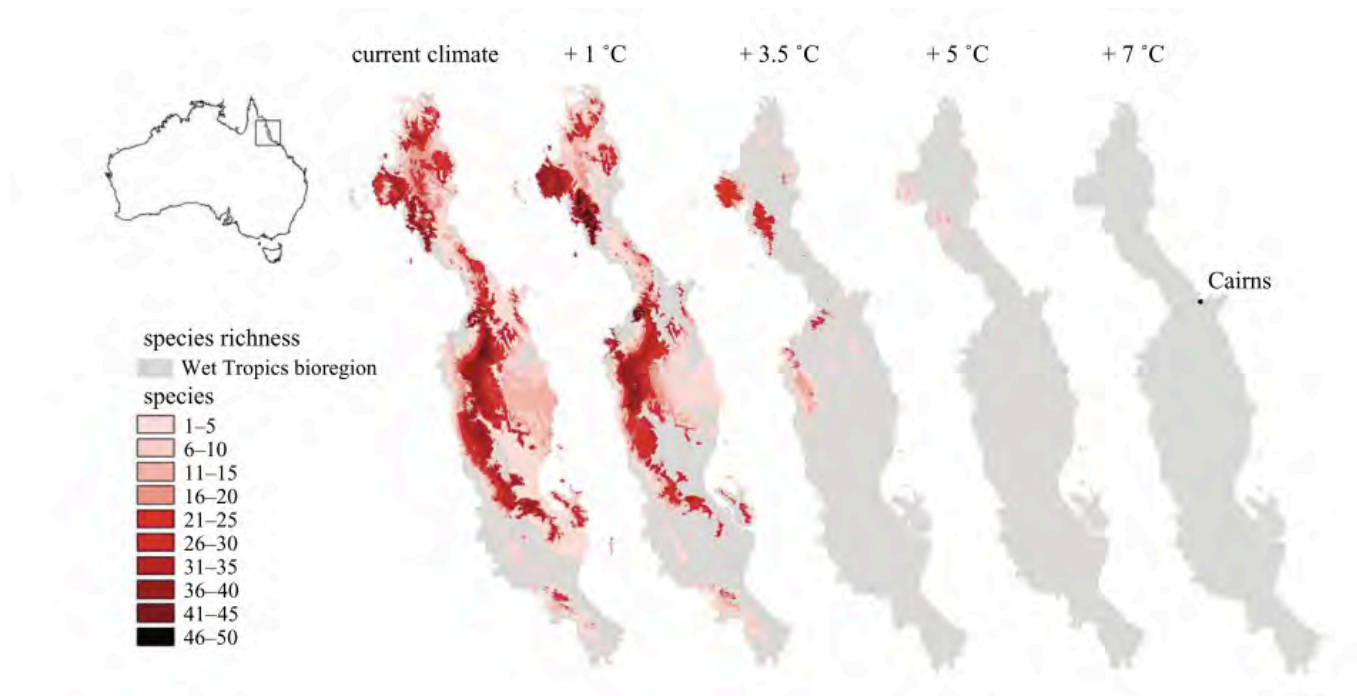


Decline in endemic plant species richness





Similar declines predicted for vertebrates



Williams et al. 2003



Practical impact:

All species may qualify for *Critically Endangered* Status under IUCN Red List Criterion A3(c)

Criterion A3(c): Species inferred to decline by 80% in terms of available habitat in a 3 generation time span.

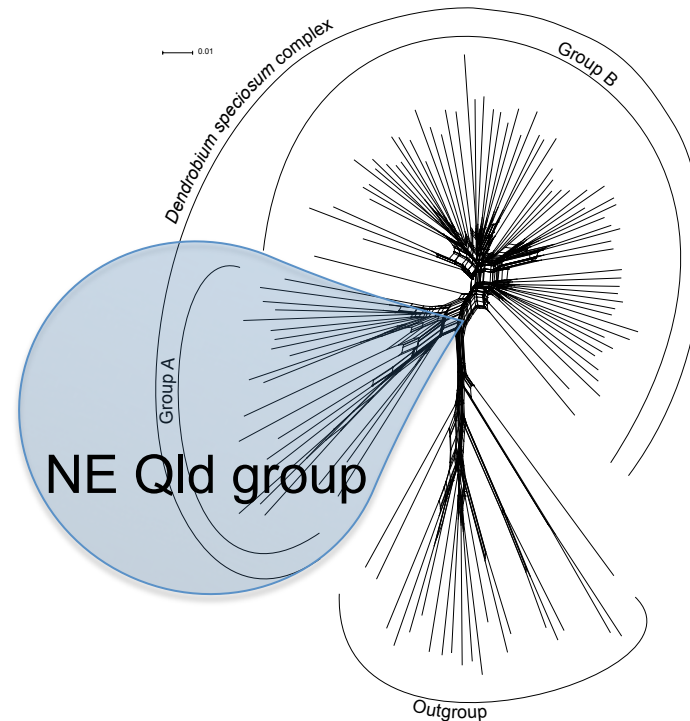
All 19 species assessed decline by a minimum of 85% by 2060 and 96% by 2080



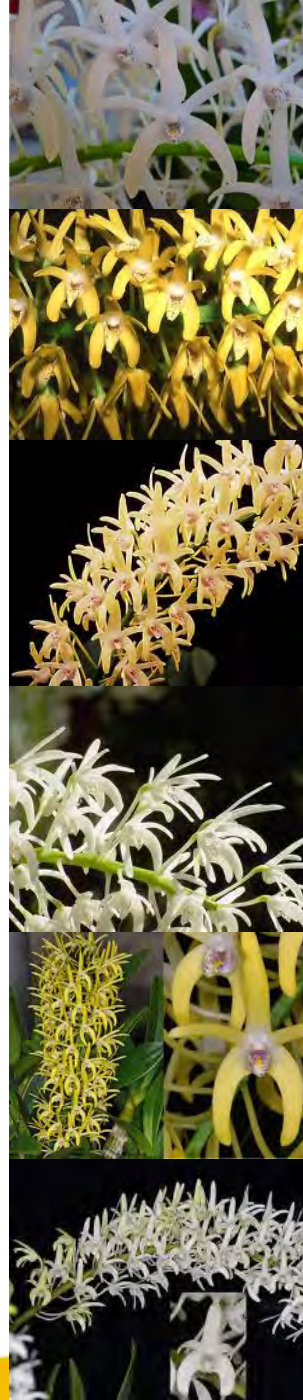


WHAT ABOUT GENETIC DIVERSITY?

- Is the geographical distribution of genetic diversity within species 'lumpy'. Are there mountaintops that harbour large amounts of genetic diversity across many species?
- King orchid – genetic diversity is relatively smoothly distributed across its geographical range in the WT



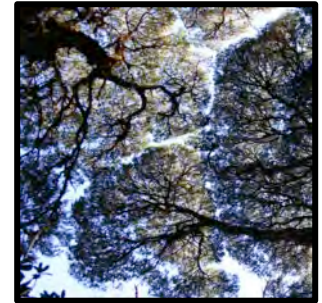
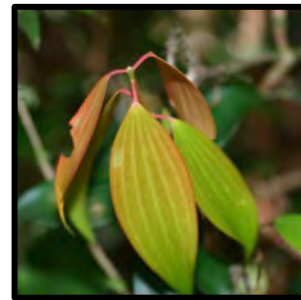
Lalita Simpson, unpublished Hons. project





FUTURE DIRECTIONS

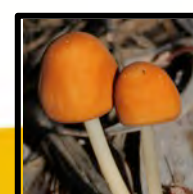
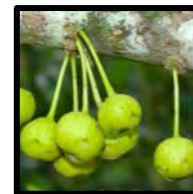
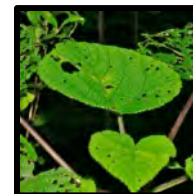
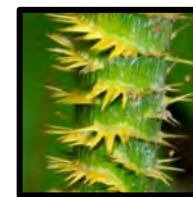
- complete genetic diversity studies of mountaintop plants
- complete surveys of macro fungi
 - checklist of species
- comprehensive surveys of upland endemic plants: improved models and conservation assessments
- acclimation potential of impacted species





KEY MESSAGES

- Genetic diversity contributes to resilience to environmental change
- Quantifying genetic diversity is important for biodiversity assessment and conservation decision-making
- Tropical montane endemic plant species may be critically endangered





PROJECT TEAM

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Thanks

Photos: Gary Wilson and Andrea Lim