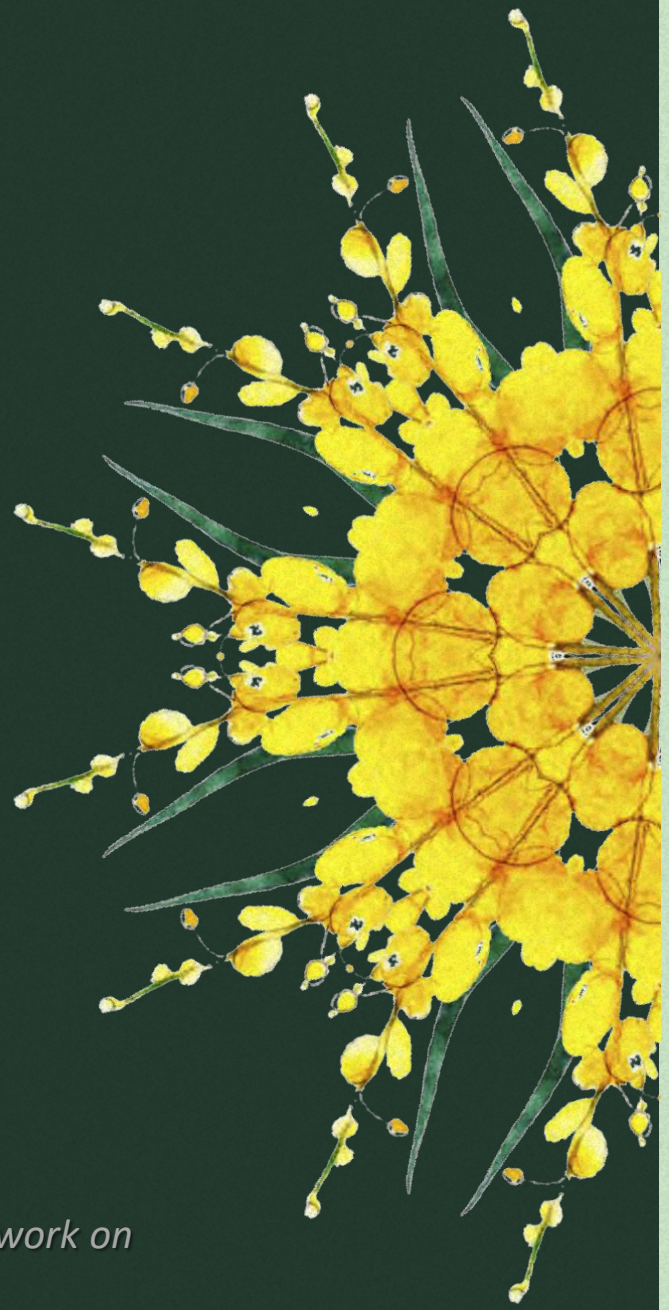
BOTANIC GARDENS OF SYDNEY

TEMPORAL DYNAMICS AND ASSEMBLY PATTERNS OF AUSTRALIAN RAINFORESTS, AND IMPLICATIONS FOR BIODIVERSITY CONSERVATION

Maurizio Rossetto

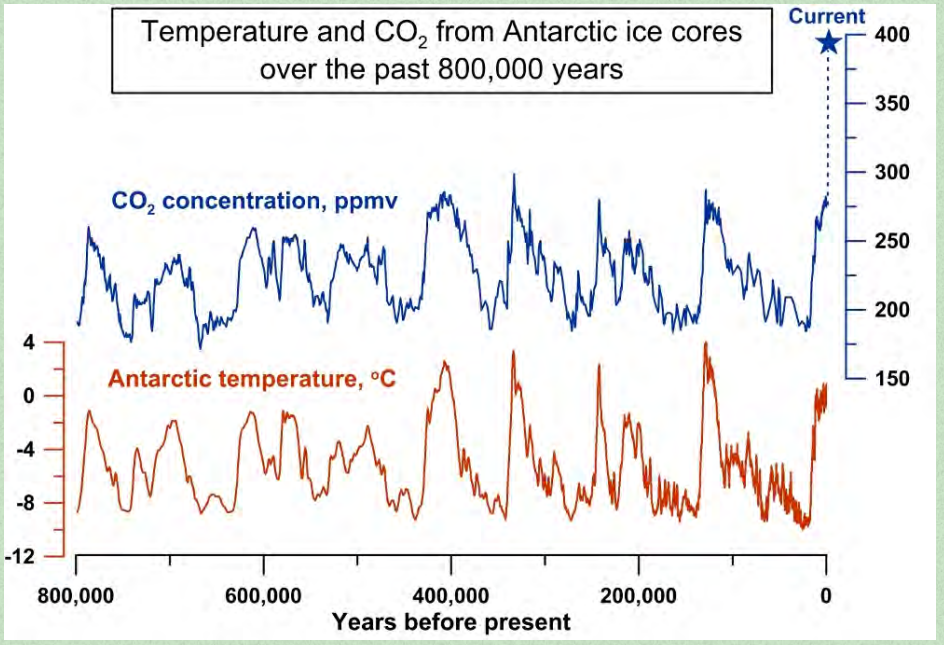
HEAD, RESEARCH CENTRE FOR ECOSYSTEM RESILIENCE



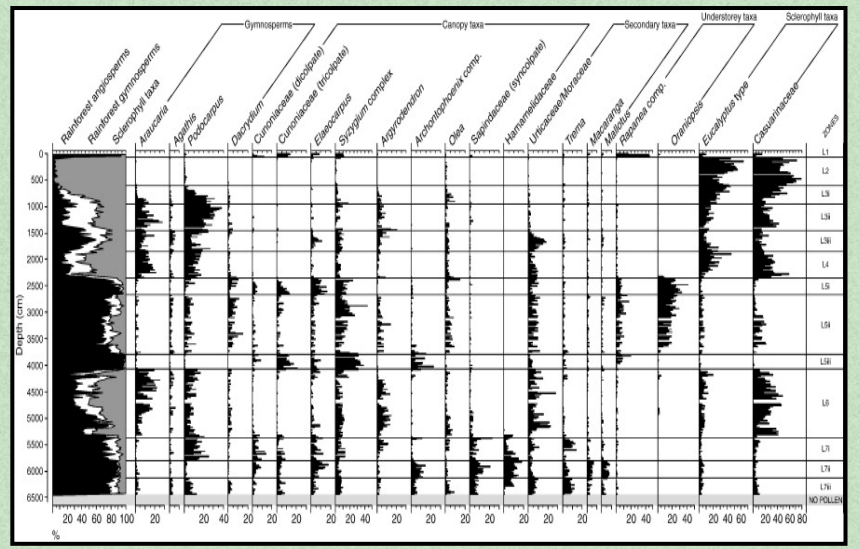
We acknowledge the Traditional Custodians of all the Lands we live and work on

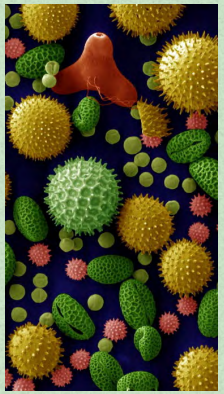
The impact of the Quaternary on rainforest flora

Harvard / Jeremy Shakun



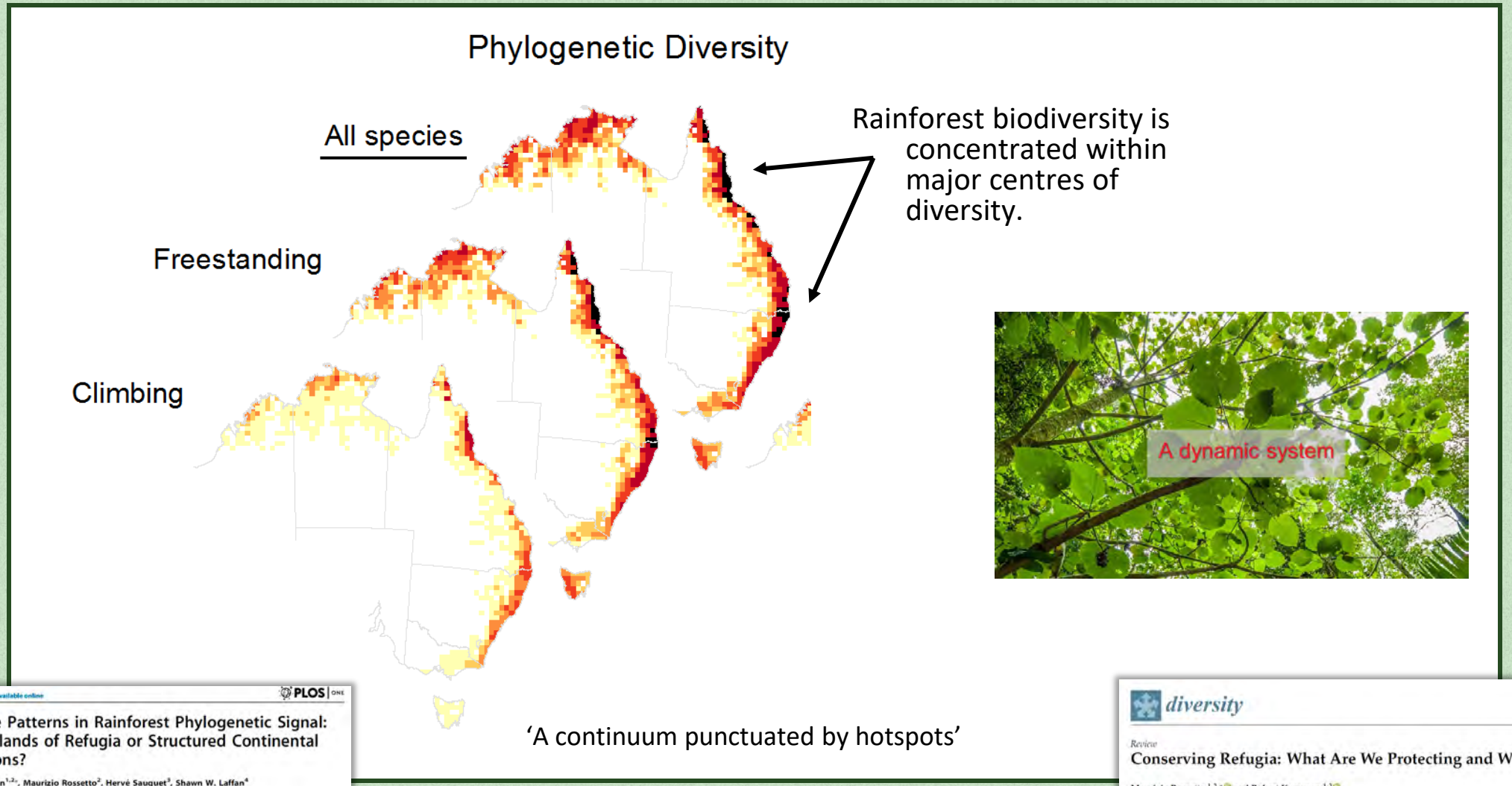
Kershaw *et al* 2007





Rainforest species dynamics and assembly patterns were significantly impacted by the environmental fluctuations of the Quaternary.

Assemblage diversity – a latitudinal gradient



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Landscape Patterns in Rainforest Phylogenetic Signal: Isolated Islands of Refugia or Structured Continental Distributions?

Robert M. Kooyman[1,2*], Maurizio Rossetto[2], Hervé Sauquet[3], Shawn W. Laffan[4]

diversity

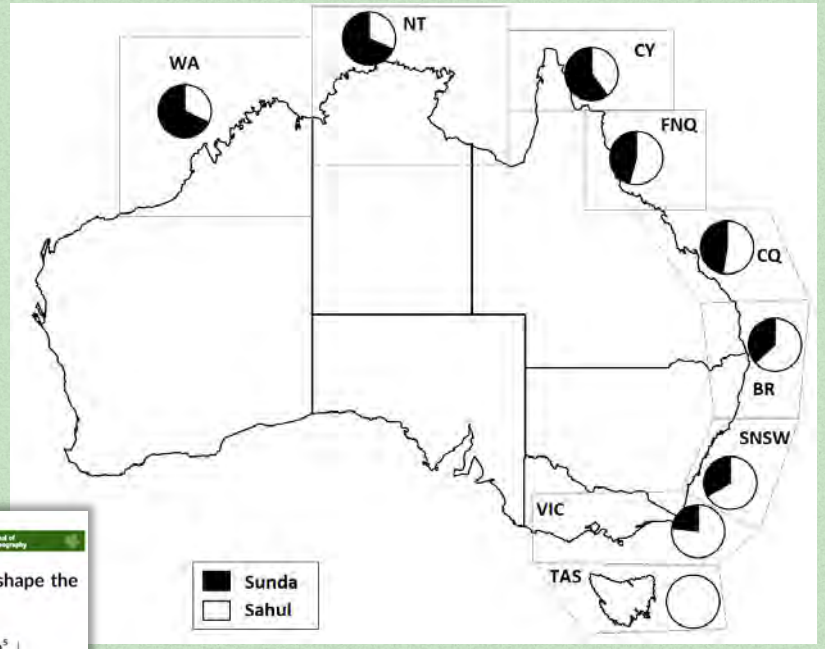
Review

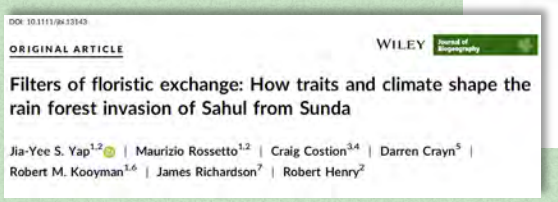
Conserving Refugia: What Are We Protecting and Why?

Maurizio Rossetto [1,2,*] and Robert Kooyman [1,3]

Biotic exchange – available pool impacts assembly patterns

Sunda-derived lineages are more common in the north.



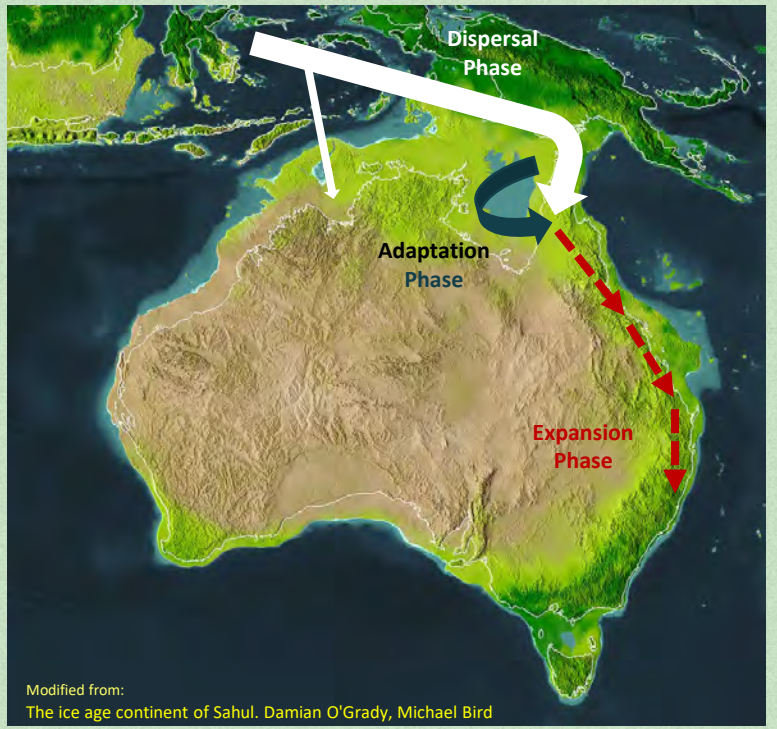


ORIGINAL ARTICLE

WILEY

Filters of floristic exchange: How traits and climate shape the rain forest invasion of Sahul from Sunda

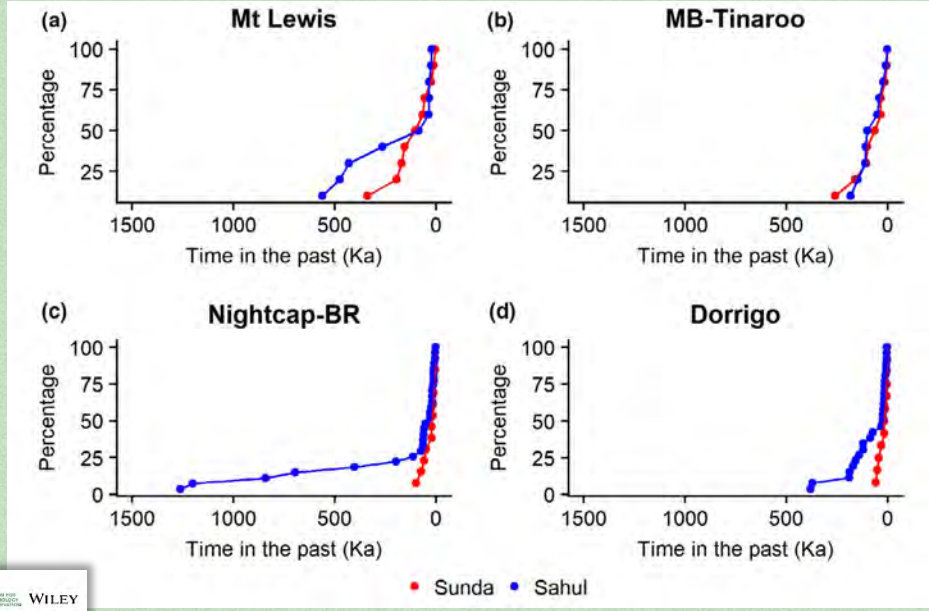
Jia-Yee S. Yap[1,2] | Maurizio Rossetto[1,2] | Craig Costion[3,4] | Darren Crayn[5] | Robert M. Kooyman[1,6] | James Richardson[7] | Robert Henry[2]

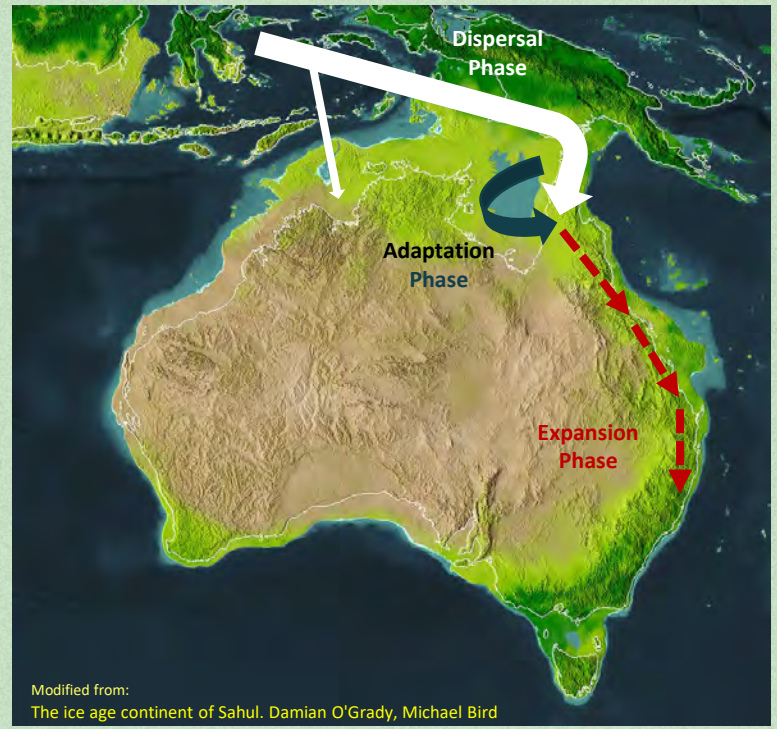


Biotic exchange – genomic evidence

Sunda-derived lineages have more recent local histories.

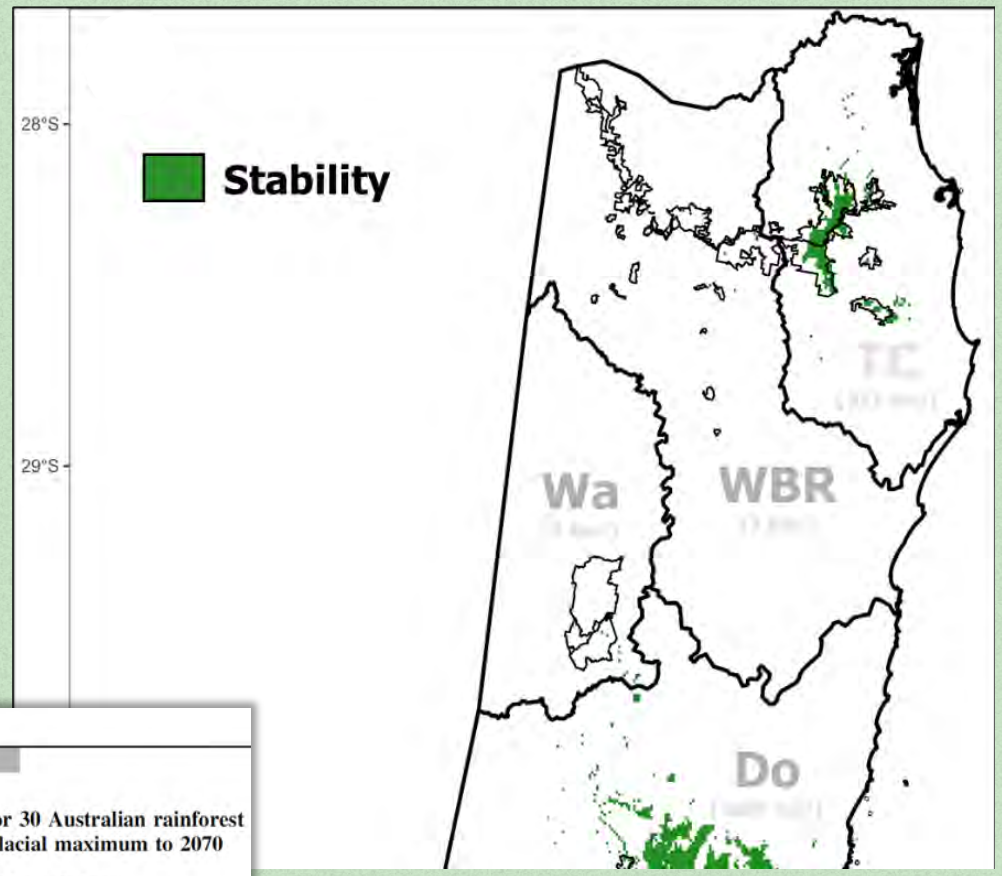
Recolonised areas have younger populations.





Persistent refugia vs. recolonised areas – habitat availability

Temporal changes in habitat availability across the landscape.



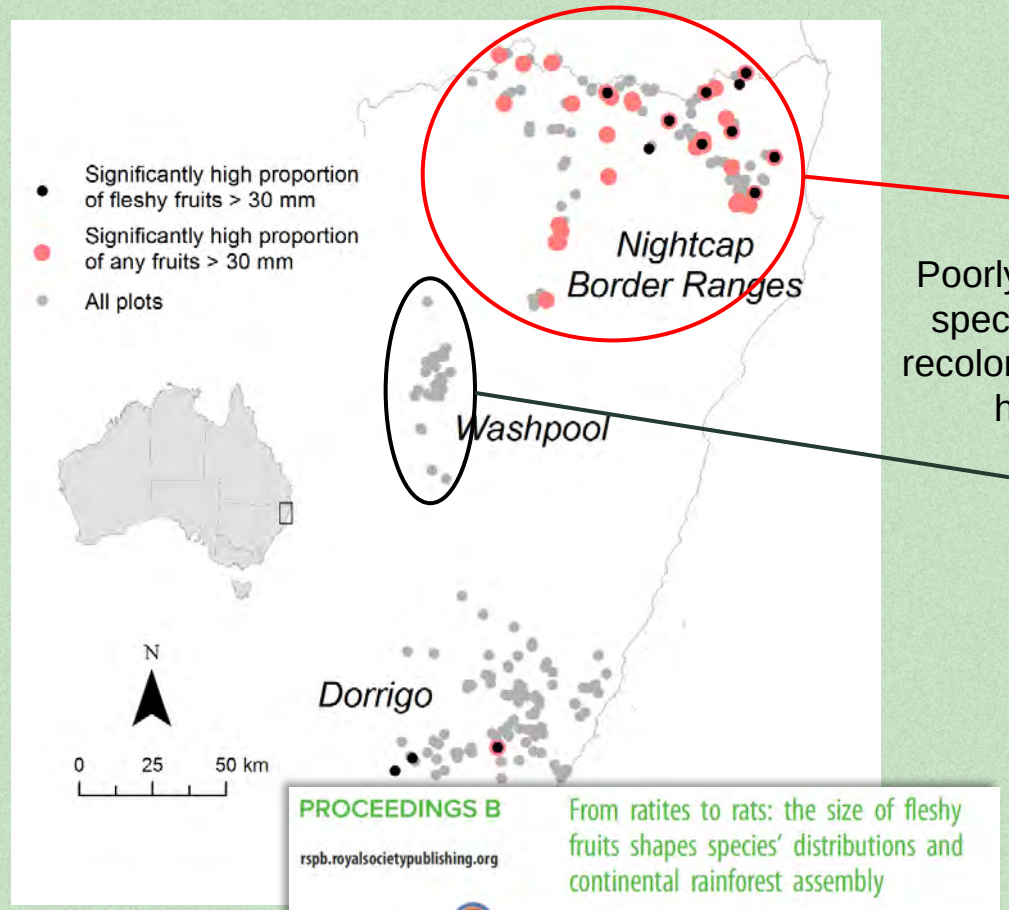
Landscape Ecol (2019) 34:2883–2896
https://doi.org/10.1007/s10980-019-00924-6

RESEARCH ARTICLE

Identifying climate refugia for 30 Australian rainforest plant species, from the last glacial maximum to 2070

Sourav Das · John B. Baumgartner · Manuel Esperon-Rodriguez · Peter D. Wilson · Jia-Yee S. Yap · Maurizio Rossetto · Linda J. Beaumont

Persistent refugia vs. recolonised areas – functional filtering



PROCEEDINGS B

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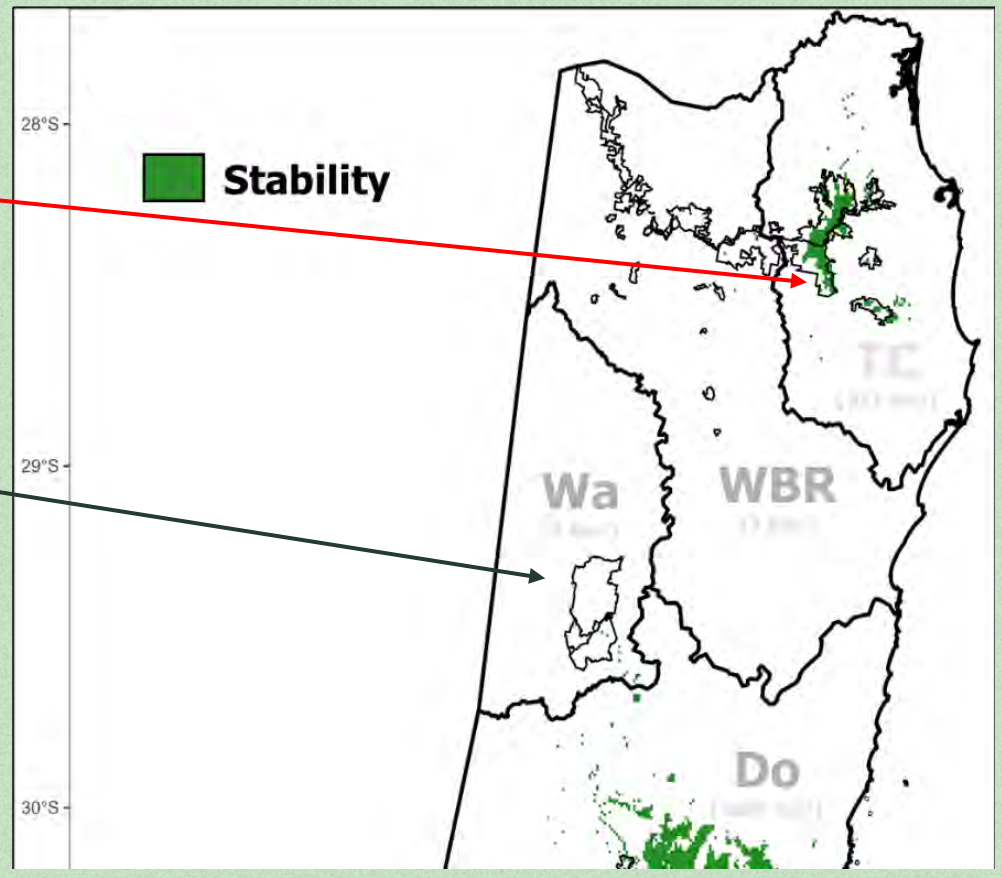
Research

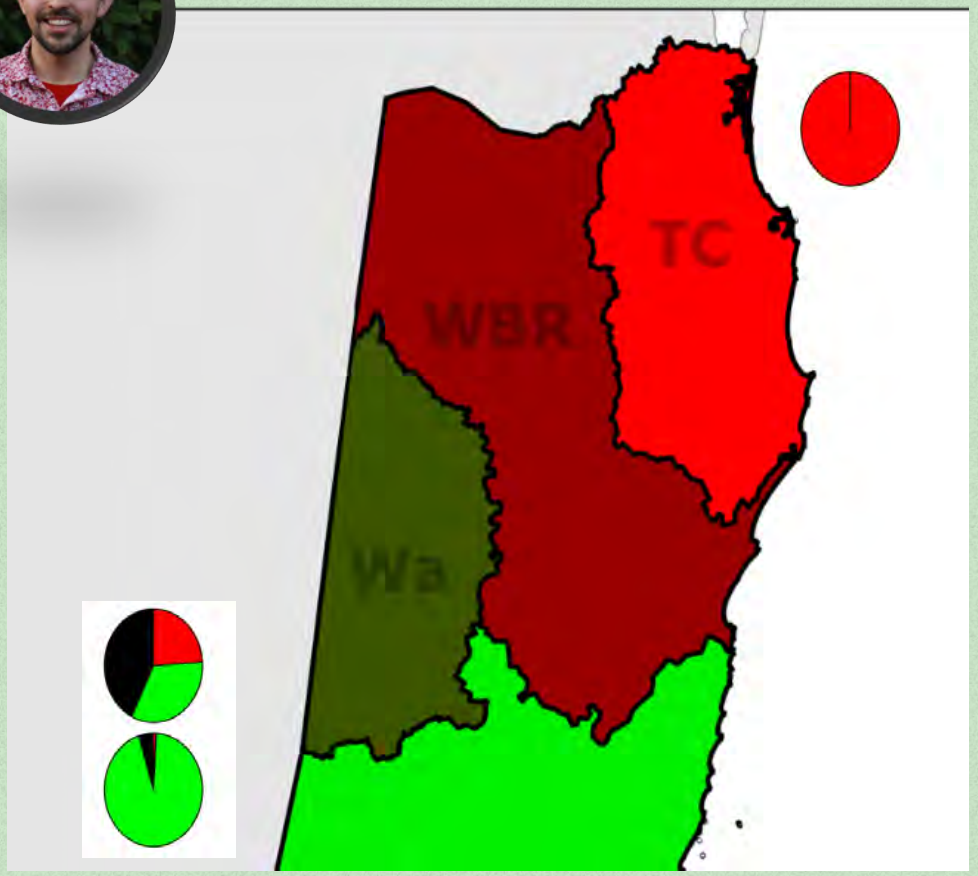
From ratites to rats: the size of fleshy fruits shapes species' distributions and continental rainforest assembly

Maurizio Rossetto[1,2], Robert Kooyman[1,3], Jia-Yee S. Yap[1,2] and Shawn W. Laffan[4]

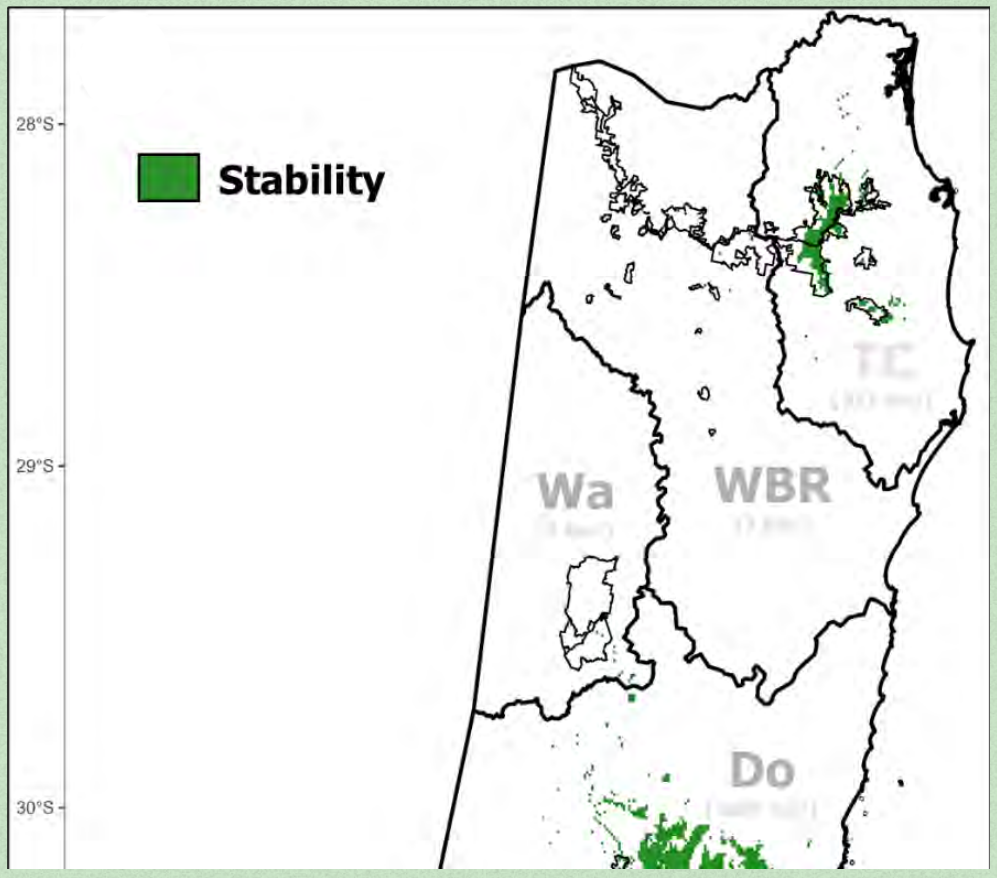
Poorly dispersed species cannot recolonise disjunct habitat.



Persistent refugia vs. recolonised areas – landscape dynamics



Genetic divergence and gene flow differentiates ancestral from admixed



Starting assemblage

Stressor / selective filtering

Simplification

Size reduction

Population-level divergence

Isolation

Suitable conditions return

Re-expansion of survivors

New arrivals

Connectivity increases diversity

Selective filtering - Functional

New assemblage

New areas

Selective filtering - Environmental

Starting area

Restart the process from different starting assemblage

Starting assemblage

Stressor / selective filtering

Simplification

Population-level divergence

Starting area

Size reduction

Isolation

Suitable conditions return

Re-expansion of survivors

New arrivals

Connectivity increases diversity

Selective filtering - Functional

New assemblage

New areas

Selective filtering - Environmental

WE SHOULD BE HERE

Starting assemblage

Starting area

Stressor / selective filtering

Simplification

Size reduction

Population-level divergence

Isolation

BUT WE ARE HERE

Suitable conditions return

Re-expansion of survivors

New arrivals

Connectivity increases diversity

Selective filtering - Functional

New assemblage

New areas

Selective filtering - Environmental

Starting assemblage

Starting area

Stressor / selective filtering

Simplification

Size reduction

Population-level divergence

Isolation

Natural processes are no longer possible

Suitable conditions return

Re-expansion of survivors

New arrivals

Connectivity increases diversity

Selective filtering - Functional

New assemblage

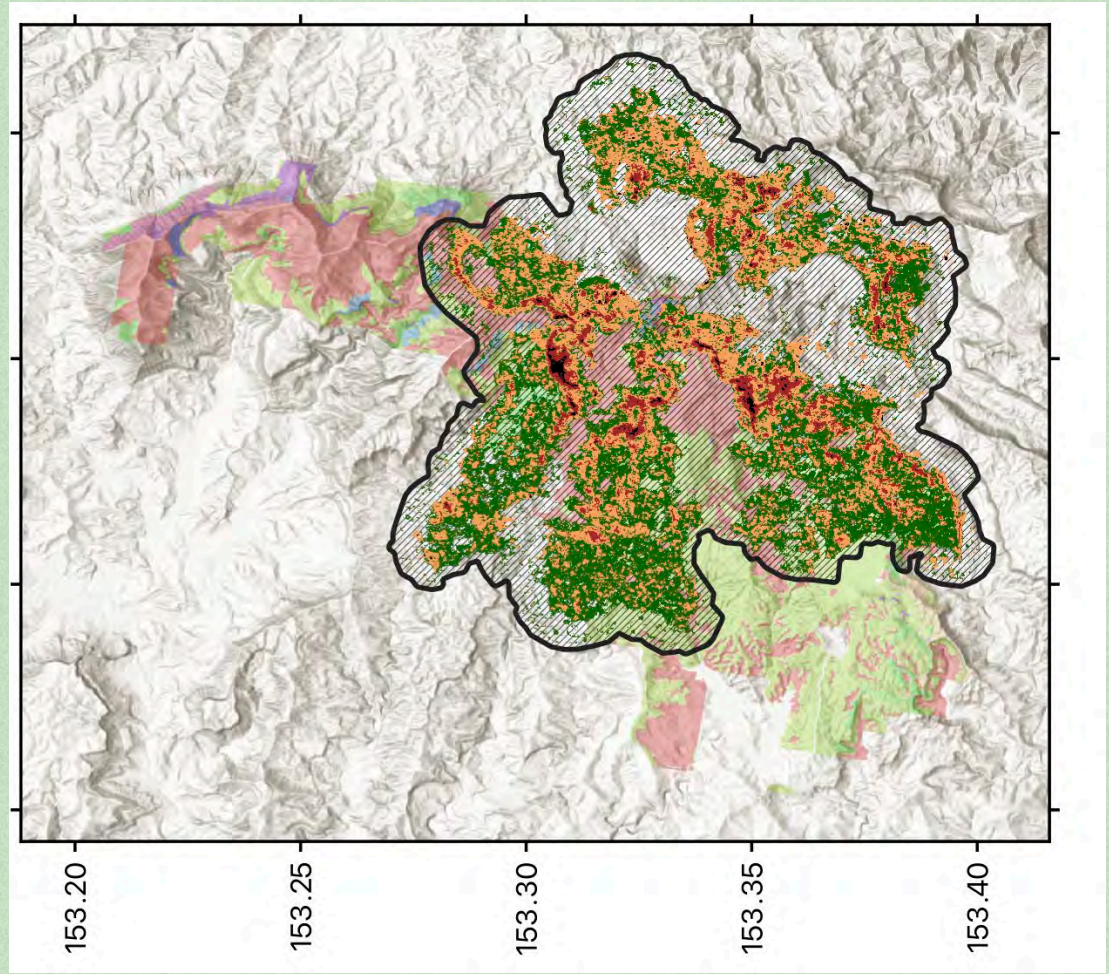
New areas

Selective filtering - Environmental

Active management is needed

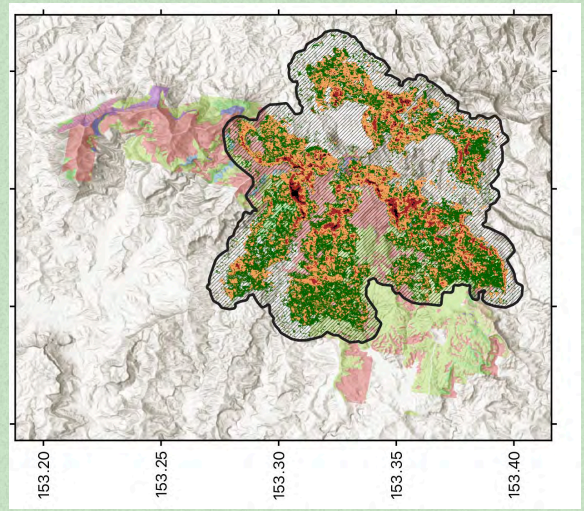

Genomic Knowledge
and Managing Change

Genomic metrics – quantifying risk

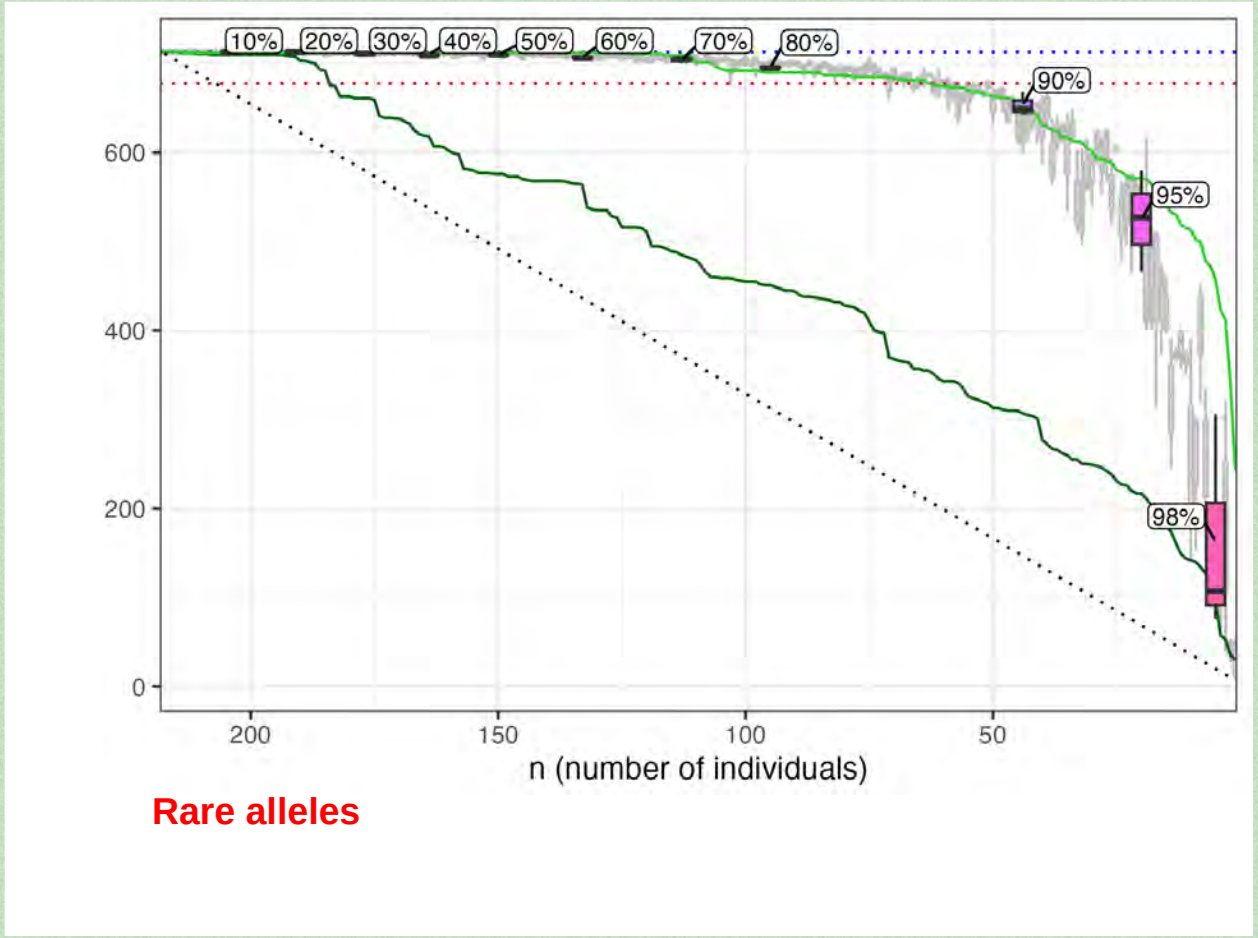


- Loss of biodiversity:
  - Where could the most irreplaceable evolutionary diversity be lost?
  - What disturbance scenarios would have greatest impact?

Genomic metrics – quantifying risk at population level

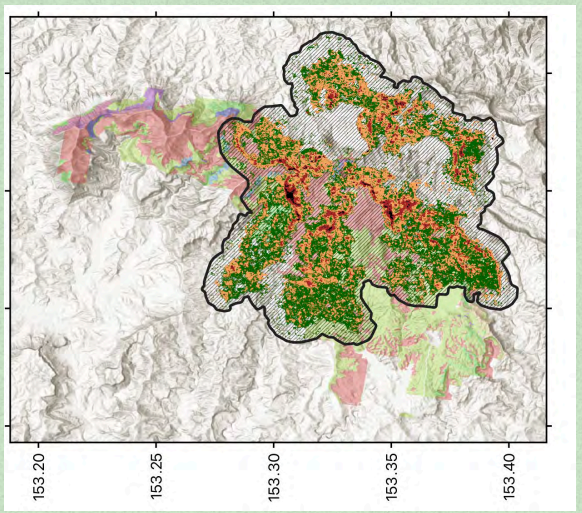


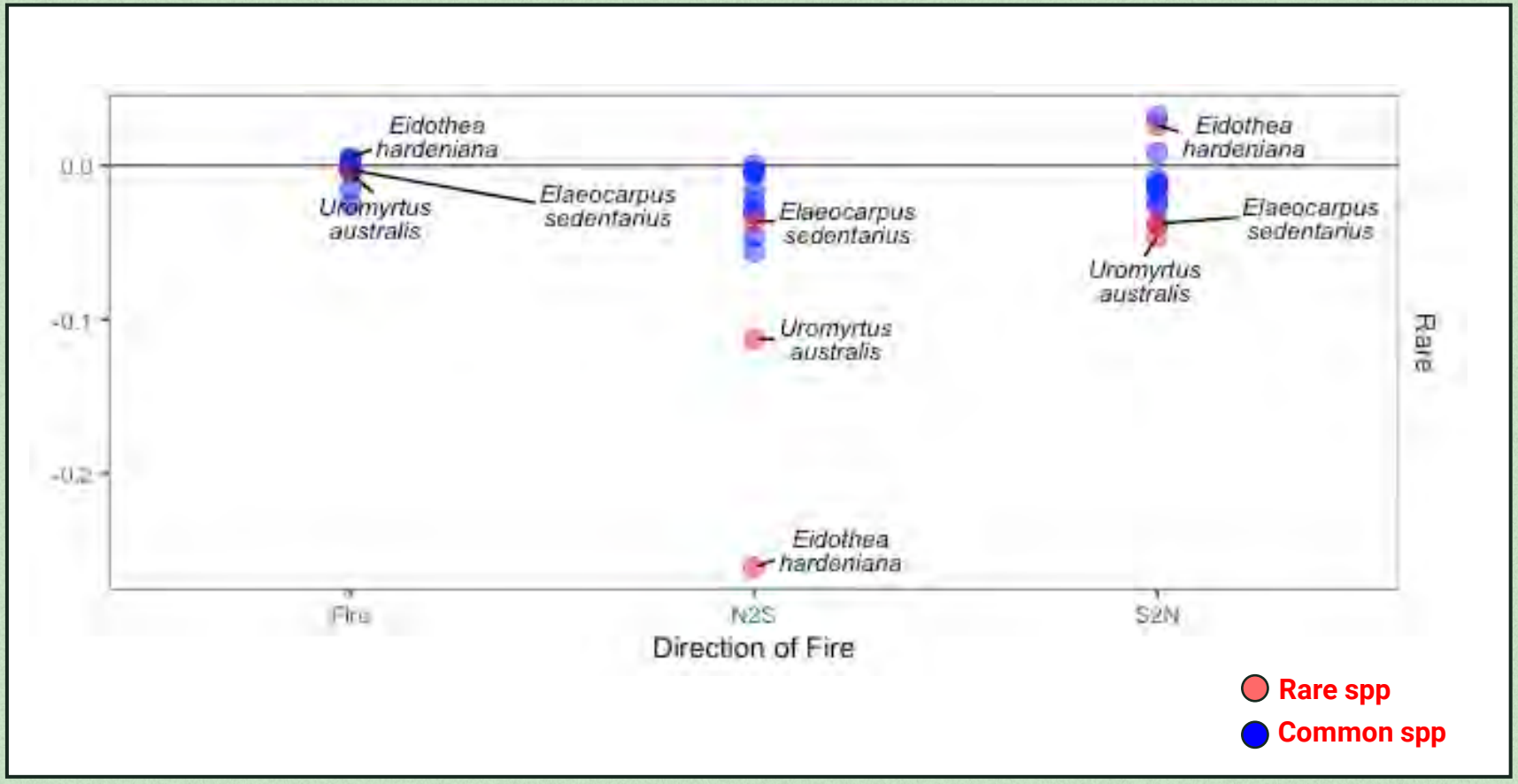
Eidothea hardeniana



Rare alleles

Genomic metrics – quantifying risk regionally





Conclusions

Highly dynamic rainforests

- Species and assemblages are highly dynamic and responsive to change.
- BUT current circumstance are extreme.

Genomics to the rescue

- Genomic Knowledge Infrastructure identifies evolutionary patterns and supports applied actions.
- EASILY accessible – prioritise as a management tool.

Opportunities for postgrad students and post docs with ReCER available now

BOTANIC GARDENS OF SYDNEY

Thank You

Funding & Collaborators

Australian Government
Australian Research Council
Australian Biological Resources Study
NSW Government
NSW Environmental Trust
Foundation of Friends of the Botanic Gardens
Big Scrub Rainforest Conservancy
HSBC
NSW Government SAVING OUR SPECIES

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