Commonwealth Environment Research Facilities
Marine and Tropical Sciences Research Facility

Impacts and Achievements of the MTSRF

Copy of abstract and presentation given at the 2010 Annual Conference of the Marine and Tropical Sciences Research Facility (MTSRF)
http://www.rrrc.org.au/news/2010_conference.html

Showcasing the Australian Government's investment in the MTSRF for improved sustainability of the North Queensland region, and Australia

18-20 May 2010
Pullman Reef Hotel & Casino
Cairns, North Queensland

Reef & Rainforest RESEARCH CENTRE

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

Abstract

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The roles of invasive species in tropical fragmented landscapes

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The lowland rain forest communities of Queensland's Wet Tropics are amongst the most fragmented communities in the bioregion, occupying marginal habitat in a mosaic of broad-acre agriculture, urban and peri-urban development and transport corridors. Fragmentation has occurred in the past 120 years, with much clearance in the past 50 years, so most fragments retain core structural and floristic indicators of their former forest type. Isolation, edge effects and continued anthropogenic modification have led to changes in recruitment patterns and species mixtures, and the addition of invasive species, and these effects are likely to be exacerbated under current management and future scenarios. We looked at the floristic composition, both native and exotic, and at measures of ecosystem health in fragments of different age, size and isolation in the coastal floodplains of three major Wet Tropics rivers. Species were categorized by up to 14 functional traits relating to recruitment requirements, growth rates, ecophysiology and reproductive behaviour, and by phylogenetic considerations and their status as either native or exotic. We discuss the decline trajectories of fragmented rain forest in terms of their biotic demise and their loss of functional groups, and discuss the role of invasive species in either facilitating declines or compensating for them in terms of replacing functional groups. We also discuss how this knowledge might be utilized in building resilience against future change into restoration or rehabilitation plantings.

The roles of invasive species in tropical fragmented landscapes

DJ Metcalfe
CSIRO
18 May 2010

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Outline

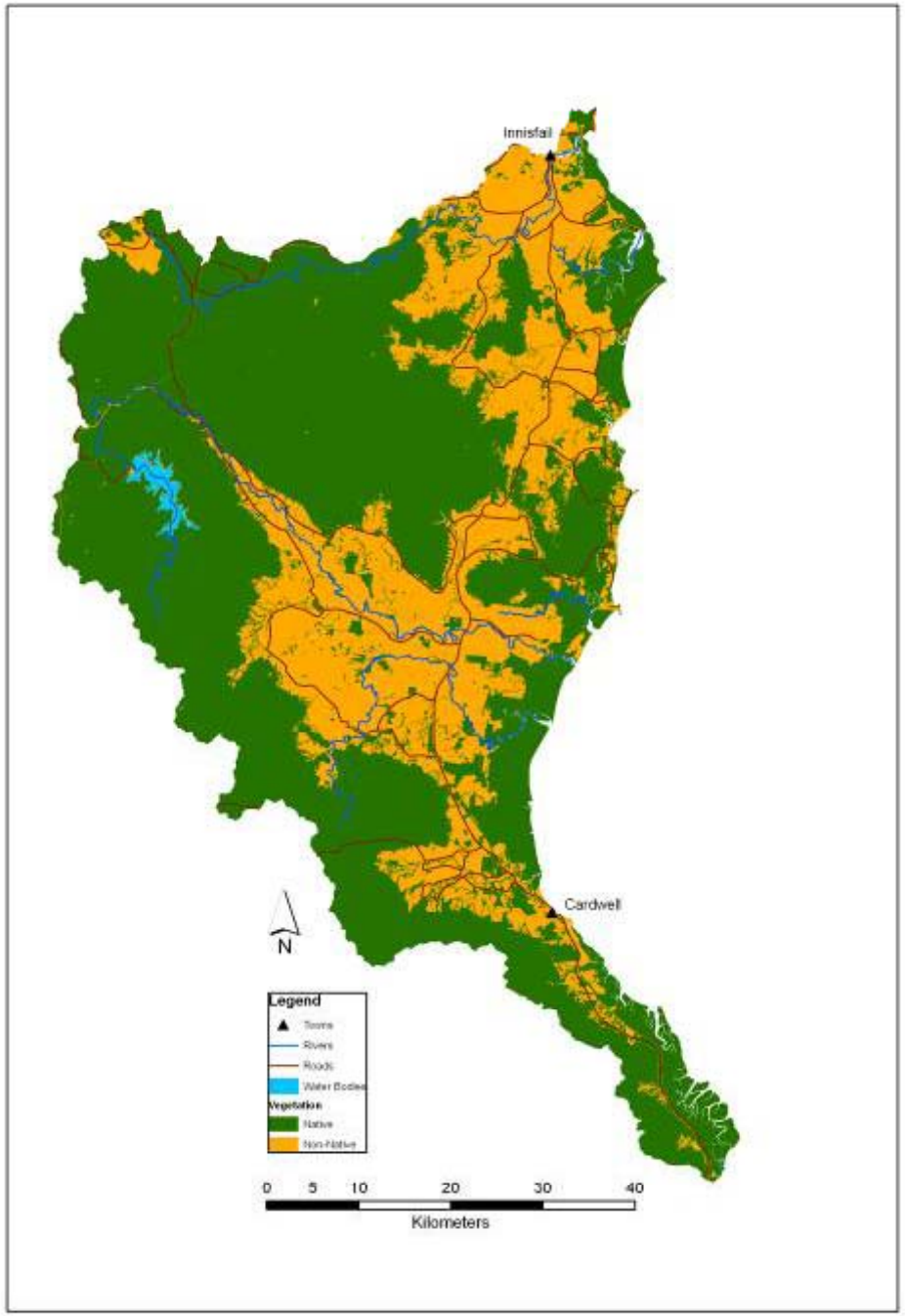
- Causes and impacts of fragmentation
- Role of invasive species in fragmentation-linked declines
- Management of invasive species
  - Identification
  - Prioritisation
  - Management options
- Potential role of invasive species in landscape management

Wet Tropics' fragmentation

- Aboriginal habitation c. 30,000 years
- European establishment 1870s onwards
  - Timber, mining, sugar, dairy, etc.
  - Soldier-settlements 1916-1920s
- End of clearing rainforest for agriculture in 1960s
  - World Heritage listing in 1988
- Changed pattern of fragmentation in last 20 years
  - Enlargement key infrastructure corridors
  - Increased urbanisation
  - Community revegetation projects & corridor planting

Contested landscape

- Coastal lowlands outside protected area
- Main communication corridors in lowlands
- Increased urban development along these corridors
- Intensive agriculture



Data collection

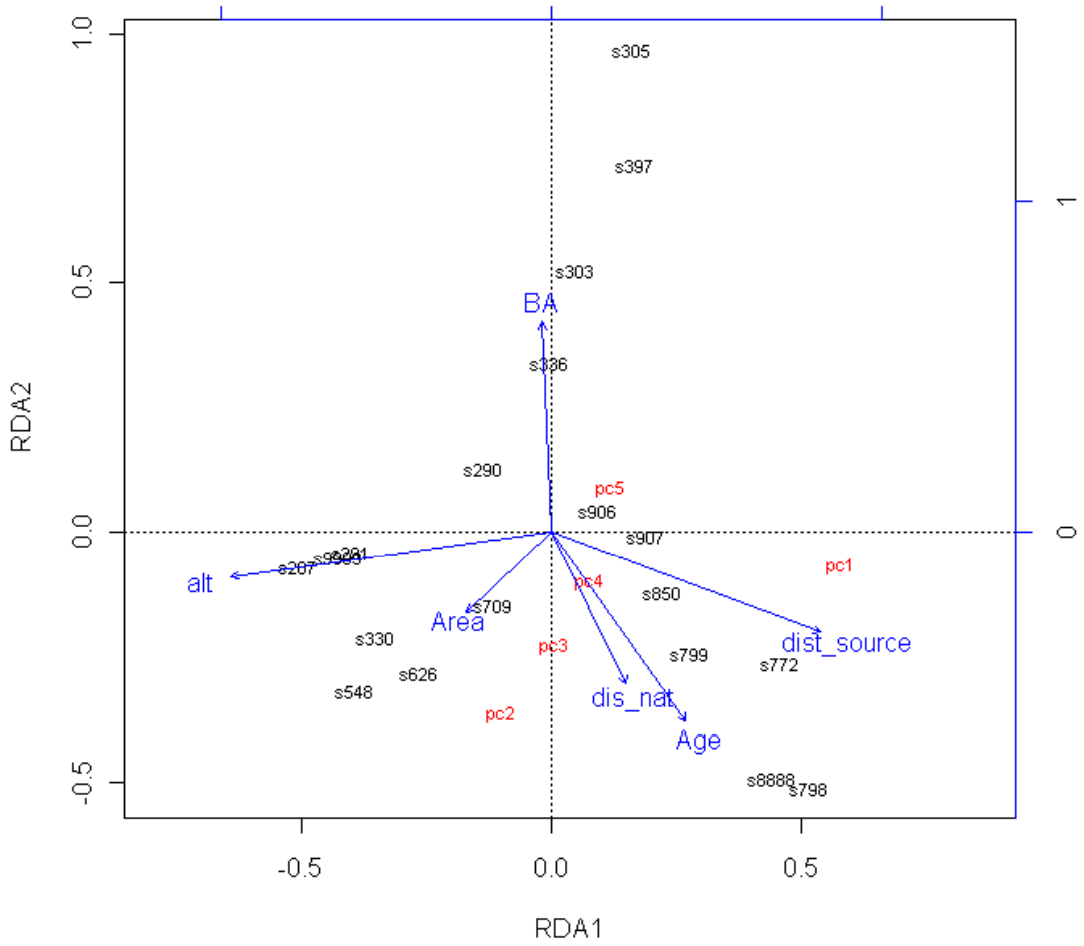
- Impact fragmentation assessed in terms species and functional traits
- All vascular plants recorded in 20 x 50 m plots, plus dbh stems >10 cm, tree height, numbers of seedlings, saplings & vines
- Fragments ranged from 1-55 ha, 20 – 70 yrs isolated, and separated from continuous forest by <100 - >3000 m
- All fragments mapped as the same forest type, with minor altitudinal differences from 5-50 m asl
- Fragment ages determined from aerial photos & maps

Functional traits

- Approach used to group taxa which carry out a similar role in their environments, regardless of taxonomic affiliations
  - effect traits (those which affect their environment, such as height, specific leaf area and wood density),
  - response traits (traits which are a response to features of the environment, such as pollination syndrome, life form and clonality)
  - some traits may act as both effect and response traits (such as nutrient uptake strategy)
- Enables an assessment of the functional richness of an environment to be assessed, and inferences about ecosystem resilience and functional redundancy to be made

Differences in fragment species composition

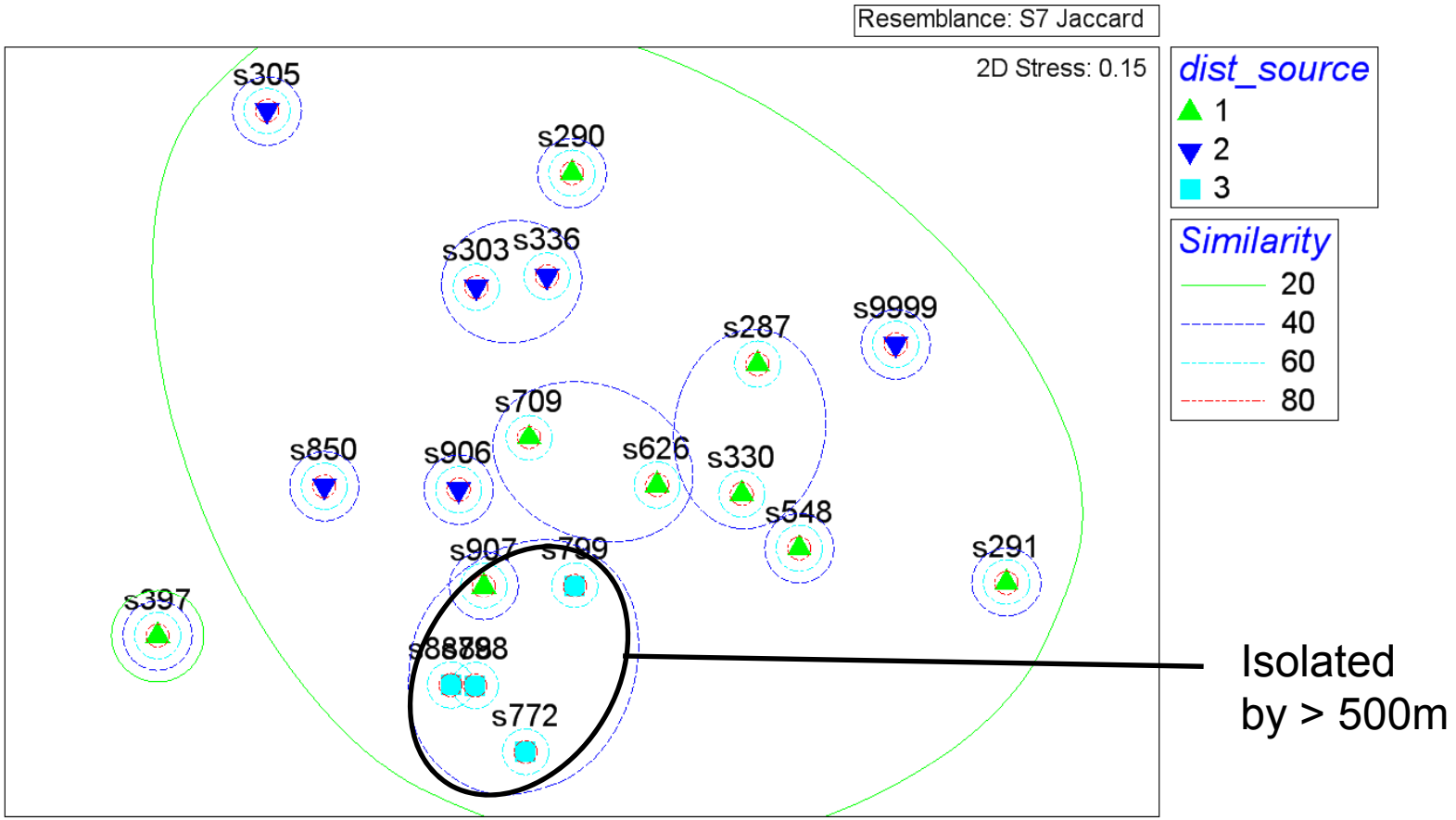
- Age has no effect
- Size has no effect
- Isolation distance significantly impacts on species composition



Species assemblages, all life stages

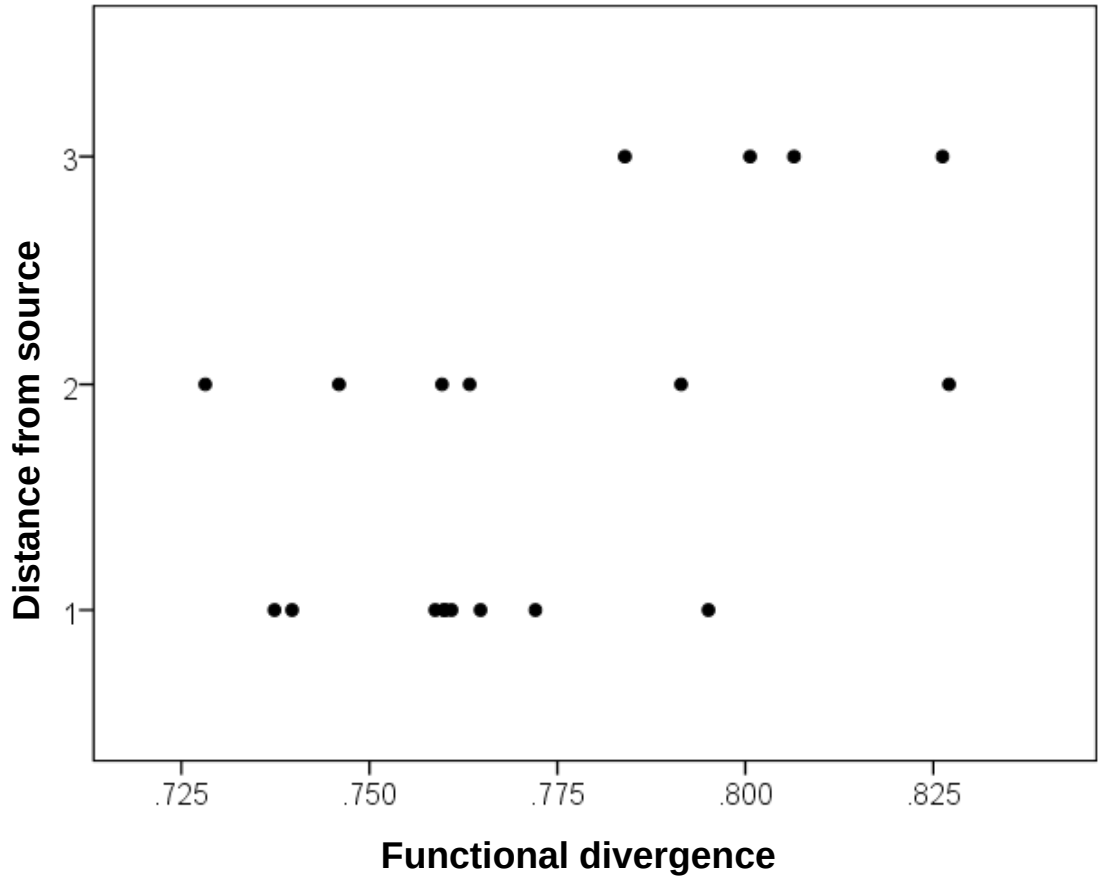
Effect of isolation distance on species mix

- Sapling community becomes more similar as fragments become more isolated



Effects on functional diversity

- Functional divergence is greater in trees in more isolated fragments – homogenisation of fragments near continuous forest



divergence is low when most species have functional traits that are close to the centre of the functional trait range. FDiv is highest when all the species are on the convex hull and at equal distance to its centre of gravity

Role of invasive species

- Weeds are present at all sites, principally at edges
- Inclusion of exotic species does not alter groupings

- Weeds are not contributing novel functional traits
- Weed taxa are predominantly herbs and vines

- Weed functional groups are occupying ‘under-utilised’ space

Implications of results

- Fragments are insufficiently old to see decline in species diversity in overstorey
- Isolation distances are sufficient, though, for seed dispersers to be impacting future composition
  - Recruits show trend for increasing similarity in species composition in more isolated fragments as diversity reduced
  - Canopy showing increasing homogenisation of traits in less isolated fragments as common species dominate
- Birds & bats are moving common species from continuous forest into fragments
- Rarer species, which contribute to species, functional, substrate and phenological diversity, becoming rarer
- Invasive species filling in physical but not trait space

Invasive species

How can we use our understanding of seed dispersal, recruitment ecology and the impact of disturbance to better manage invasive species?

1. assess the pool of invasive species,

Assess the pool of invasive species

	Species		Genera		Families	
	No.	∑%	No.	∑%	No.	∑%
Total	**2141**	**-**	**855**	**-**	**188**	**-**
Exotic	206	8.8	122	12.5	10	5.1
Total including exotics	2347	-	977	-	198	-

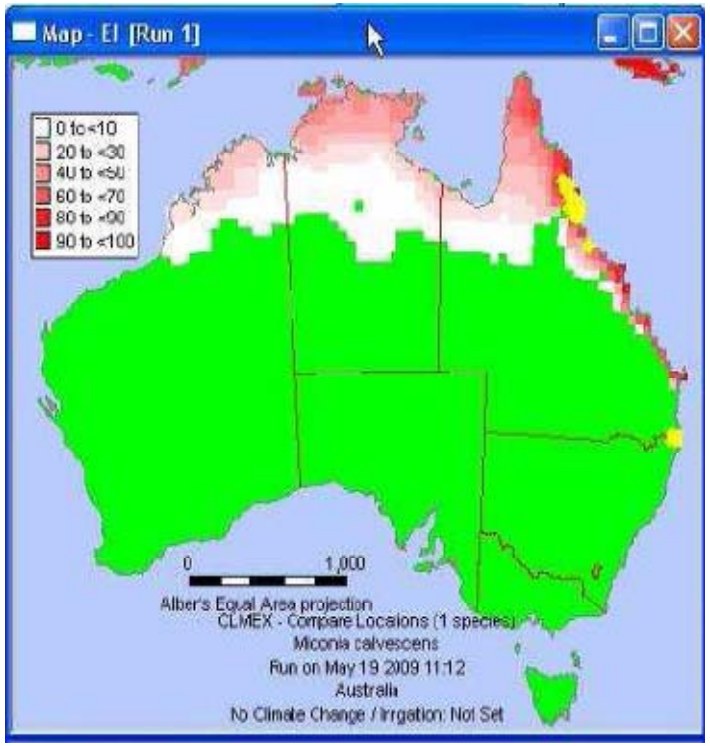
Prioritise species in terms of current impact

- In Australia, weed species are classified as
  - Weeds of National Significance
  - Species of concern at State level (classes 1-4, etc.)
  - Priority species at broad regional scale
  - Target species at individual city or shire level

- Weeds are also classified as Environmental or Agricultural in impact
  - Agricultural weed research largely funded by industry bodies
  - Environmental weed research funded through public purse

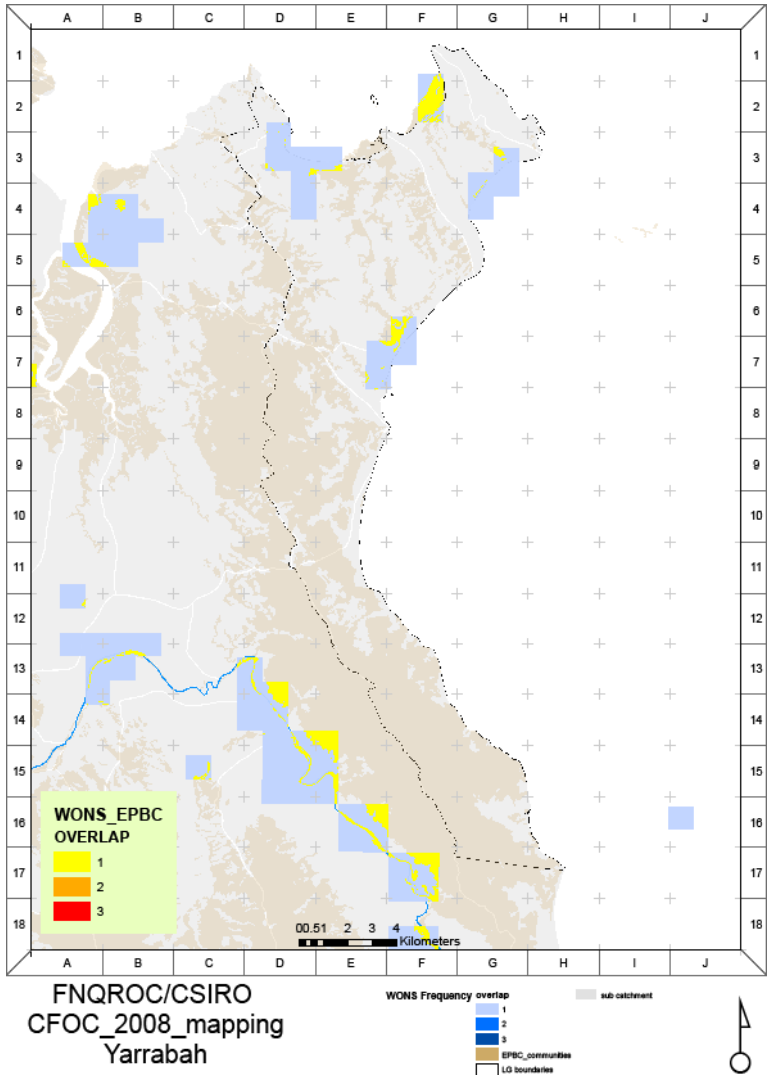
Prioritise species based on future impact

Growing recognition that weeds need to be managed in light of changing climate scenarios



Weed mapping for prioritisation

- Accurate weed mapping can help prioritise on-ground activities
- here have overlaid weed mapping and threatened species mapping to highlight key threat areas
- similar mapping would be possible for weeds in combination with other spatially-mapped resources with ascribed values



Think about management options

- Prevention
- Eradication
- Containment
- Control
- Acceptance

Invasive species in landscape management

- All invasive species are not the same
  - Some are significant threats
  - Some pose little or no threat, and are incorporated into the native vegetation
  - Some may provide useful or beneficial roles in landscape management
- These roles change with environmental context
- These roles are likely to change as changing climates alter community relationships
  - We have little understanding of the directions of these changes

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Thank you

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