Combining Approaches to Multi-Species Viability Assessment

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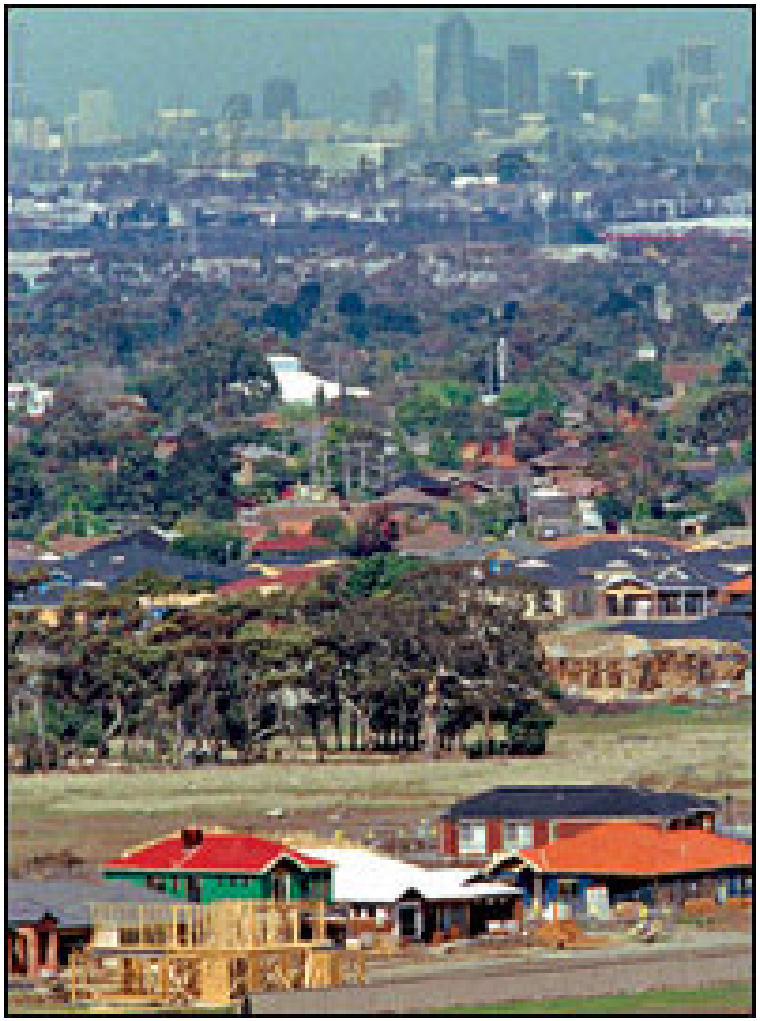
RMIT UNIVERSITY

Re-Imagining the Australian Suburb

- Inter-disciplinary umbrella project at RMIT University, Melbourne, Australia.
- Looking at sustainability and urban development:
  - **Biodiversity**
  - Local government and community governance
  - Eco-homes / Eco-Footprint
  - Sustainable water systems
  - Building lifecycle assessment
- **www.re-imagining.org.au**
- Industry partners:



Industry Partners

State Government Victoria

Port Phillip and Westernport CATCHMENT MANAGEMENT AUTHORITY

HUME CITY COUNCIL

City of Whittlesea

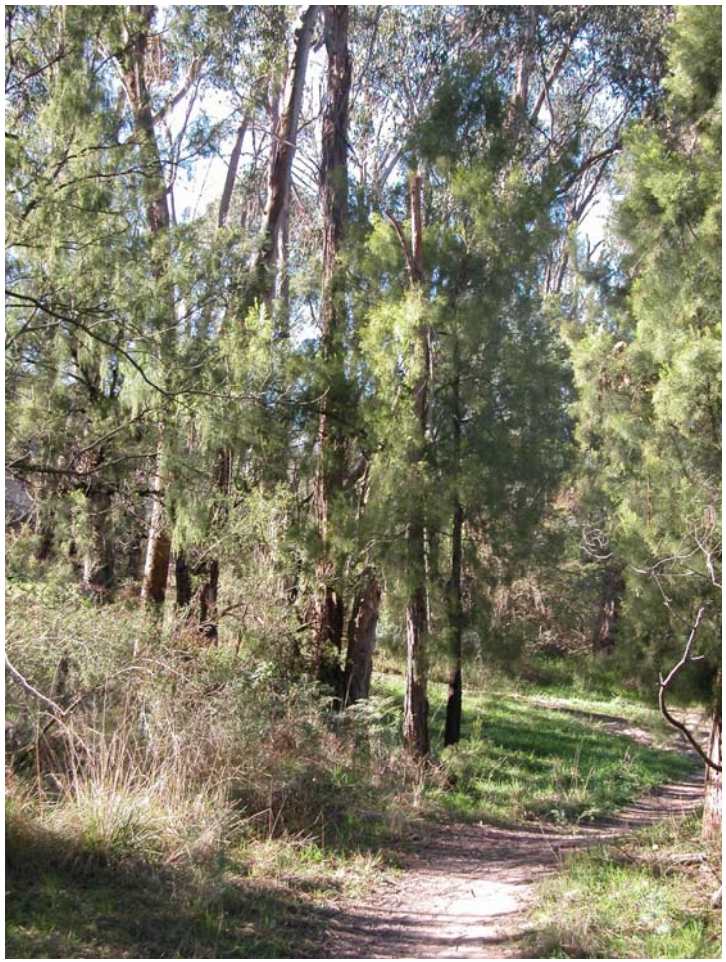
Stockland

Background and Aim

- Number and size of urban areas is increasing.
- Over 50% of threatened spp occur in urban areas.
- Develop a framework that can use ecological knowledge in conservation planning for urban development.
- Help determine where and how much area needs to be managed for biodiversity.
- Provide information in a way that local councils / property developers can use.

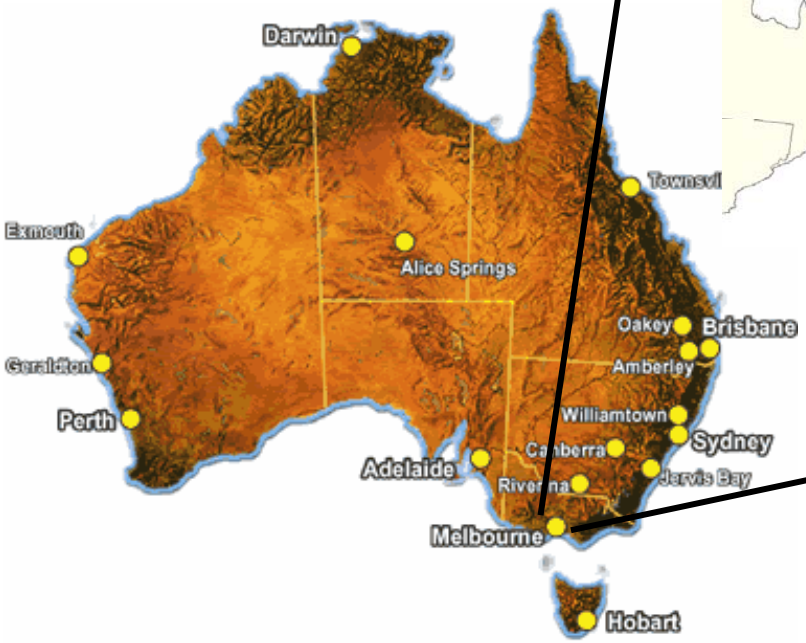
Conservation Planning

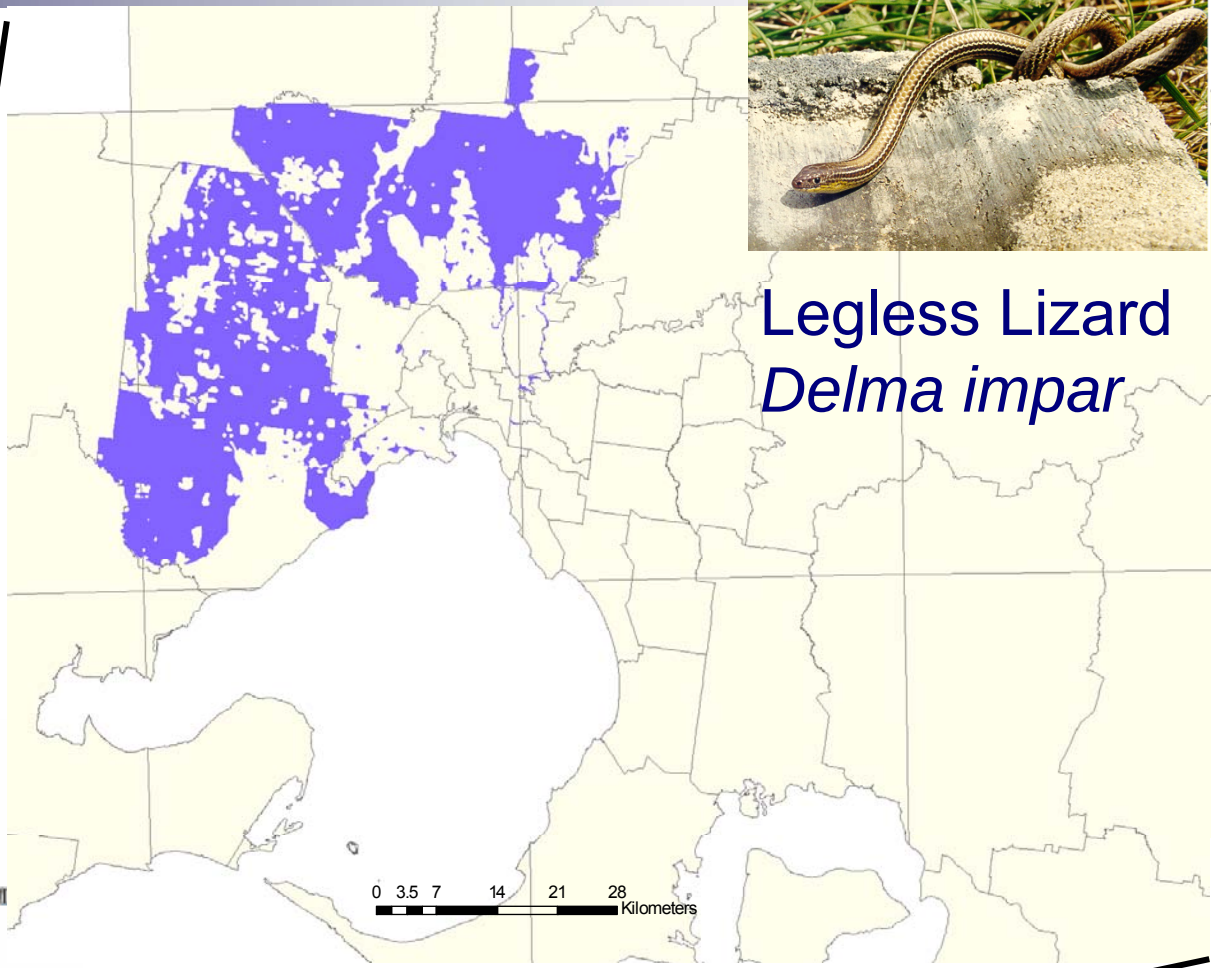
- Two core goals are conserving areas that are:
- Representative (*where*)- being able to represent the full range of biodiversity for a given region at all levels of organisation.
- Adequate (*how much*) – conditions are met such that individual species, communities and ecosystems have a "*good*" chance of long-term survival.
- Question: How to best achieve these goals given the limited threatened species data we have for Melbourne?



Threatened Species Habitat Maps

Matt White - ARI, DSE
Habitat maps for > 50 threatened spp.



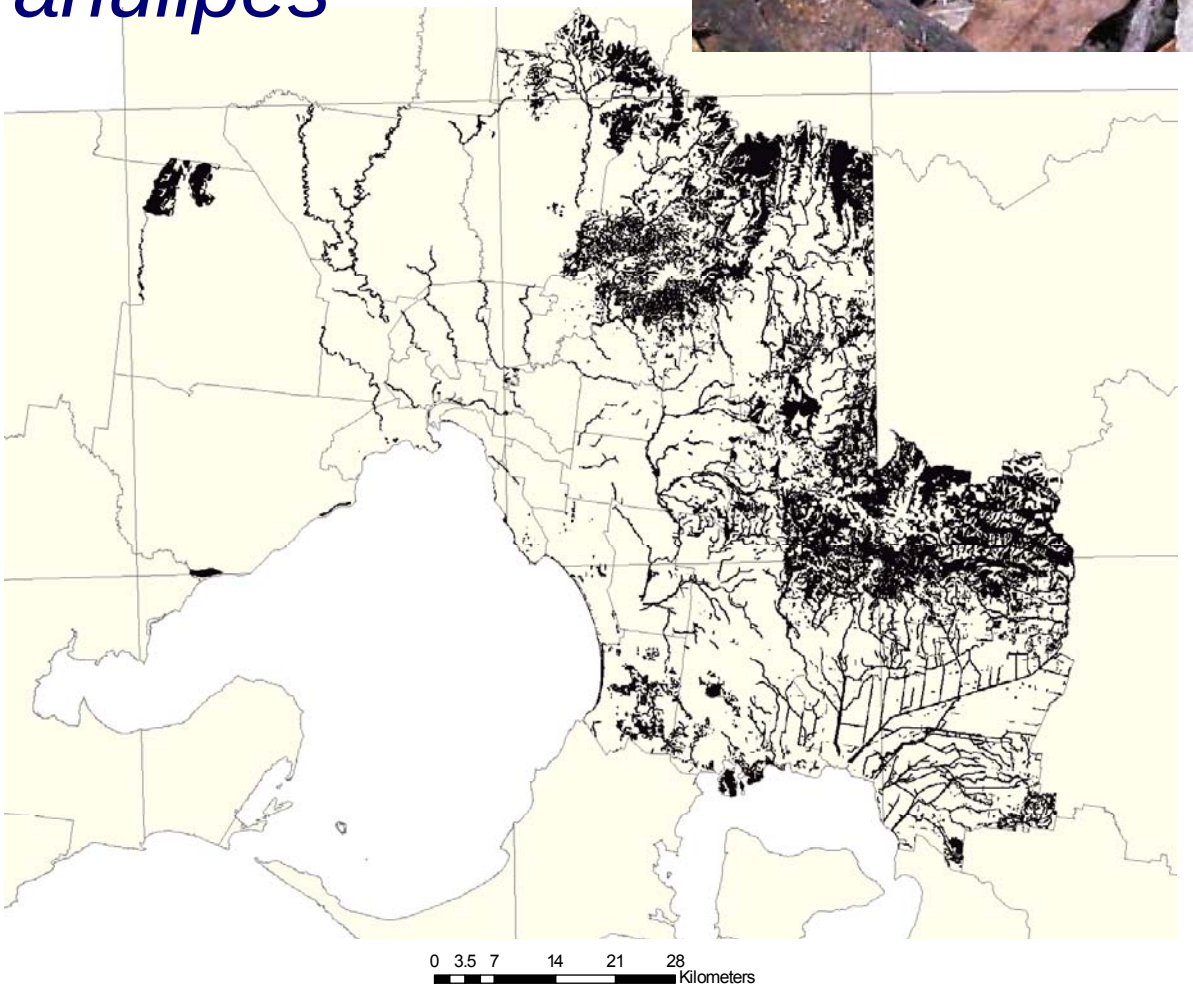


Legless Lizard
Delma impar

Habitat Map for the White Footed Dunnart, *Sminthopsis granulipes*

Habitat maps derived primarily from expert opinion and based on maps of:

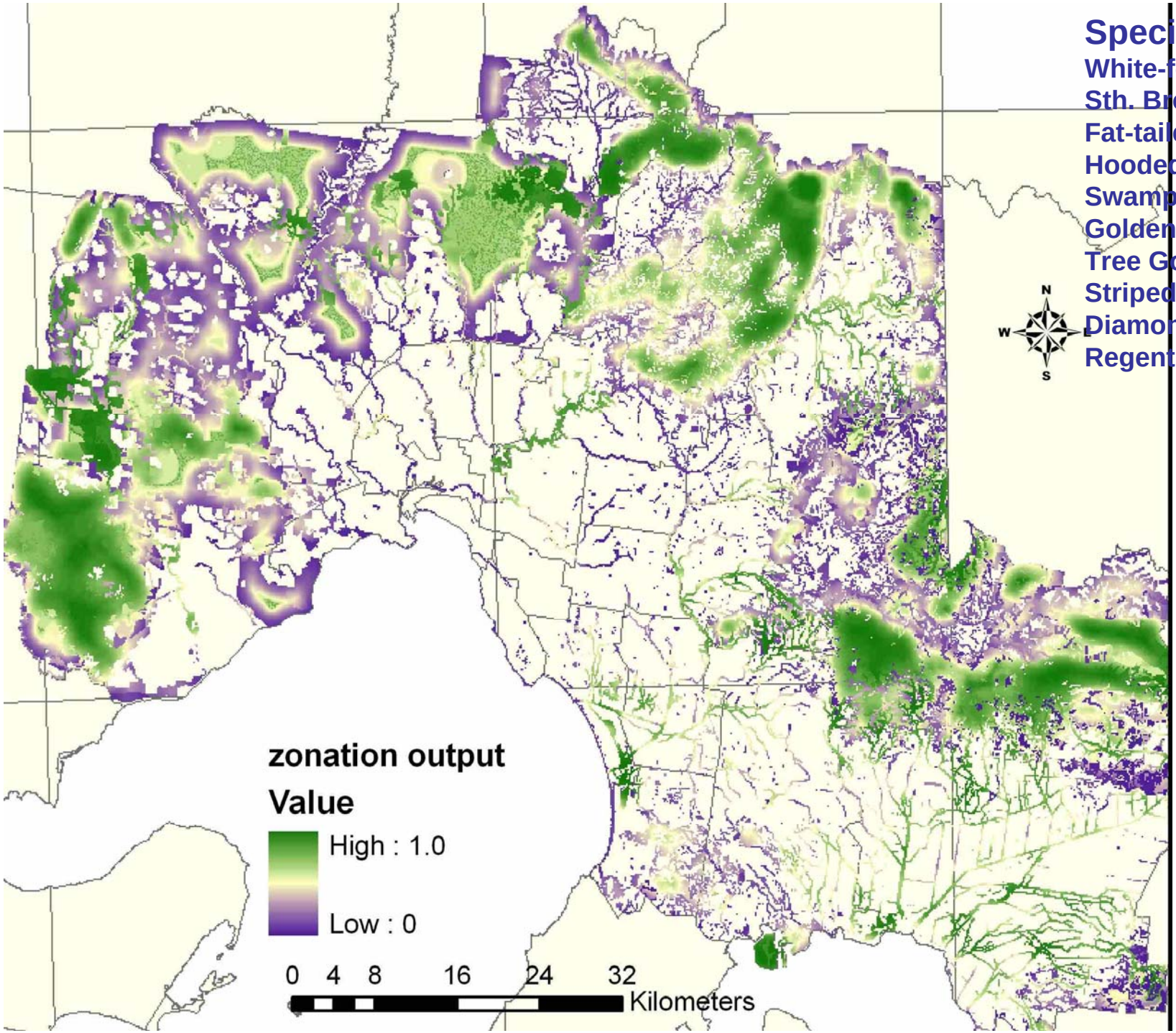
- Ecological vegetation types
- Land Use
- Hydrology



Representativeness

- Used habitat maps for 10 species
- "Top-down" approach using *Zonation* algorithm to develop optimised landscape scenarios.
  - produces a ranking of the landscape optimised to be **representative** all species;
  - while also selecting the most connected areas.
  - allows for species to be weighted relative to each other.
- Results in hierarchical zones of connected landscape where each zone will provide some habitat for all species.

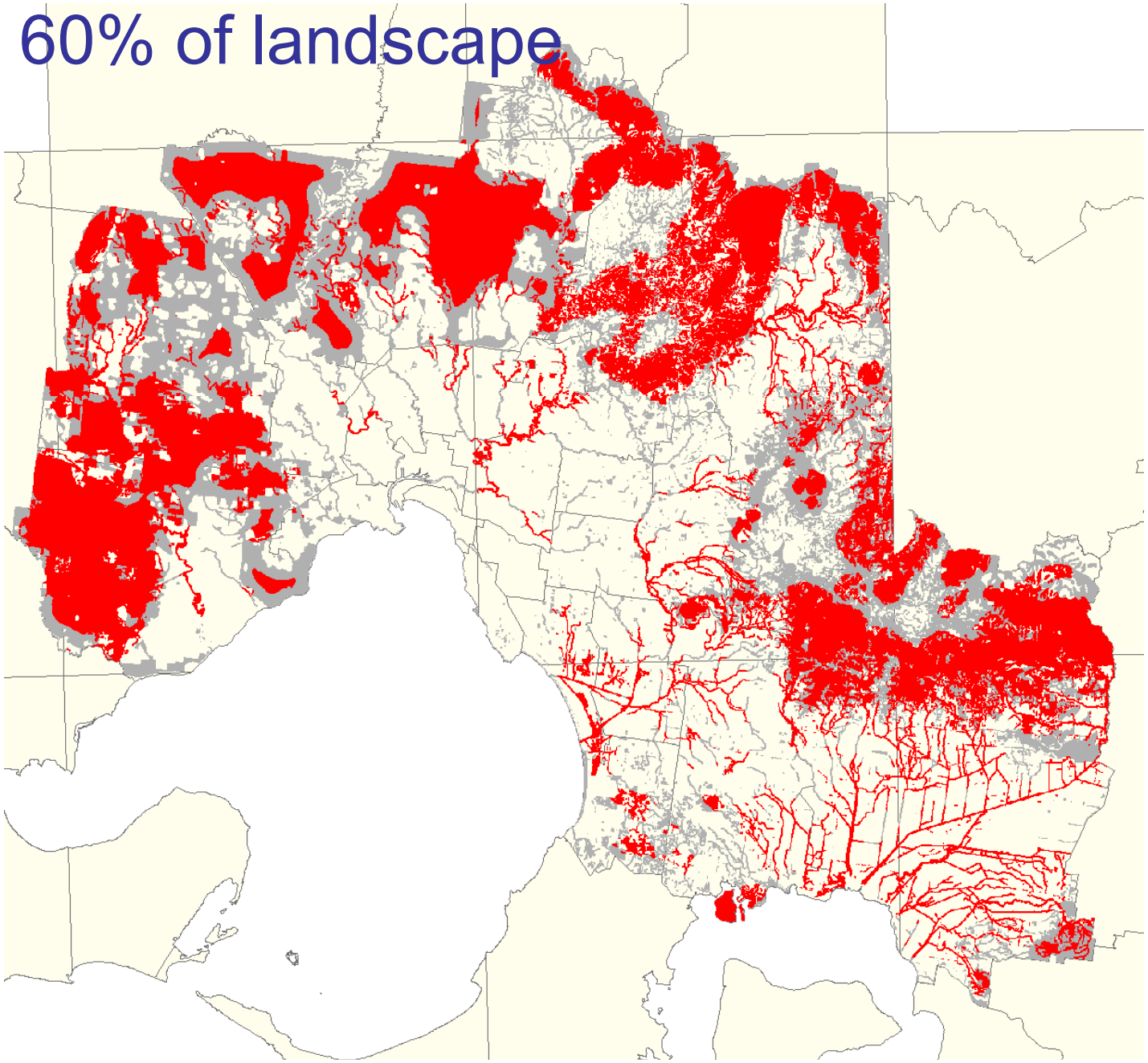
Orange Bellied Parrot *(Neophema chrysogaster)*
(from www.view.com.au/ watts/3-3.htm)



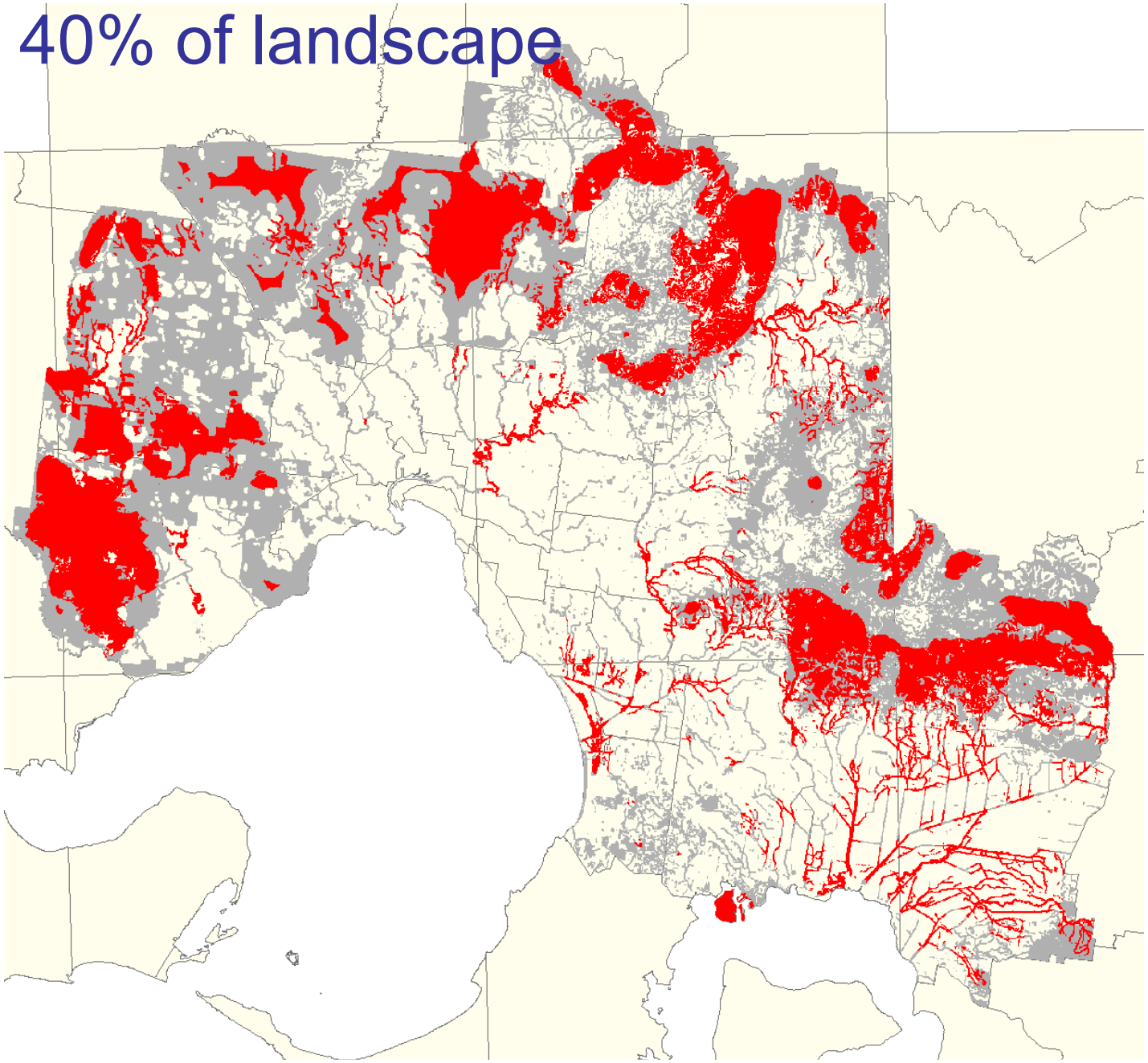
Species Used:

- White-footed Dunnart
- Sth. Brown Bandicoot
- Fat-tailed Dunnart
- Hooded Robin
- Swamp Skink
- Golden Sun Moth
- Tree Goanna
- Striped Legless Lizard
- Diamond Firetail
- Regent Honeyeater

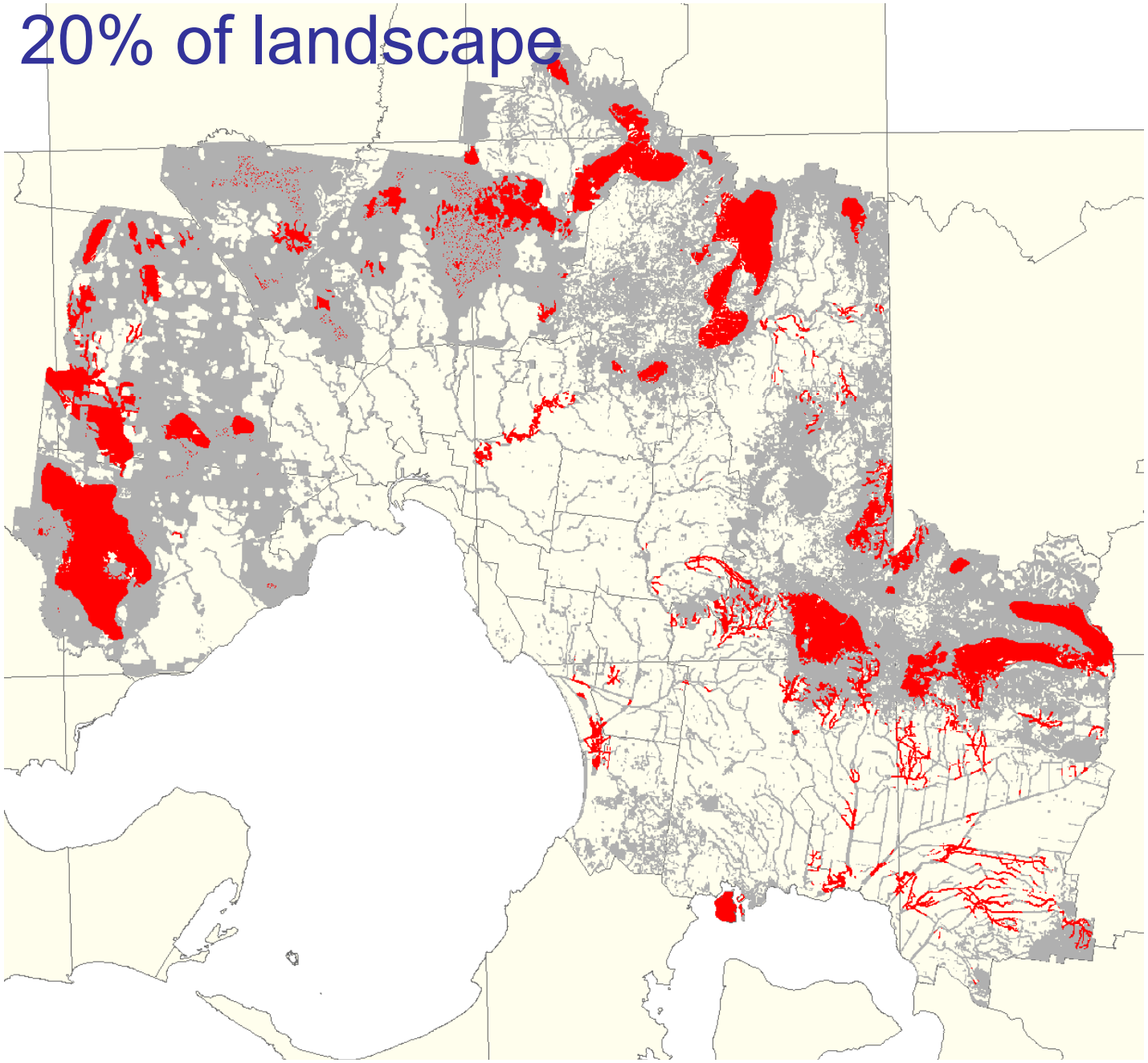
Top 60% of landscape



Top 40% of landscape



Top 20% of landscape



Incorporating Persistence?

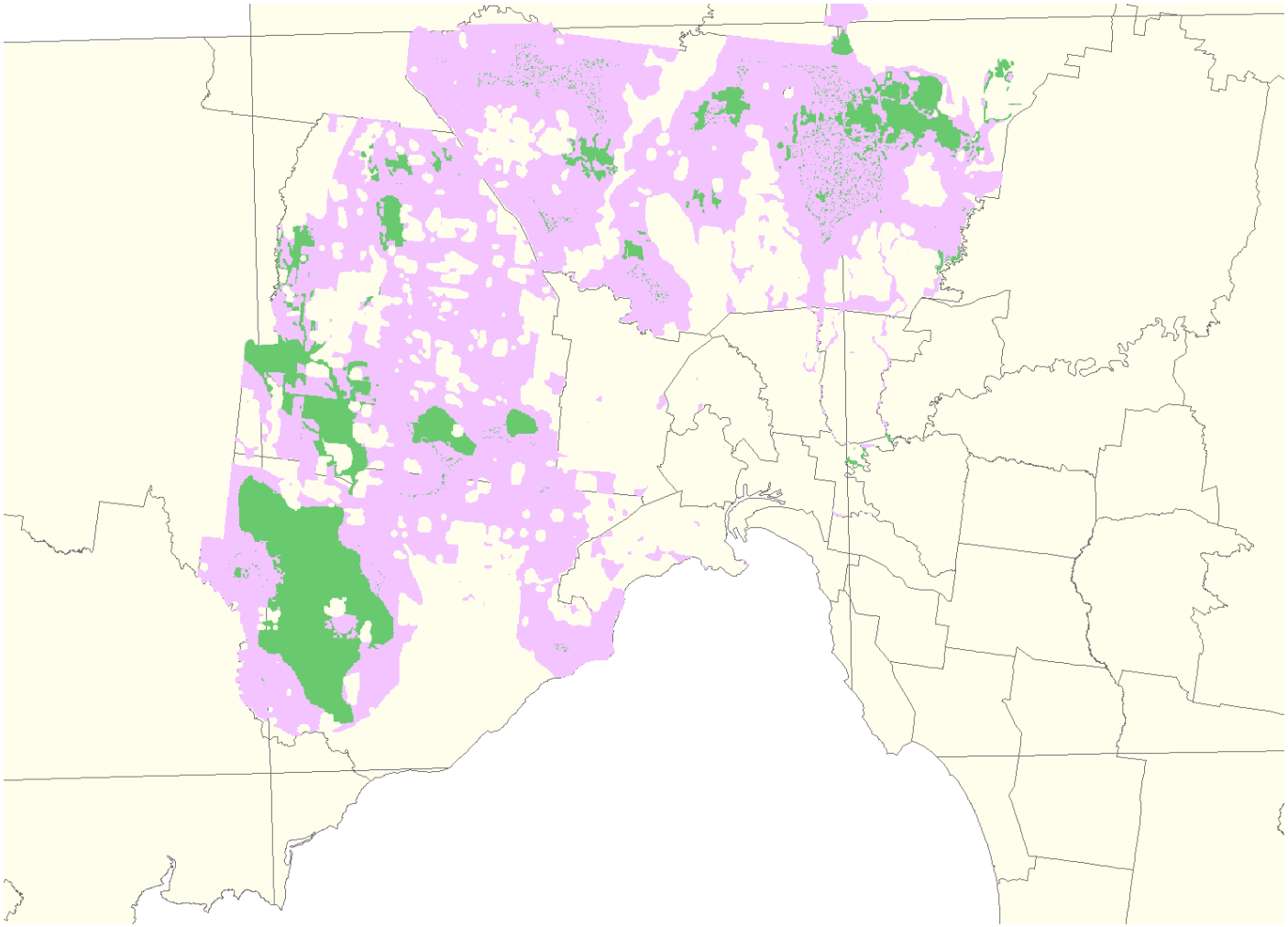
- Still need to address the "how much" question.
- Combine landscape level (spatial context) with single patch persistence requirements.
- Use a simple model for now, to develop methodology:
  - Minimum viable areas were estimated using a model developed by Possingham & Andelman (unpublished).
- Inputs: density, lifespan and trophic level (as a surrogate fro reproductive and survival variability).

Species	Area (ha)		
	Min	Mean	Max
Fat-tailed Dunnart	20656	28284	37947
White-tailed Dunnart	20656	28284	37947
Striped Legless Lizard	161	495	791
Tree Goanna	6200	14534	25562
SB Bandicoot	500	2795	7071
Diamond Firetail	500	1443	3536
Swamp Skink	200	387	3354
Hooded Robin	6455	25456	79057
Regent Honeyeater	6455	42426	94868

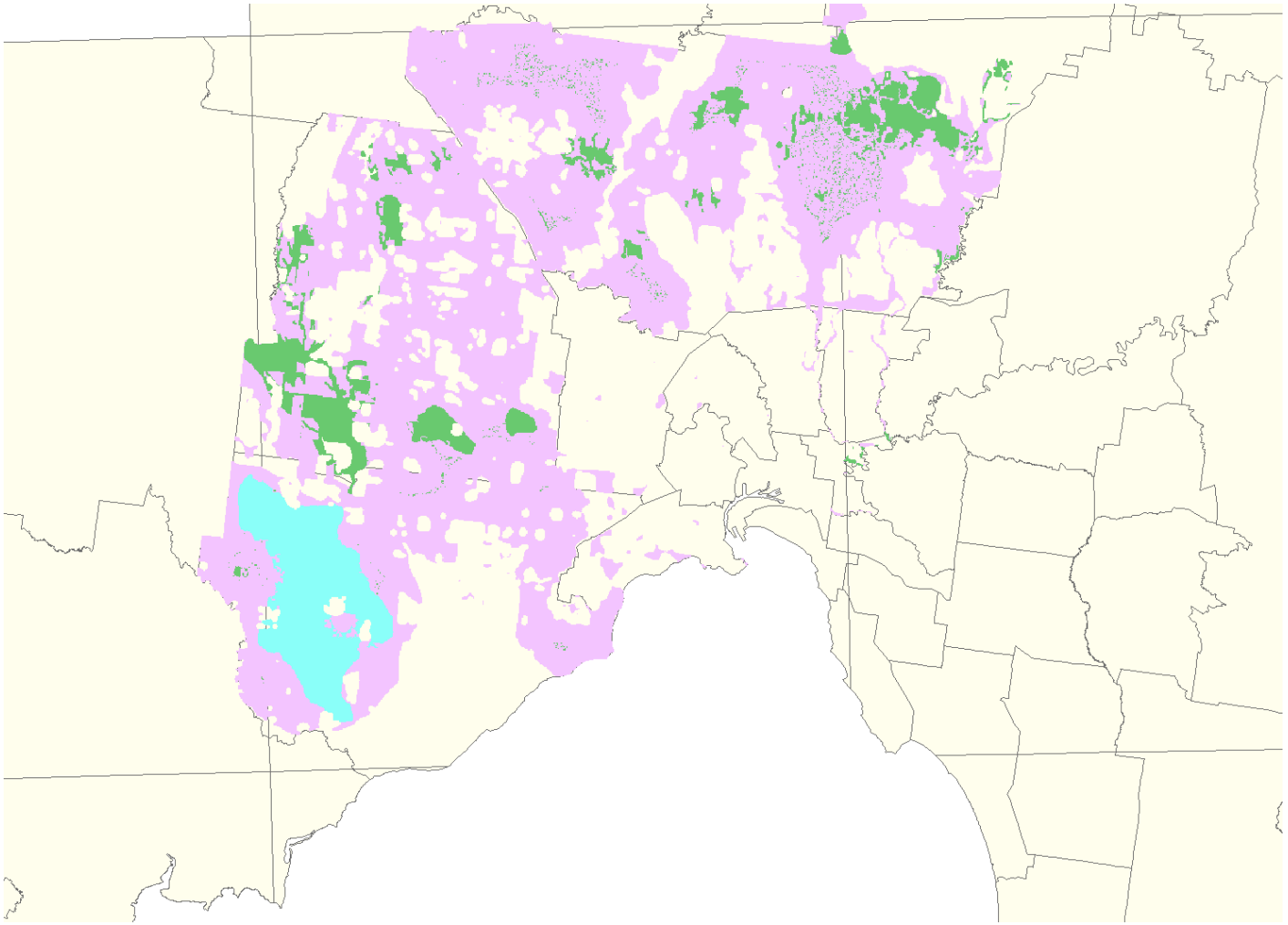
Assumption: there is no dispersal between patches.

A valid assumption for many spp if urban development occurs between patches?

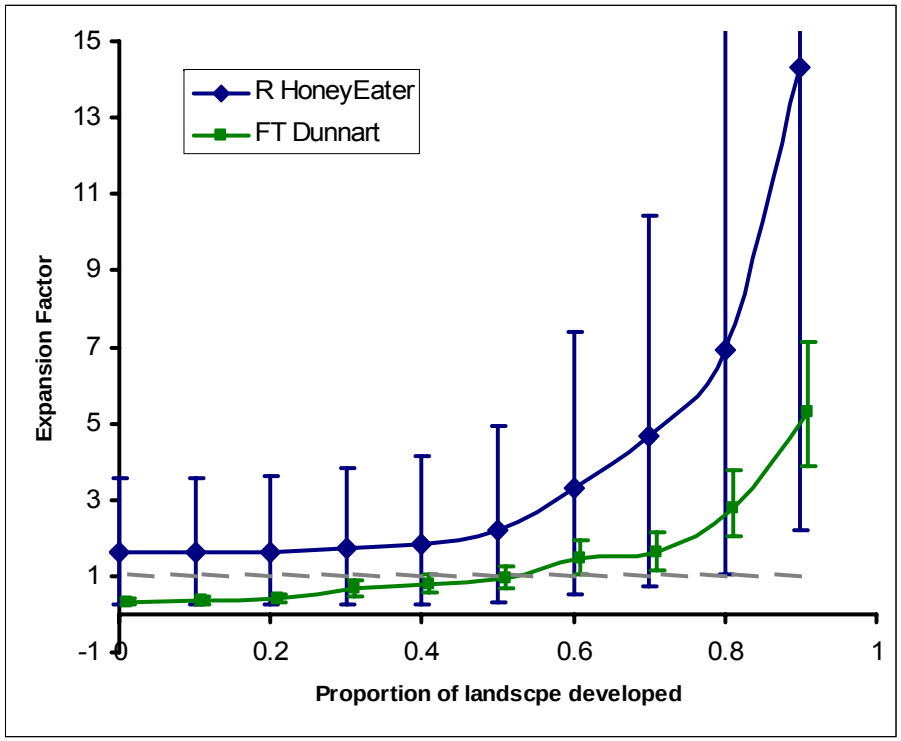
Fat-tailed Dunnart habitat that overlaps with the top 20% of landscape

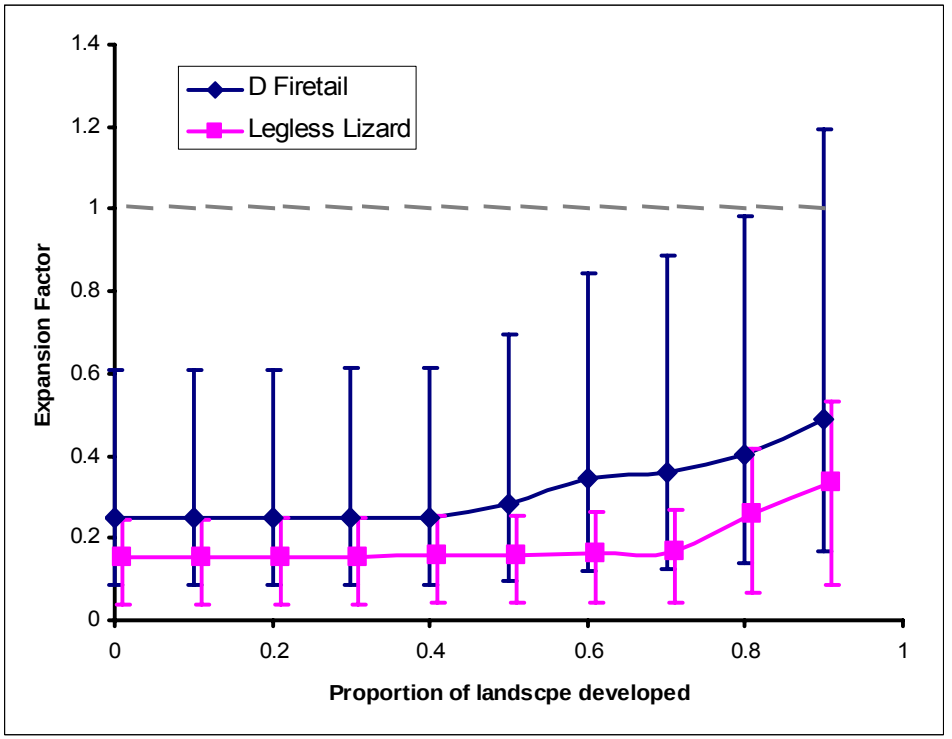


Fat-tailed Dunnart habitat that overlaps with the top 20% of landscape

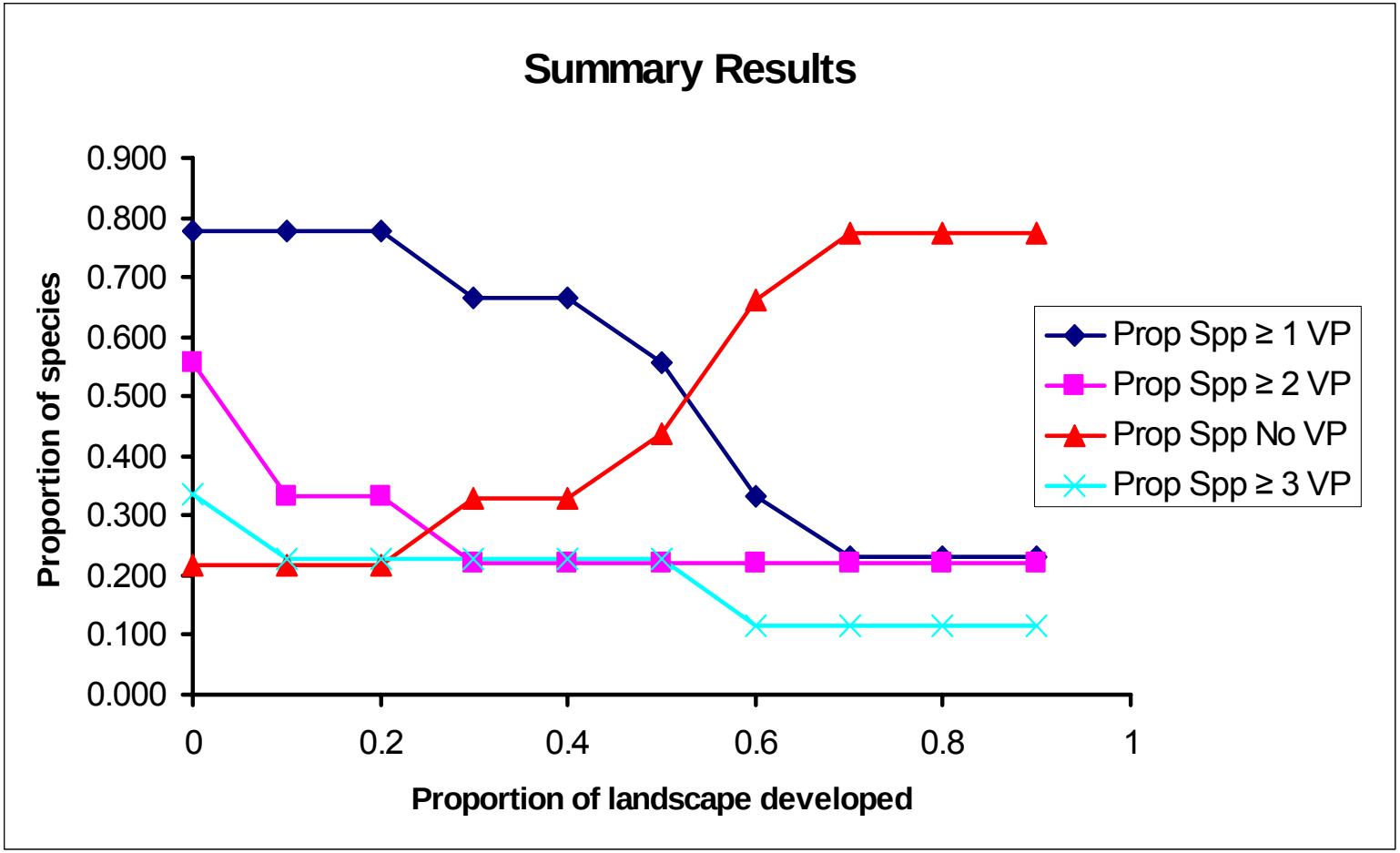


Results: Single Species





Results: Summary for all Species



Issues

- Method can be easily updated when new data is available.
- Currently, only have maps for threatened species.
- Method does not consider temporal order of management actions.
- Uncertainty
- Much of the land is privately owned. Need to develop strategies to manage biodiversity across different land tenures and political boundaries

Conclusions

- Initial phase of developing a framework applicable to urban fringe areas that:
  - incorporates spatial context
  - incorporates quantitative persistence requirements (very preliminary)
  - can be used with the limited available data for Melbourne
- Will probably need to manage a large proportion of areas predicted by the *Zonation* algorithm to have viable populations for most species.
- Some species may only have one viable patch.
- Some species may not be viable without revegetation or other management actions.

Thanks to…

- Matt White
- Sarah Bekessy
- Michael Black
- Jo Morcombe
- Brendan Wintle
- Alex Lechner

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Zonation cell value calculations

- The value of each cell is given by the terms:

$$\frac{qw}{Qc}$$

- This is calculated for each species.

- q = quality factor, determined from species data, or other factors
- w = weight
- Q = rarity of species
- c = “cost”

Minimum Area Calculations

$$A = \frac{1000\ T}{D\sqrt{L}}$$

- D = density
- L = Lifespan
- $1 \leq T \leq 10$ depending on trophic level

Species Used in Optimisation

- White-footed Dunnart
- Southern Brown Bandicoot
- Fat-tailed Dunnart
- Hooded Robin
- Swamp Skink
- Golden Sun Moth
- Tree Goanna
- Striped Legless Lizard
- Diamond Firetail
- Regent Hon