Wetlands in the Wild City: now and for the future in a drying climate

AQUATIC ECOSYSTEMS RESEARCH GROUP

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Images by: S Beatty, M Bogan, J Chambers, E Chester, M Cover, J Davis, D Morgan, B Robson, S Strachan, Google Earth, WA Museum, Arkive

RURAL PONDSCAPES

URBAN PONDSCAPES

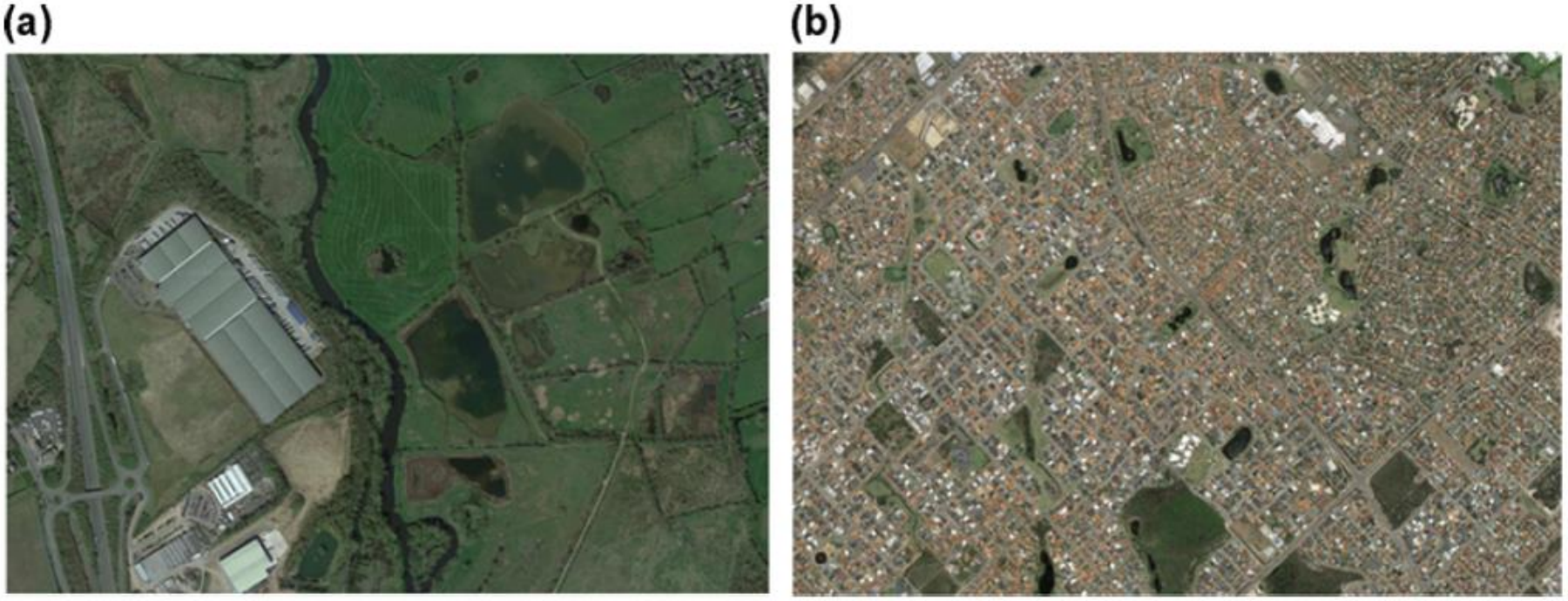


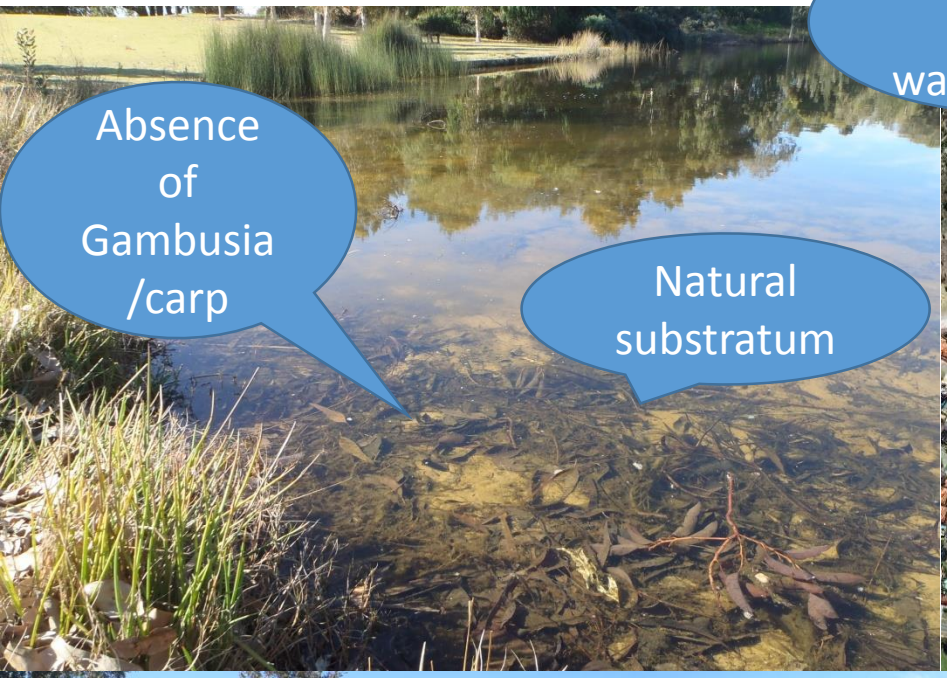
FIGURE 1 Groups of small ponds and surrounding habitats ("pondscapes") provide important ecosystem services in human-dominated landscapes. A pondscape in (a) an agricultural landscape in the United Kingdom (Leicestershire) and (b) an urban setting in Australia (Perth; providing important habitat for amphibian meta-communities). Map data credit: Google Earth (2016)

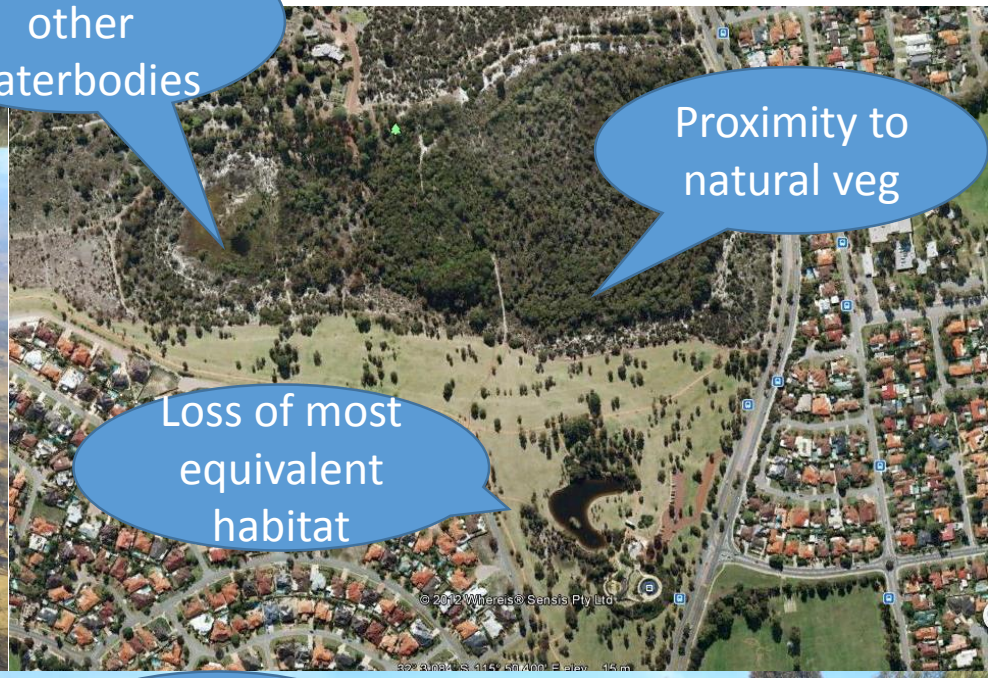
Hill MJ, Hassall C, Oertli B, Fahrig L, Robson BJ, Biggs J et al. (2018) New policy directions for global pond conservation. *Conservation Letters*, 11, e12447.

What characteristics are associated with high invertebrate biodiversity in anthropogenic waterbodies?

Local scale factors

Landscape scale factors

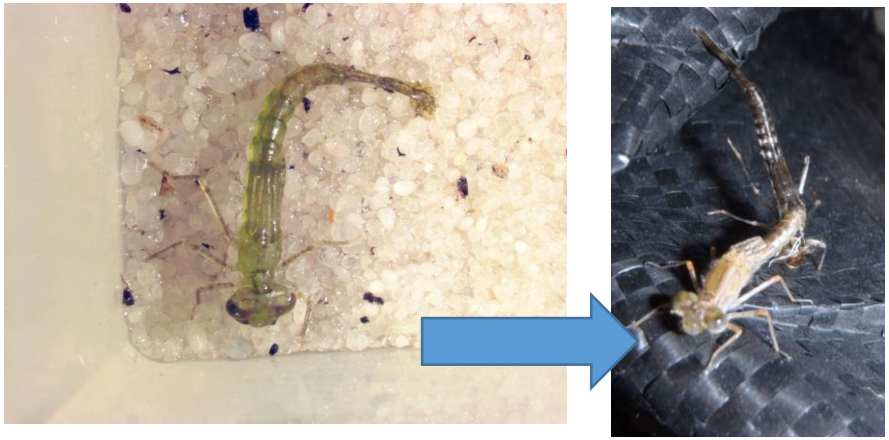




Moderate levels of management intervention

Our research discoveries:

Some damselfly species can survive the absence of surface water and emerge



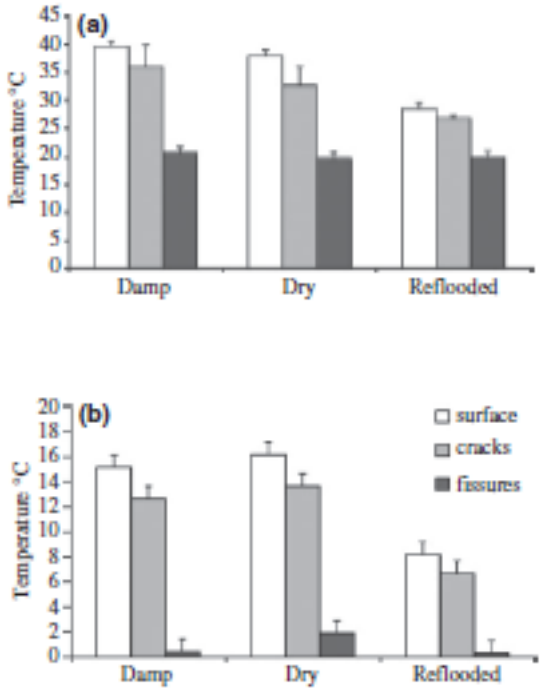
Xanthagrion erythroneurum, Ischnura aurora, Ischnura heterosticta

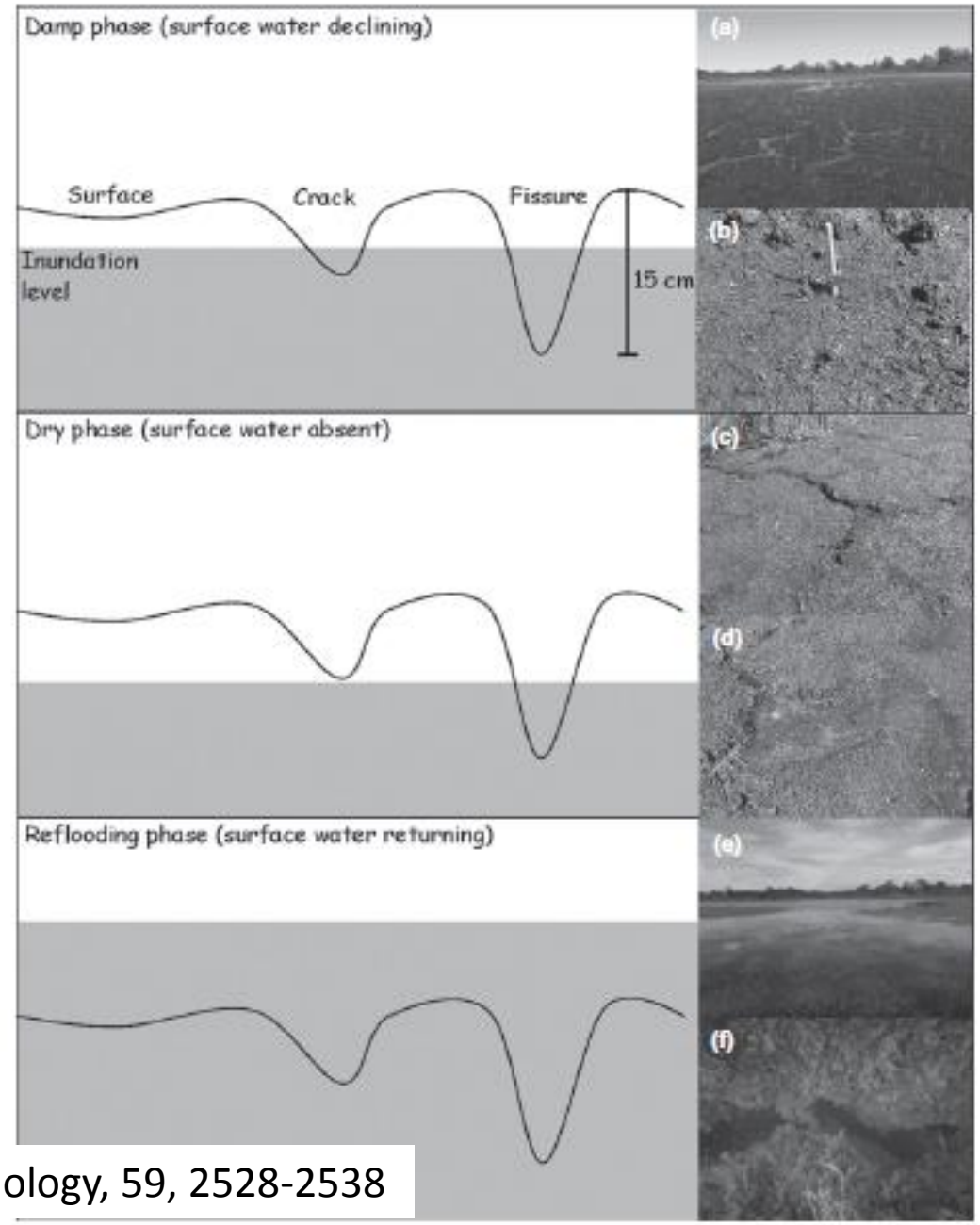
No variation in this response among 9 ‘populations’ tested

A survival trait recorded nowhere else in the world

Chester et al. (2013) Novel methods for managing freshwater refuges against climate change in southern Australia: anthropogenic refuges for freshwater biodiversity. National Climate Change Adaptation Research Faciility, Gold Coast.

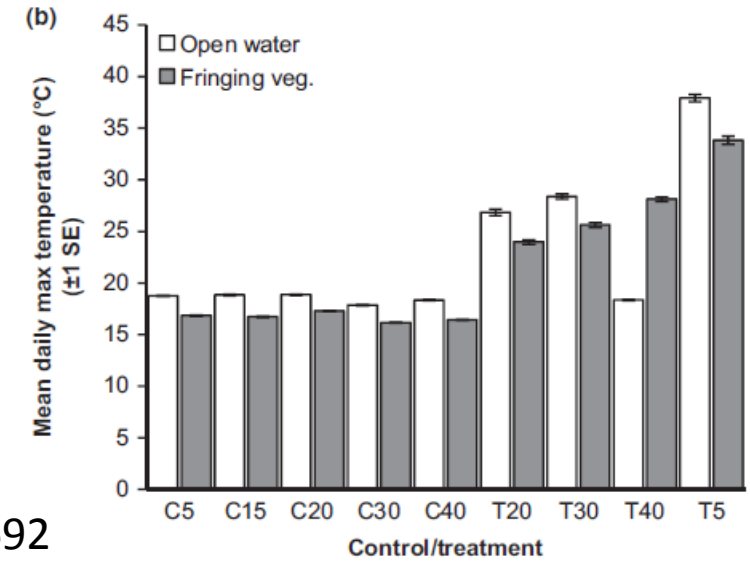
Our new discoveries: Cracks in wetland sediment vital for drought survival





Strachan et al. (2014) Freshwater Biology, 59, 2528-2538

Our new discoveries: Fringing trees vital for drought survival

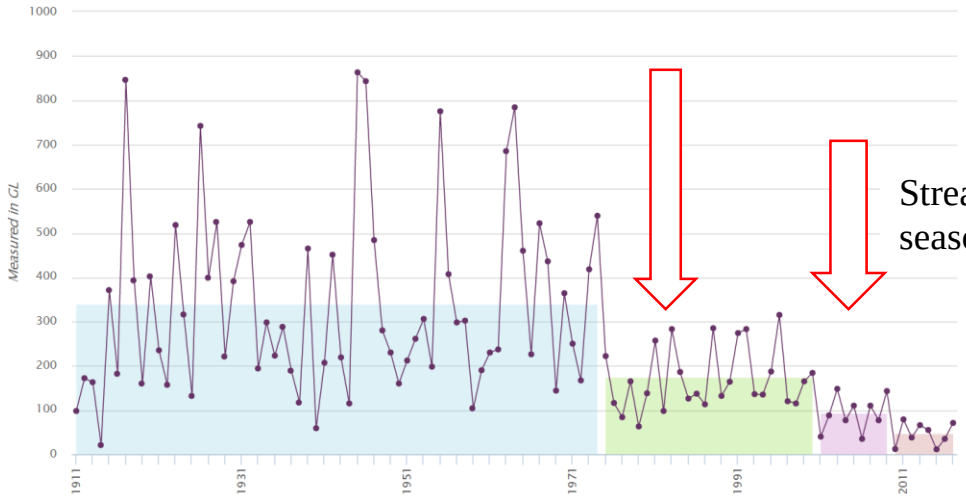


Strachan et al. (2014) Freshwater Biology, 61, 680-692

PhD student Nicole Carey

How does flow regime change from perennial to seasonal affect stream ecology?

- Drought refuges
- Leaf litter breakdown processes
- Life history phenology
- Biodiversity change
- All compared to data from 1980s



Streams begin switching to seasonal flows (from 2001)

Peri-urban:

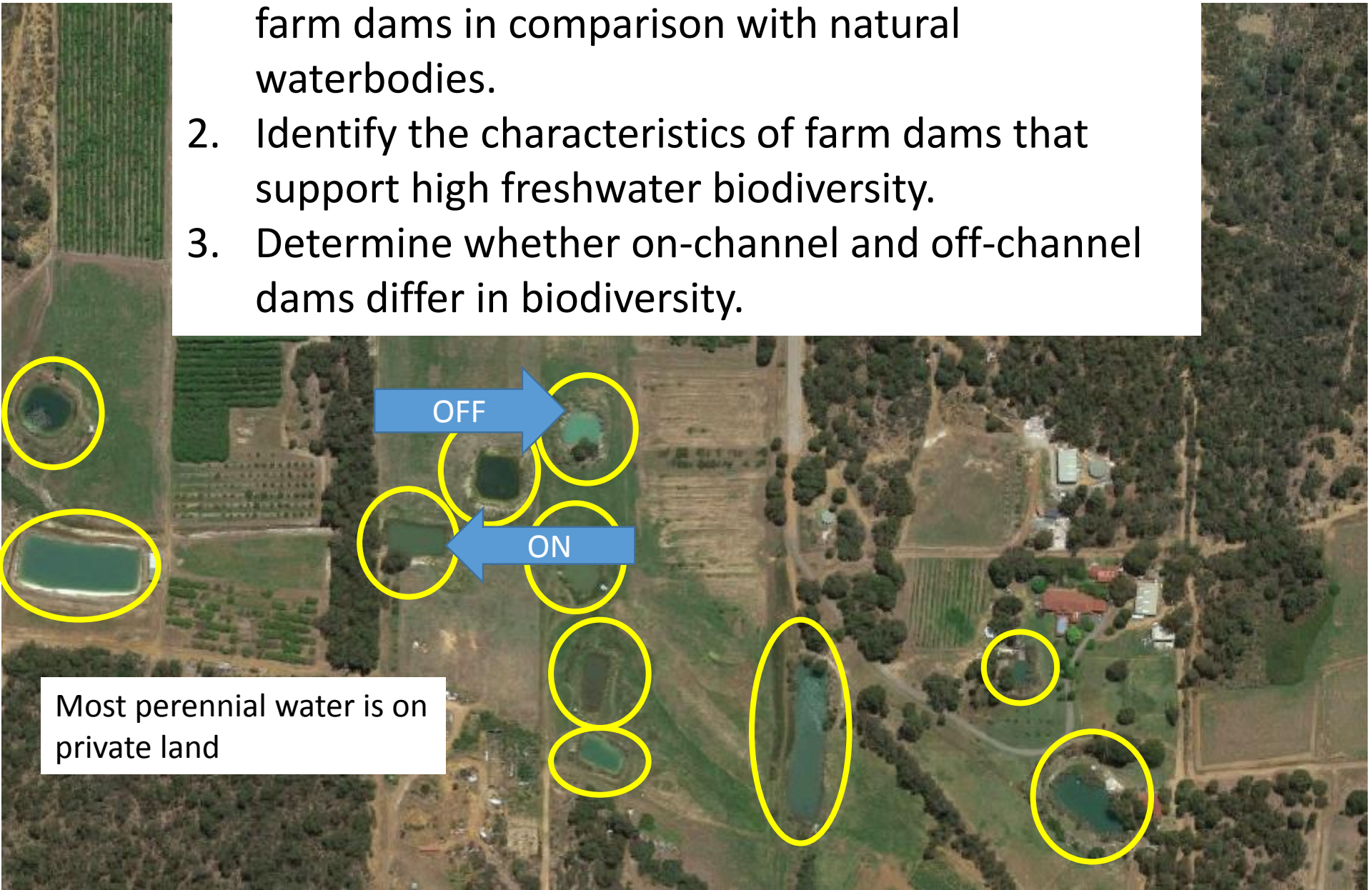
Are farm dams refuges for freshwater plants and animals in a drying climate (in the Perth Hills)?

Collaboration: EMRC & Murdoch Uni

Funded by Lotterywest

Aims:

1. Determine which native freshwater species use farm dams in comparison with natural waterbodies.
2. Identify the characteristics of farm dams that support high freshwater biodiversity.
3. Determine whether on-channel and off-channel dams differ in biodiversity.



Species that can cross land and locate refuges not connected by surface water

Species that use aquatic movement and rely on refuge pools

Frogs that lay eggs in burrows:

This is a common breeding method for some of our larger frog species. The male digs a burrow and the female lays her eggs there. The eggs wait until water levels rise and flood the nest, and then they hatch.

Found only in the Perth Hills

Whooping frog
Heleioporus inornatus

Sand frog
Heleioporus psammophilus

Hooting frog
Heleioporus barycragus

In a drying climate, this is a risky strategy because if water levels do not rise, or do not rise much, eggs can perish.

Crawling toadlet
Pseudophryne guentheri

Frog pictures from WA Museum Frogwatch

How do we use anthropogenic waterbodies to adapt to the drying climate?

- Acknowledge their potential
- Understand biodiversity
- Manage ‘pondscapes’ = public & private land, natural & anthropogenic waterbodies
- Ensure sufficient perennial water in landscapes
- Reduce other stressors on freshwater ecosystems
- Actively manage connectivity +/-
- Engage communities to restore urban, peri-urban waterbodies
- More research

Future Research:

- Better understanding of life histories of native species, and their flexibility
- Understand what comprises a population
- Understanding connectivity
- Methods to control damaging invasive species (i.e. Gambusia, carp/koi, yabby *Cherax destructor*)
- New & improved methods for managing anthropogenic and natural waterbodies

THANK YOU!