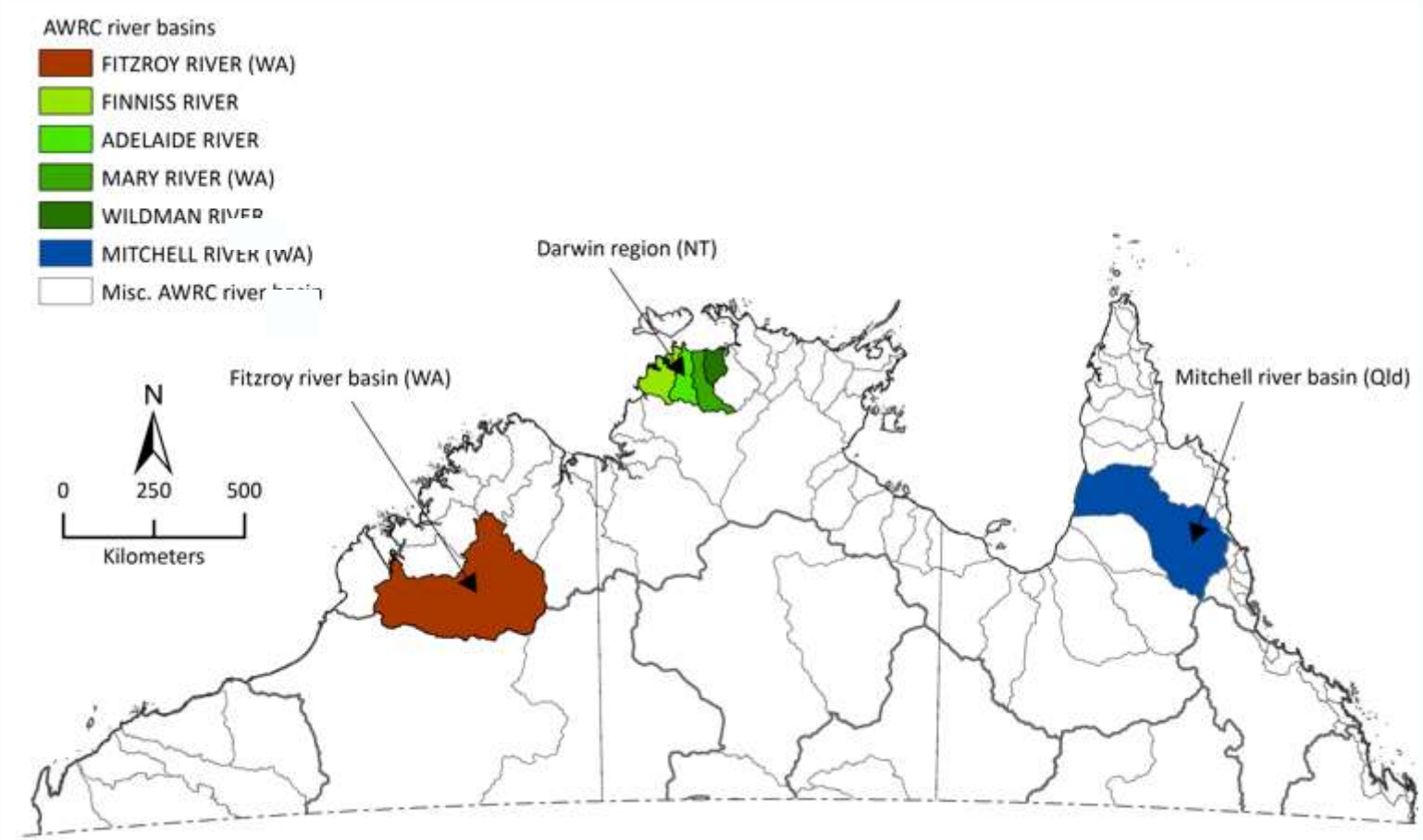
A synthesis of knowledge to support the assessment of impacts of water resource development to environmental assets in northern Australia

LAND AND WATER
www.csiro.au

NA Water Resource Assessment Catchments



Primary purpose

To provide information to reduce the uncertainty of investors and regulators

Overview of activity
i.e. What is the issue?

NA White Paper:

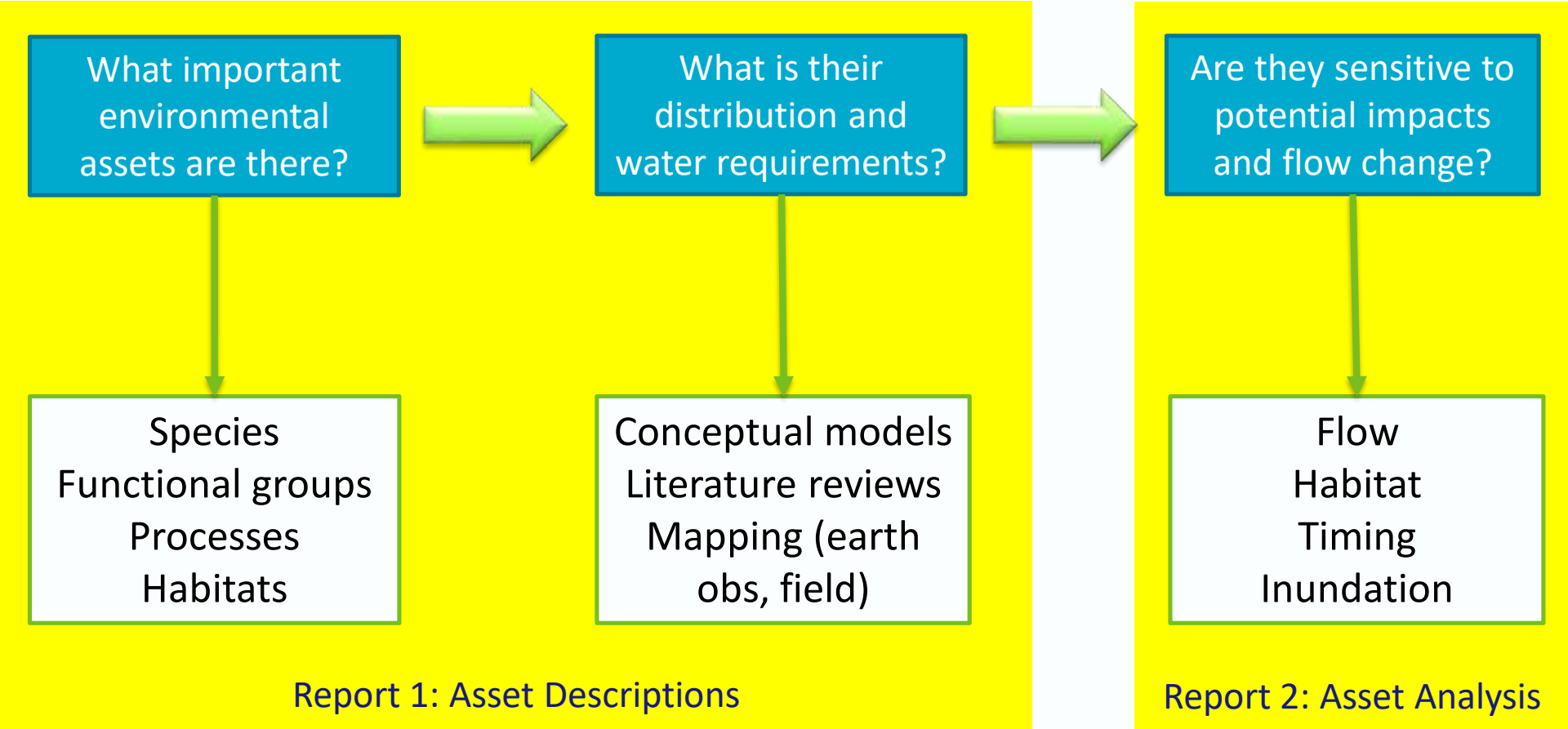
- How do you secure water supplies while safeguarding the natural environment?

NAWRA:

- Activity: How will the development of irrigation infrastructure *(and changes in land use)* potentially impact ecology?
  - What aspects of ecology are important to focus on?
  - What are the potential impacts to environmental assets?
  - *How can these impacts be minimised?*
- Output: A set of products that can underpin decision making

NAWRA Ecology

The Ecology activity had three major activities:



Report 1: Asset Descriptions

How do we define Environmental Assets?

Assets grouped as Marine and Freshwater:

- Significance: Ecological, Conservation, Recreation, Commercial, *Indigenous/Cultural*
- Water-dependent: Require flows from a river channel for all or part of their life cycle or to improve condition
- Representative: Capture a range of flow requirements for biota, habitats and ecological processes
- Complete: Synergies in selection of Assets across the Assessment Regions (few exceptions – NPF, MVF)
- Distinctive: Minimise overlap in flow requirements
- Evidence: Sufficient evidence to describe relationships with flows

Table 2-1 Analysis approach used for each asset, organised by asset group and type

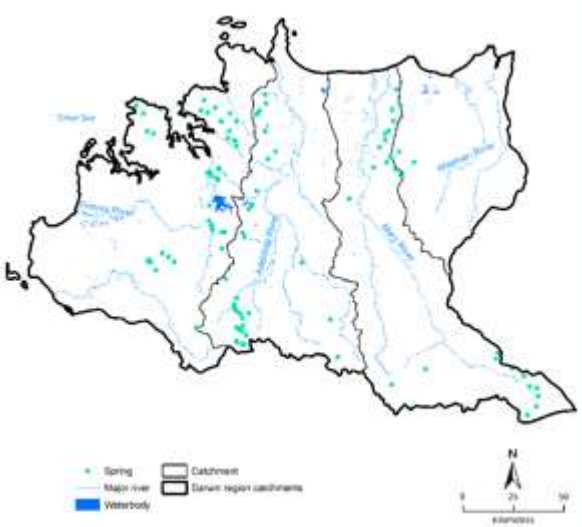
GROUPING	TYPE	ASSET	ASS
Freshwater	Habitats	Floodplain wetlands	
		Waterholes – inchannel	
		Riparian vegetation	
		Monsoon rainforest	
	Functional groups	Migratory fish	
		Stable flow spawning fish	
		Turtles and long-necked turtles	
	Species of significance	Magpie geese	
		Barramundi	
		Sawfish	
		Whipray	
		River sharks	N
Marine	Habitats	Mangroves	Hyd
		Seagrass	
		Salt flats	
		Coral	
	Species of significance	Mullet spp.	
		Mud crabs	
		Longbums	
		Saltwater crocodiles	
		Snubfin dolphin	
		Threadfin	
		Grunter	
		Banana prawns	
	Processes	Productivity	
		Fluvial geomorphology	No

12 Freshwater assets:
4 Habitat types;
3 Functional groups;
5 Species that require freshwater for part or all of lifecycle

14 Marine assets:
4 Habitat types;
8 Commercial and conservation species;
2 Ecological processes

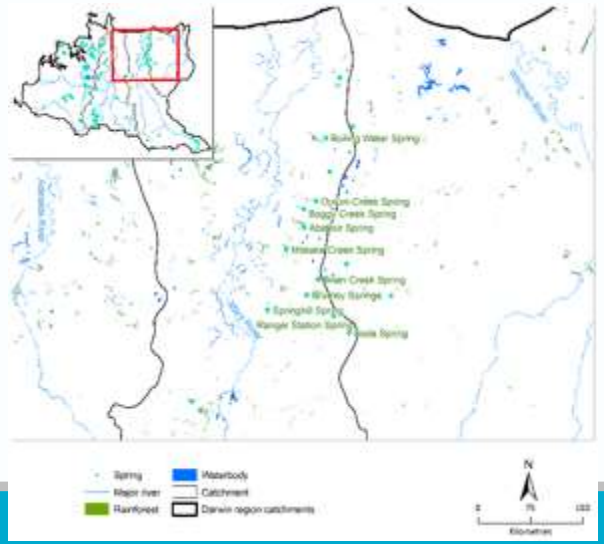
Example: Asset Maps (Darwin Catchments)

Springs

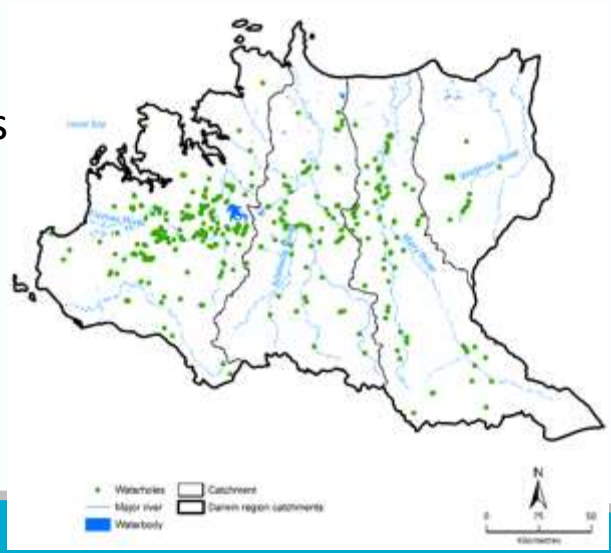


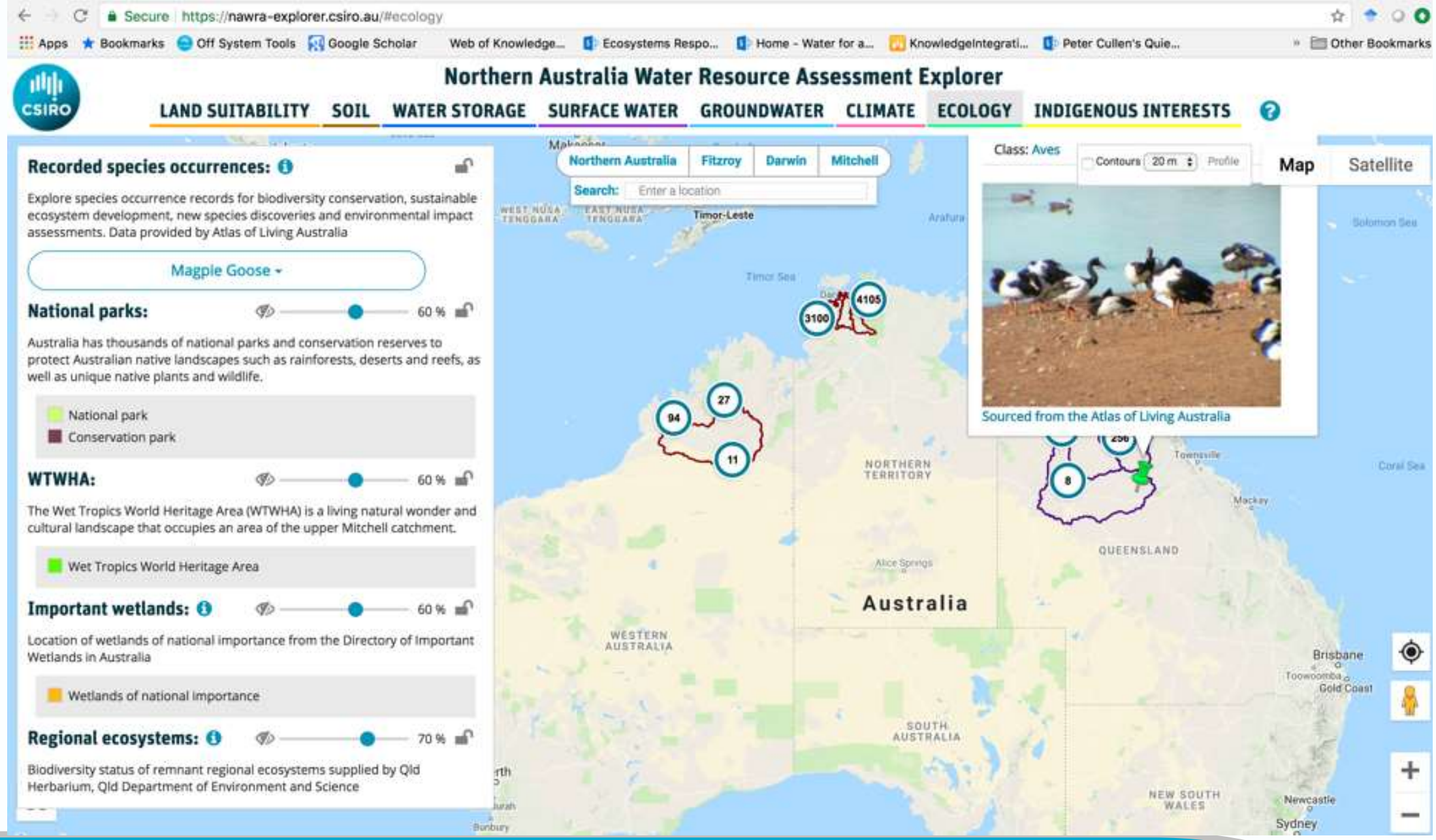
Floodplain

Vine Forests (Wildman)



Waterholes




Secure https://nawra-explorer.csiro.au/#ecology
Apps Bookmarks Off System Tools Google Scholar Web of Knowledge... Ecosystems Respo... Home - Water for a... KnowledgeIntegrati... Peter Cullen's Quie... Other Bookmarks
CSIRO
Northern Australia Water Resource Assessment Explorer
LAND SUITABILITY
SOIL
WATER STORAGE
SURFACE WATER
GROUNDWATER
CLIMATE
ECOLOGY
INDIGENOUS INTERESTS
Recorded species occurrences:
Explore species occurrence records for biodiversity conservation, sustainable ecosystem development, new species discoveries and environmental impact assessments. Data provided by Atlas of Living Australia
Magpie Goose
National parks:
60 %
Australia has thousands of national parks and conservation reserves to protect Australian native landscapes such as rainforests, deserts and reefs, as well as unique native plants and wildlife.
National park
Conservation park
WTWHA:
60 %
The Wet Tropics World Heritage Area (WTWHA) is a living natural wonder and cultural landscape that occupies an area of the upper Mitchell catchment.
Wet Tropics World Heritage Area
Important wetlands:
60 %
Location of wetlands of national importance from the Directory of Important Wetlands in Australia
Wetlands of national importance
Regional ecosystems:
70 %
Biodiversity status of remnant regional ecosystems supplied by Qld Herbarium, Qld Department of Environment and Science
Northern Australia
Fitzroy
Darwin
Mitchell
Search: Enter a location
Class: Aves
Contours 20 m
Profile
Map
Satellite
Sourced from the Atlas of Living Australia
Timor-Leste
Timor Sea
Arafura
Solomon Sea
Coral Sea
4105
3100
27
94
11
8
NORTHERN TERRITORY
QUEENSLAND
Townsville
Mackay
Alice Springs
Australia
WESTERN AUSTRALIA
SOUTH AUSTRALIA
NEW SOUTH WALES
Brisbane
Toowoomba
Gold Coast
Newcastle
Sydney
Bunbury

Report 2: Asset Analysis

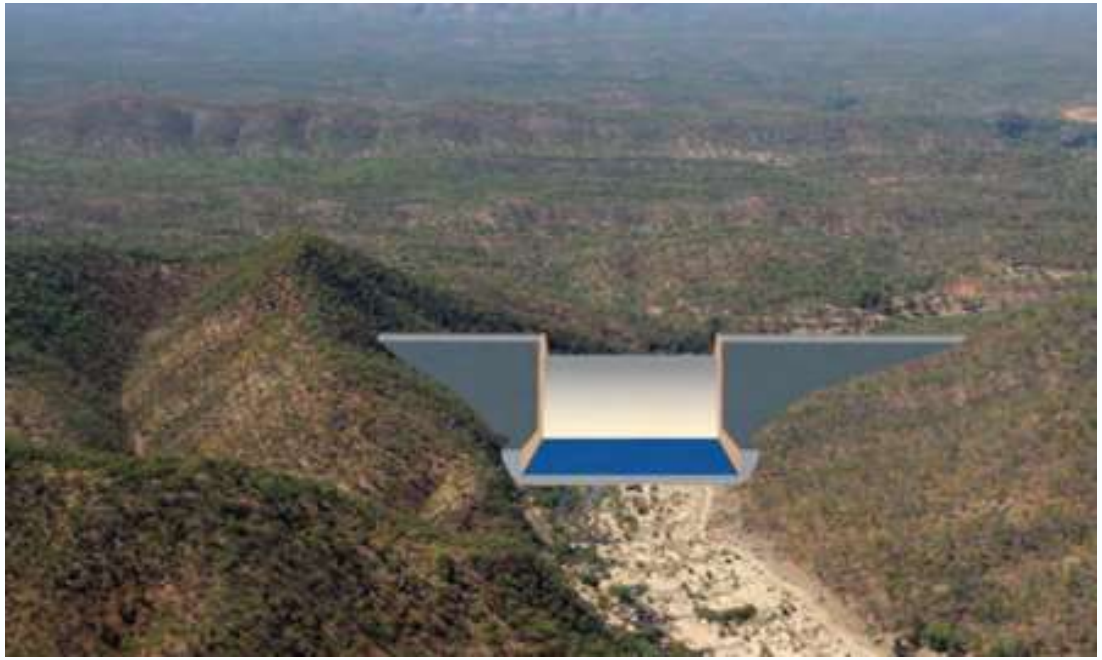
Scenarios of potential change

Water harvesting

- System extraction volumes
- Low and high threshold pumping
- Intersected with and without climate change

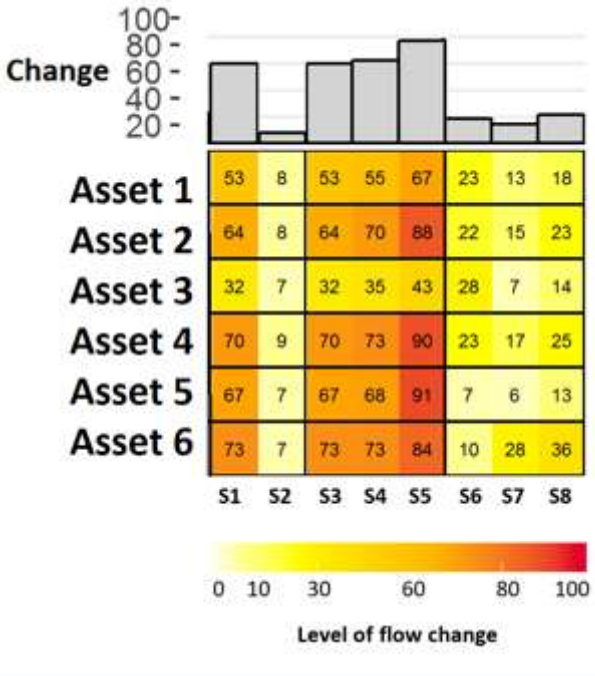
Dams

- Location with operating rules
- Individual and multiple dams
- Intersected with and without climate change



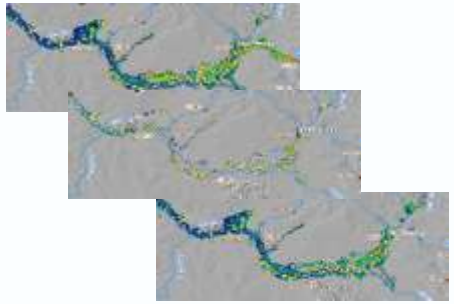
Asset Analysis: A two-tiered approach

Tier 1: Flow screening hydrometrics

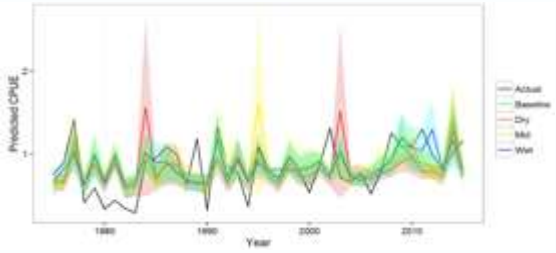


Tier 2: Quantitative analysis – flow requirements

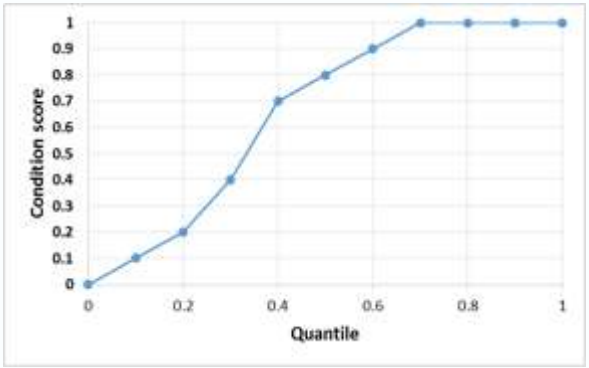
Inundation analysis

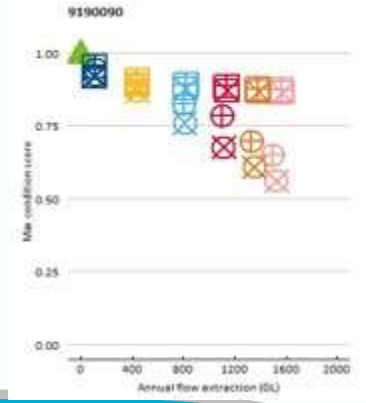


Statistical analysis



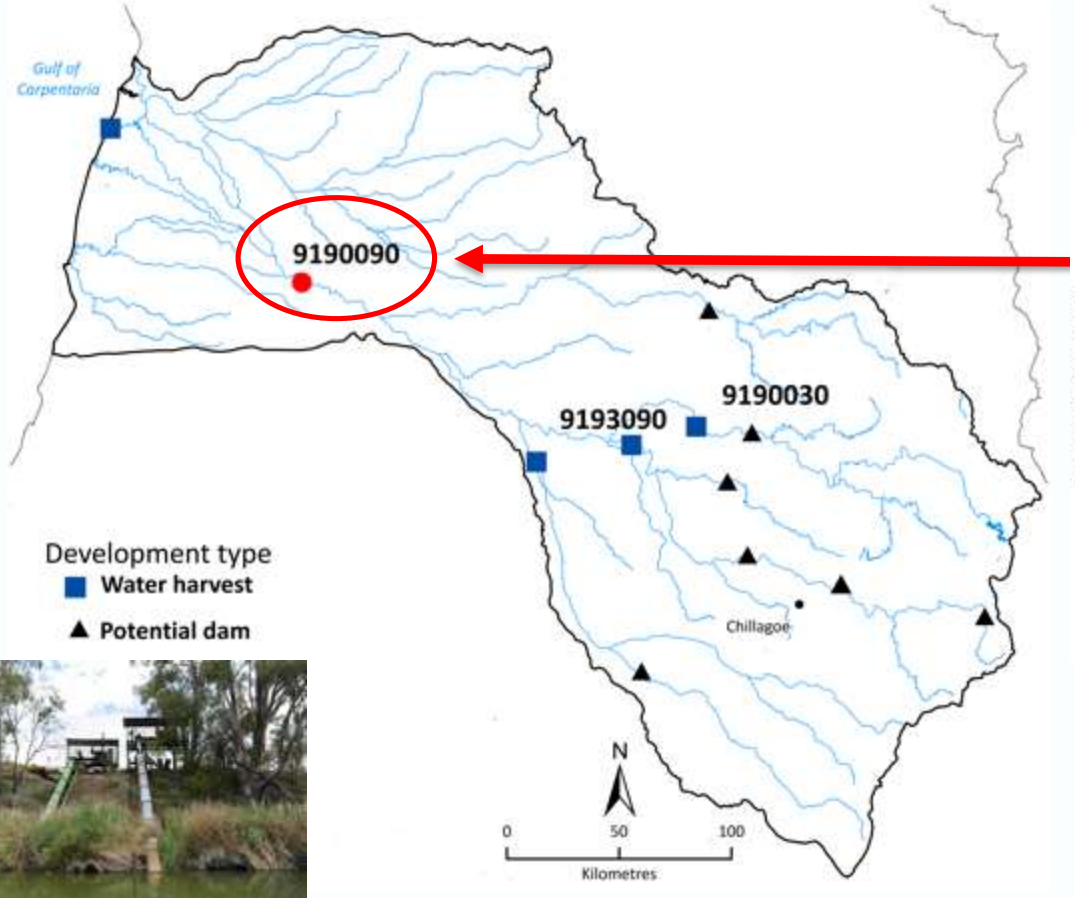
Habitat suitability: Preference Curves

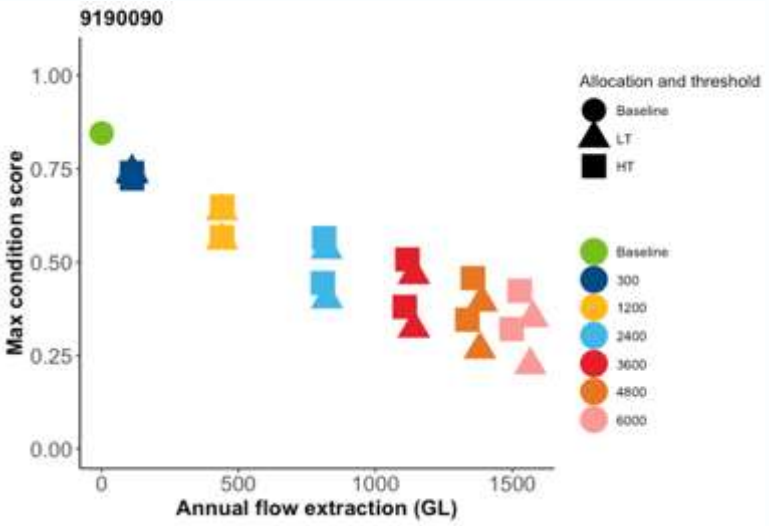





https://nawra-river.shinyapps.io/river/
Apps
Bookmarks
Off System Tools
Google Scholar
Web of Knowledge...
Ecosystems Respo...
Home - Water for a...
KnowledgeIntegrati...
Peter Cullen's Quie...
Other Bookmarks
About
Model simulation
Select a catchment that you would like to run AWRA-R for
Mitchell
Run model
Eco-hydrology analysis
Version history
Mitchell
Mean change (%)
100
75
50
25
0
White.banana.prawn
Wetlands
Waterholes
Turtles
Threadfin
Stable.flow.spawners
Snubfin.dolphin
Sawfish
Salt.flats
Riparian.vegetation
Mullet
Mudcrabs
Migratory.fish
Mangroves
Magpie.geese
Longbums
Grunter
Crocodiles
Barramundi
Asset
9190000
9190030
9190060
9190090
9190092
9190111
9193090
Gauge ID
Relative change (%)
0
10
30
60
80
100

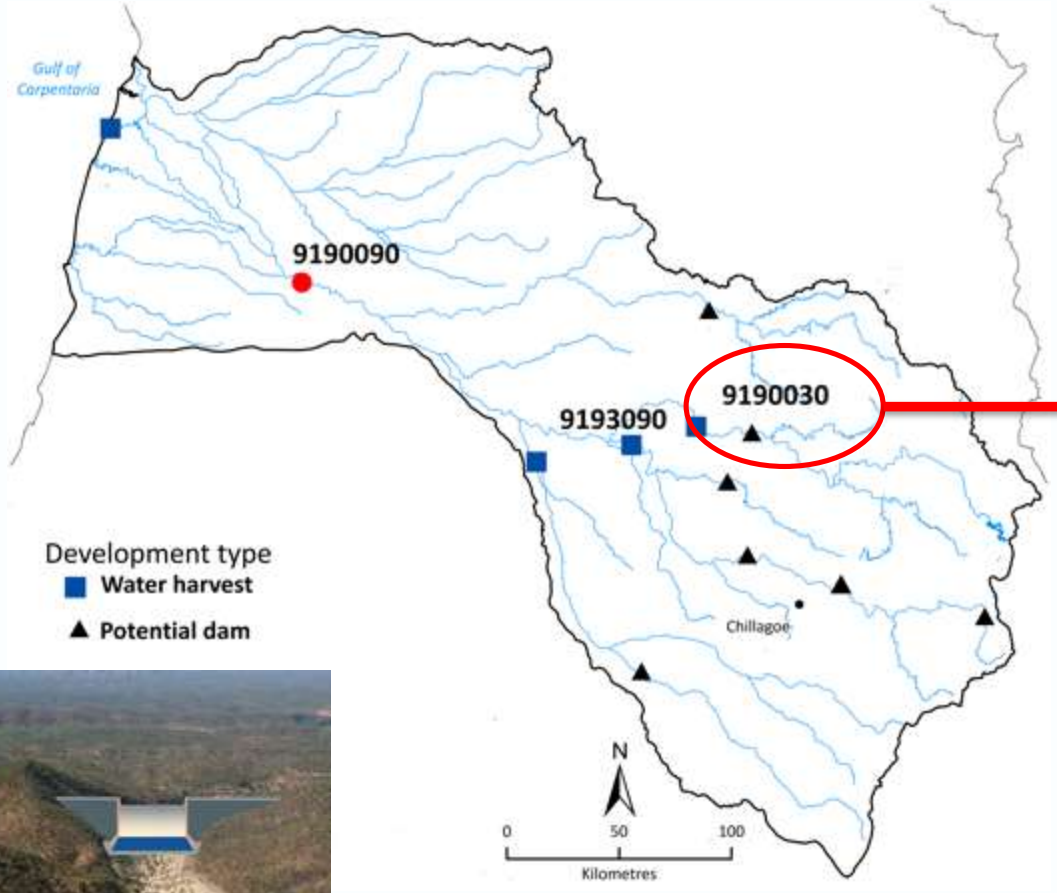
Case study: Water harvesting impacts on sawfish

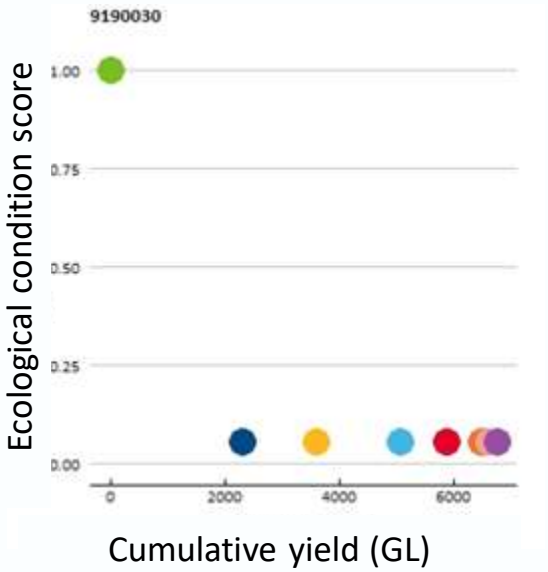


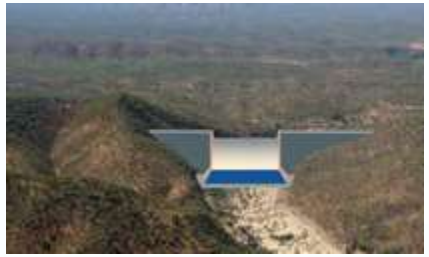


Potential for water harvesting impacts: Cumulative through to the end of catchment

Case study: Dam impact on sawfish





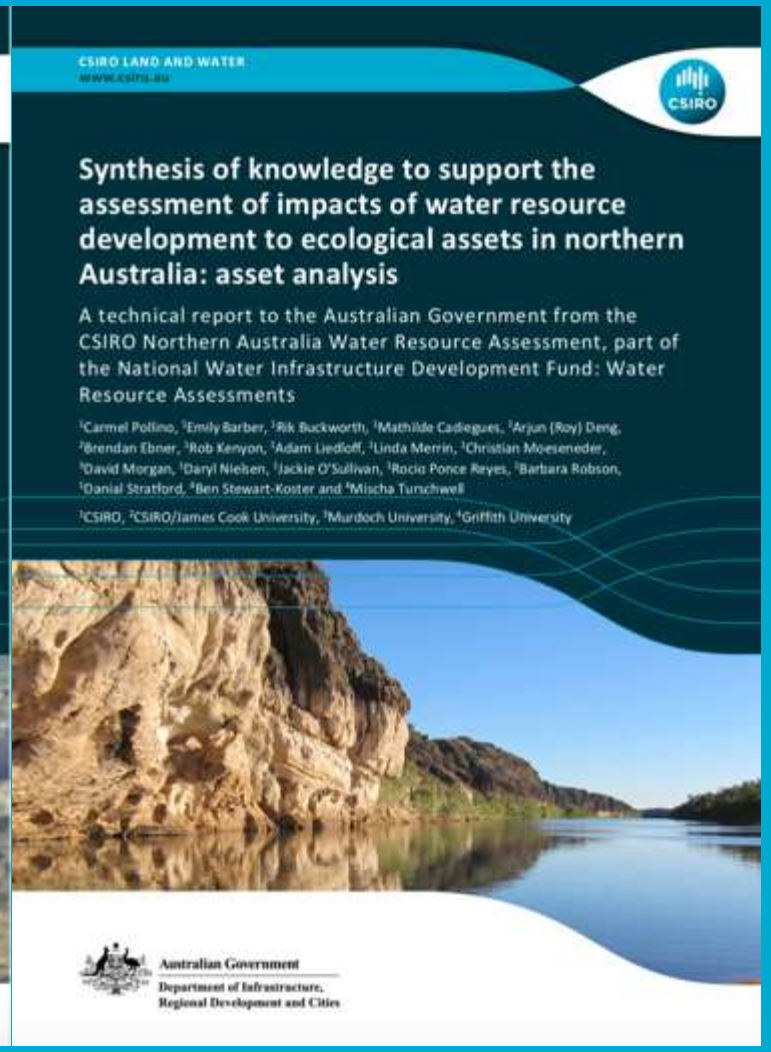


Potential for dam impacts: Greatest downstream of the dam wall

Summary

- We have collated data and knowledge, to support assessments of impact associated with potential infrastructure development
- This information was used to support assessments of potential impacts of new water infrastructure in NA
- What is needed?
  - Technical: A process by which this information can be adopted and maintained with new data and information, especially at local scales
  - Scientific: A broader systems view of change, considering land use changes, invasive species, second order impacts
  - Investment: Some basic knowledge of species, habitats and ecosystem function is lacking
  - Decisions: Being informed about risks and trade-offs by what information we have today

Carmel Pollino
Emily Barber
Rik Buckworth
Mathilde Cadigues
Garry Cook
Roy Deng
Brendan Ebner
Rob Kenyon
Adam Liedloff
Linda Merrin
Chris Moesender
David Morgan
Daryl Nielsen
Jackie O'Sullivan
Rocio Ponce Reyes
Barbara Robson
Danial Stratford
Ben Steward-Koster
Mischa Turschwell



https://www.csiro.au/en/Showcase/NAWRA

Asset Conceptual Models