University of South Australia

Improving The Health of At-Risk Western Australian Estuaries:

Assessing The Relationship Between On-Land Water Use and Estuarine Health

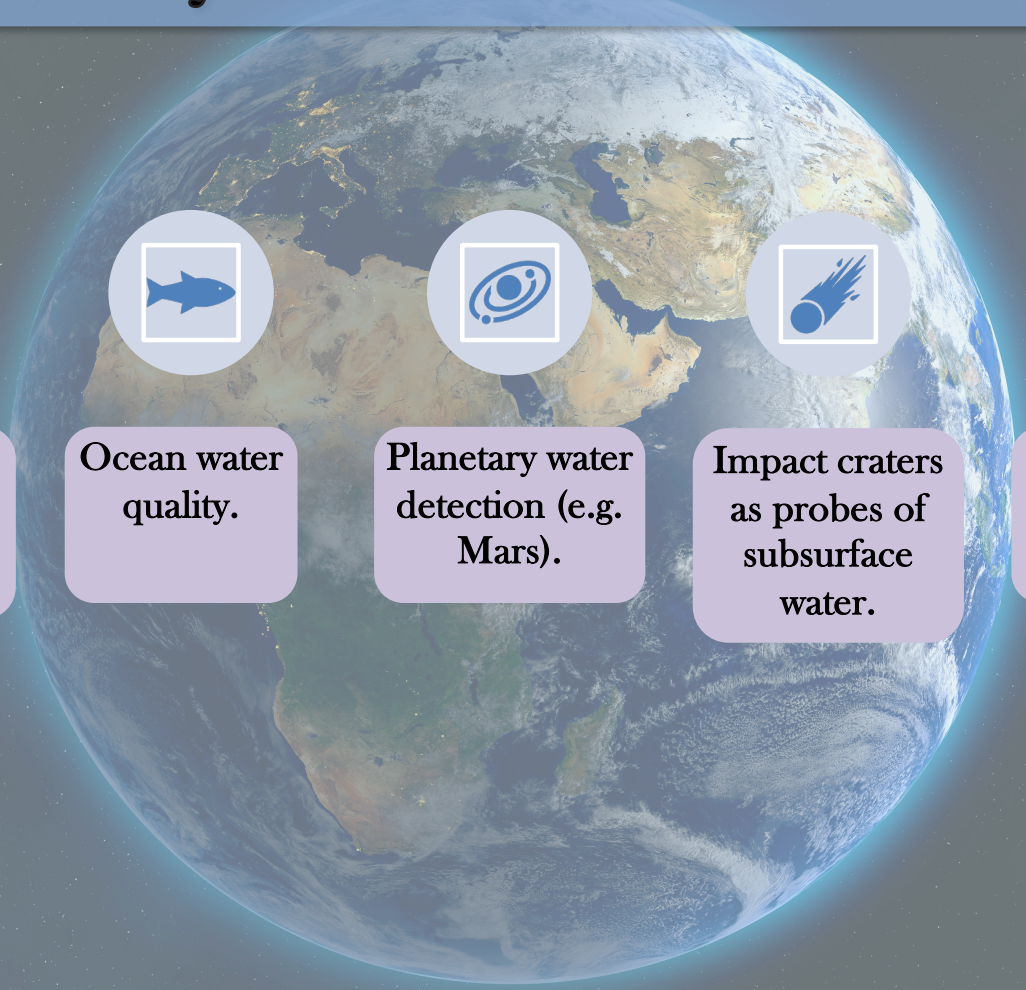
Curtin University

Dr Eriita Jones, Planetary & Space Scientist, Remote Sensing & GIS Analyst.

About Me

- **PhD in Astrophysics** from the Australian National University (2012).
- Researcher at the Institute for Earth and Space Exploration, **Western University, London, Ontario, Canada.** Research on using impact craters and satellite data to search for hidden subsurface water on Mars.
- Project Manager for **Canadian Space Agency** contract on Mars analogue sites and science on Earth.
- Researcher with **Consilium Technology and UniSA** on developing a product to using satellite imagery and machine learning to automatically detect all grapevines within Australia: Geospatial AI For Agriculture (GAIA).
- Researcher with **UniSA and National Institute of Forest Products and Innovation** on plantation forestry water accounting from space "Optimising the management of plantation, water and environmental assets" (NIFPI Project number NS024).
- Researcher with **Curtin and Department of Water and Environmental Regulation** on estuarine water quality and land water use interactions.

My Research Interests



- Satellite remote sensing for environmental problems.
- Sustainable forestry & water accounting.
- Ocean water quality.
- Planetary water detection (e.g. Mars).
- Impact craters as probes of subsurface water.
- Bushfire risk and detection.
- Vegetation health.

LULC Vegetation Water Use

- WASTAC funded project: “A Pilot Study In Improving The Health of At-Risk Western Australian Estuaries: Assessing The Relationship Between On-Land Water Use and Estuarine Health.”
- Project team:
  - Curtin University: David Antoine, Professor, Lead of the Remote Sensing and Satellite Research Group (RSSRG) and Eriita Jones Research Fellow.
  - WA Department of Water and Environmental Regulation (DWER): Kieryn Kilminster, Principal Scientist (Estuaries) and Frances M.L. D'Souza, Estuarine Ecologist.
- Project objectives:
  - **Examine four WA estuaries to decipher the impact of land-use and land-cover (LULC) water use surrounding the estuaries, and the estuary water quality.**
  - Derive high frequency measurements of LULC water usage (mL/day).
  - Derive estuary phytoplankton content, total suspend matter and organic particle concentration.
  - Identify the LULC sources of threats to estuary ecosystem health and water quality, and contribute actionable data products to DWER to assist with decision making around future estuarine management.

Background image: Oyster Harbour WA, https://estuaries.dwer.wa.gov.au/estuary/oyster-harbour/.

LULC Vegetation Water Use

- Raparapa / Fitzroy.
- Kuwinywardu / Gascoyne.
- Djilba / Peel-Harvey.
- Miaritch / Oyster Harbour (Albany).

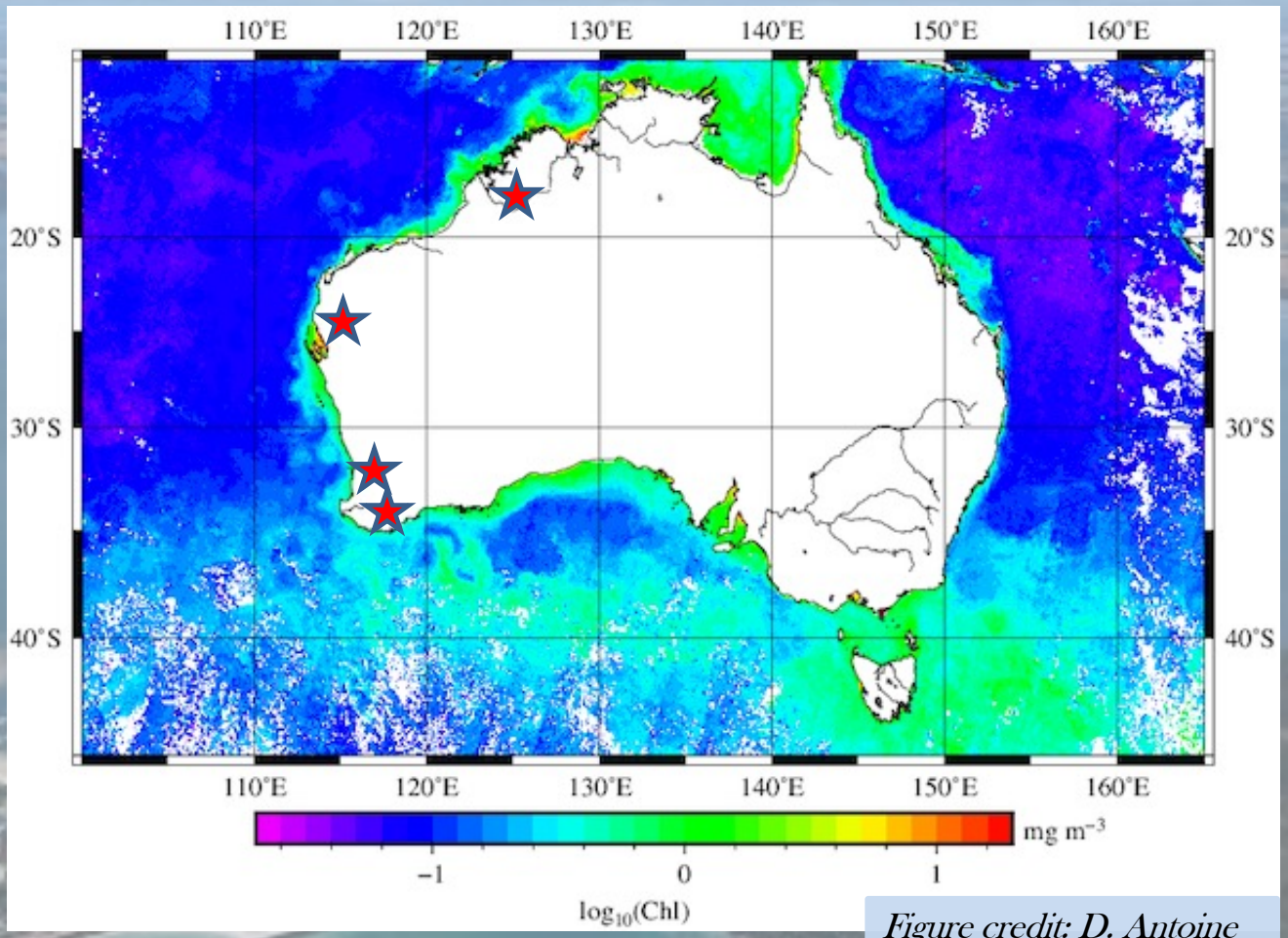
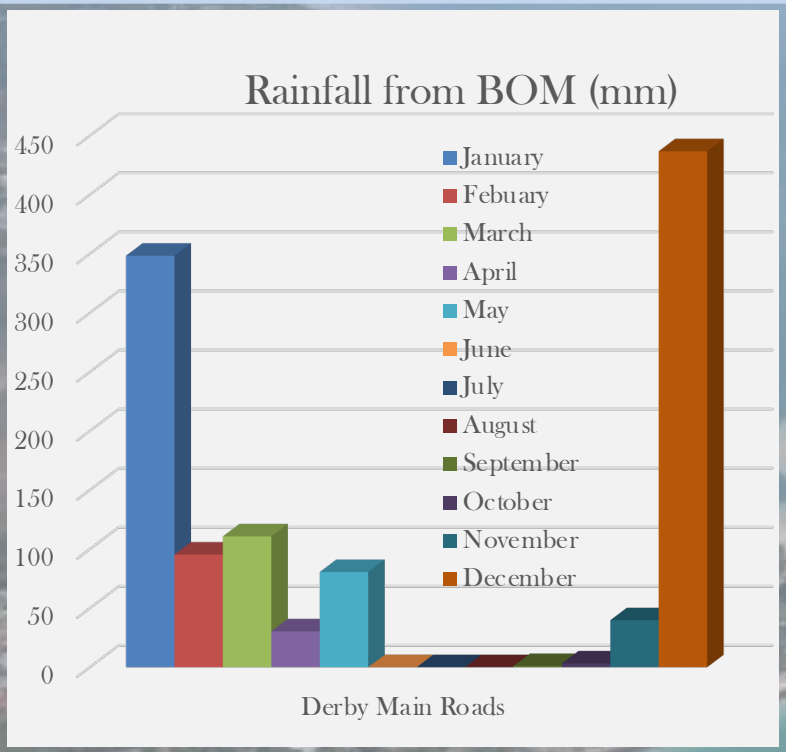


Figure credit: D. Antoine

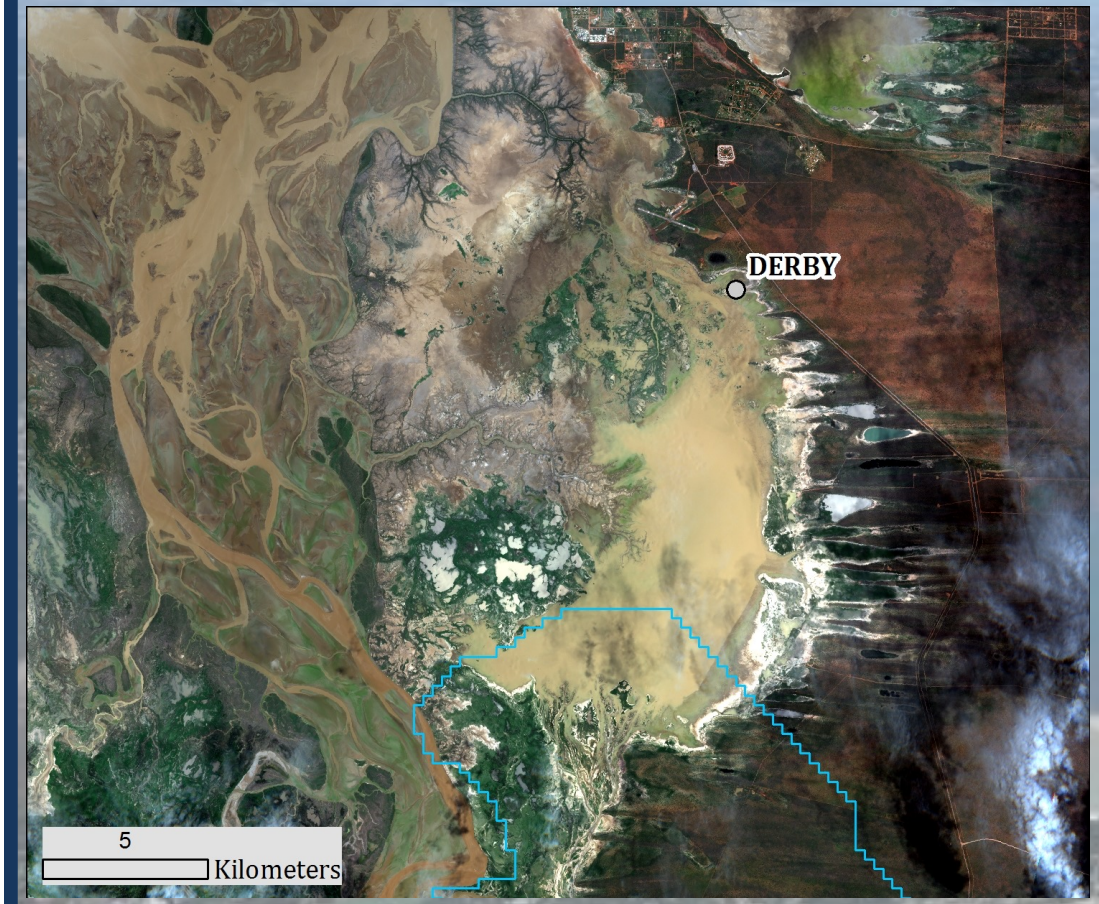
Background image: Oyster Harbour WA, https://estuaries.dwer.wa.gov.au/estuary/oyster-harbour/ .

Raparapa / Fitzroy Estuary

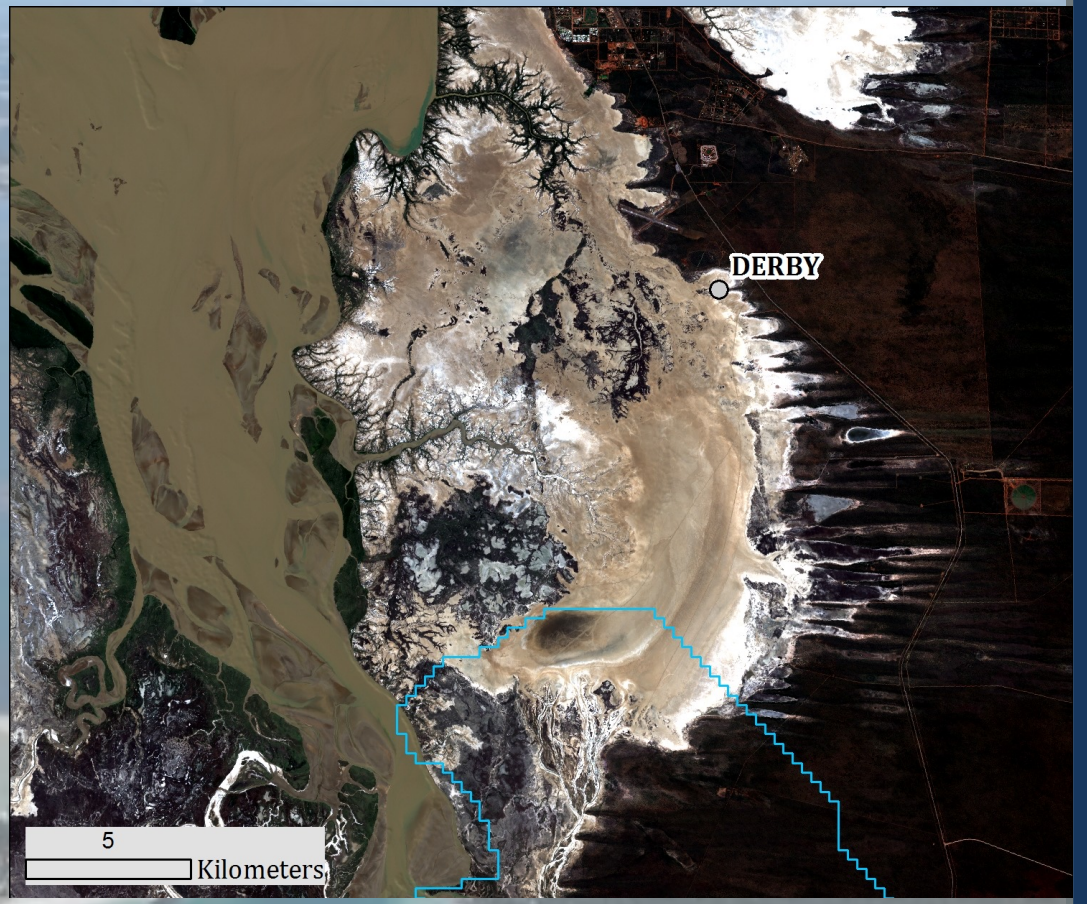
- Major difference between wet and dry season: 800mm (Dec-Jan), 0mm (June-July).



Raparapa / Fitzroy Estuary



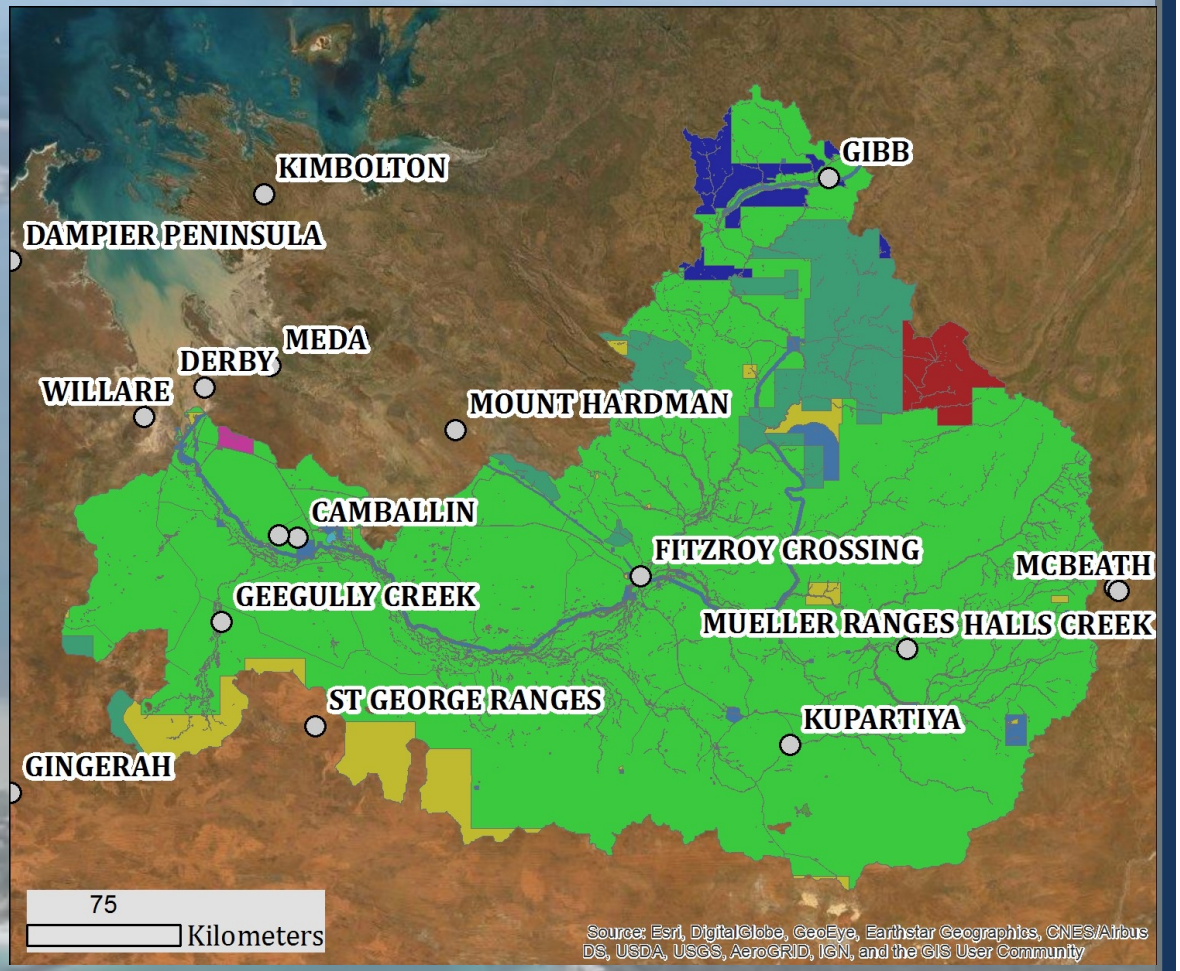
Sentinel-2 26/01/20



Sentinel-2 29/06/20

Raparapa / Fitzroy Estuary

- LULC vegetation water use will be analysed within the catchment boundary.
  - 35 LULC categories across catchment.
  - Some are not appropriate for the satellite derived ET algorithm which requires vegetated pixels (e.g. not urban or water).
  - 12 categories are maintained for satellite derived ET estimation, and these cover 99.3% of the catchment area.



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Raparapa / Fitzroy Estuary

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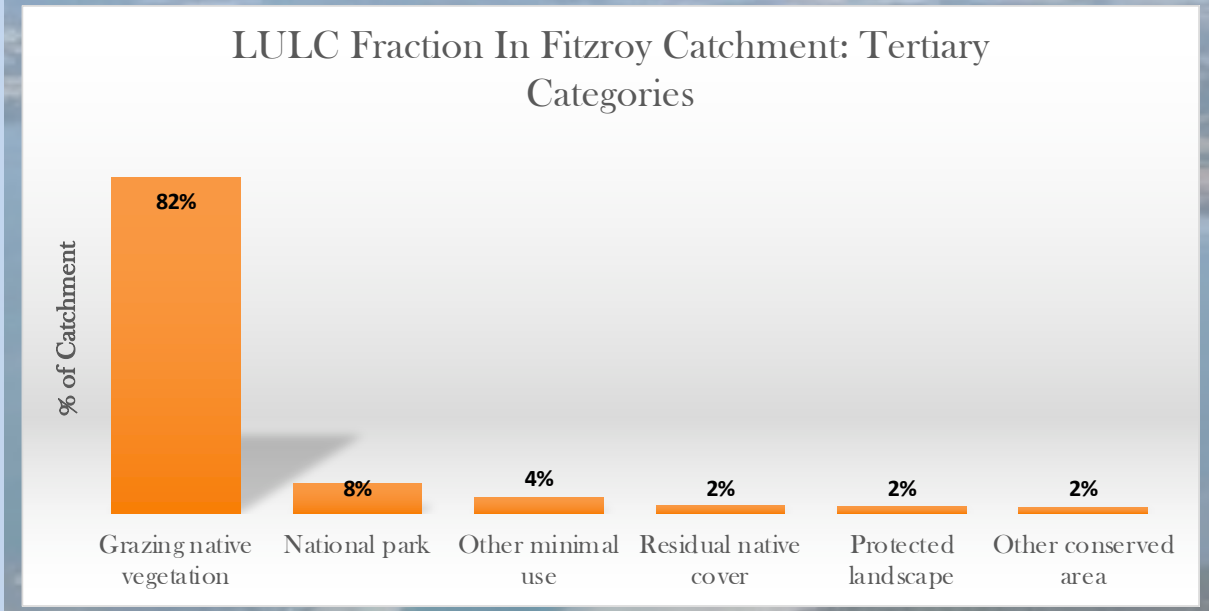
  - Some are not appropriate for the satellite derived ET algorithm which requires vegetated pixels (e.g. not urban or water).
  - 12 categories are maintained for satellite derived ET estimation, and these cover 99.3% of the catchment area.
- Predominately conserved and natural land use, or relatively natural production (e.g. sheep farming). Dryland and irrigated agriculture combined comprise < 1%.



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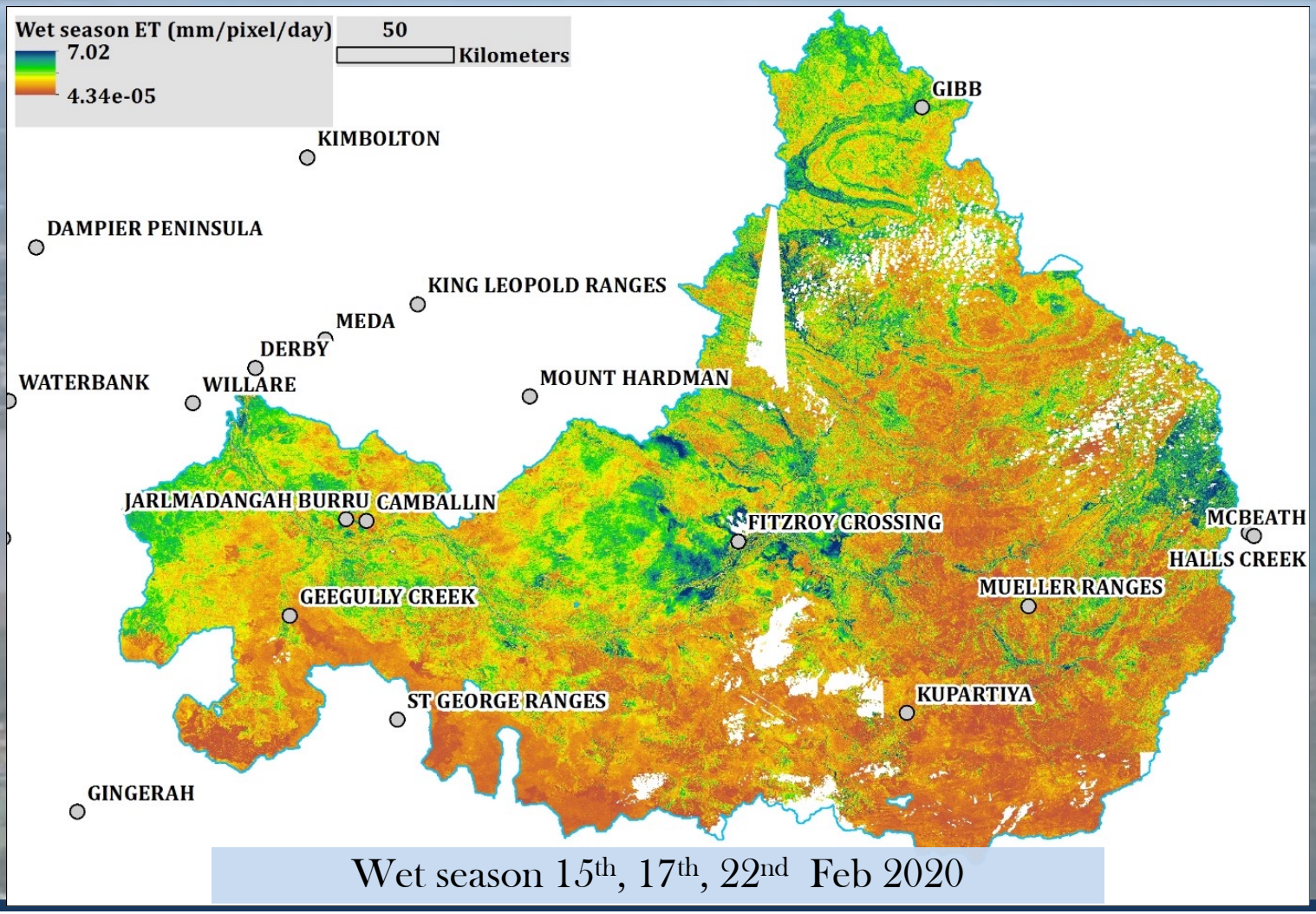
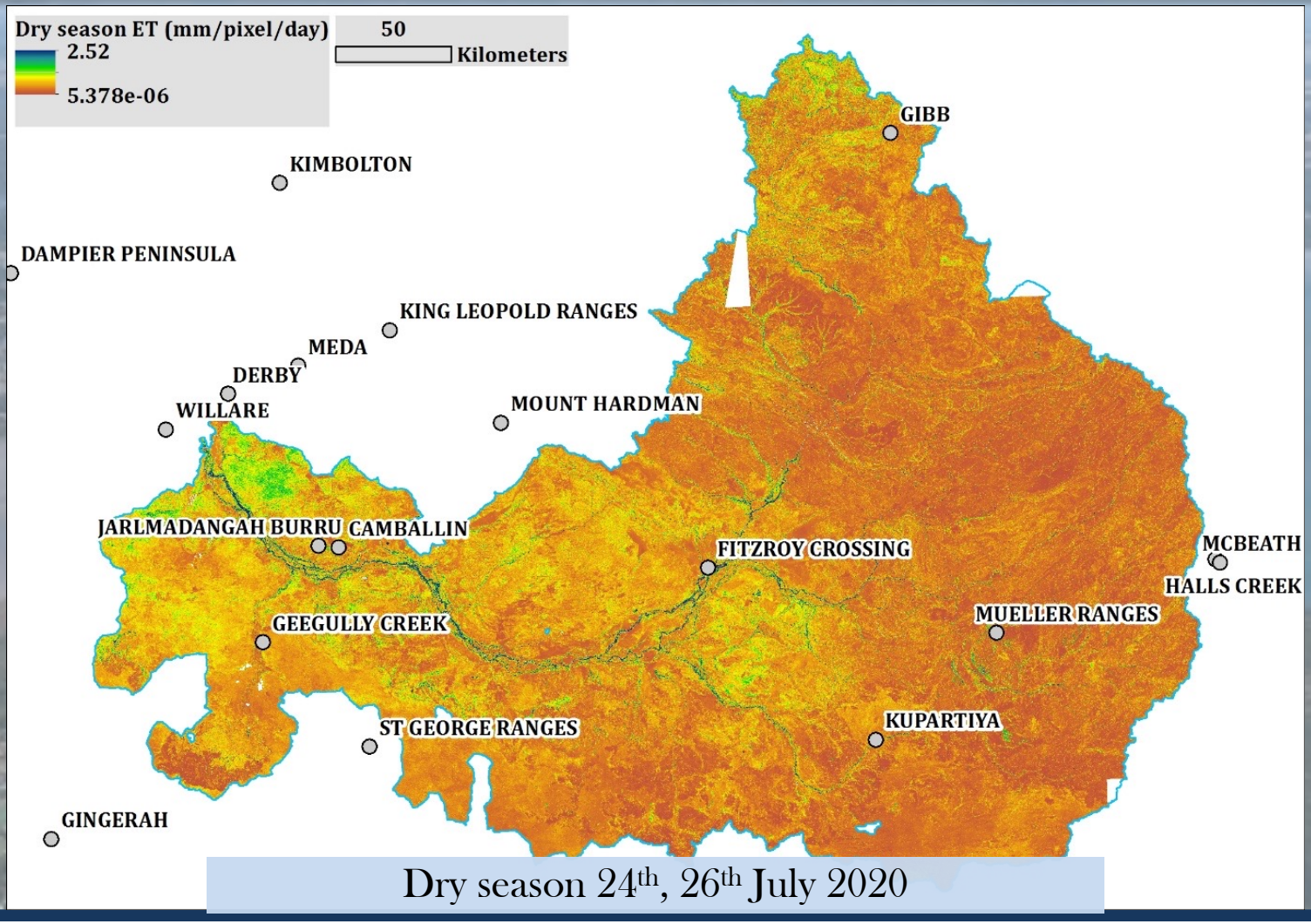
Raparapa / Fitzroy Estuary



Wet season 15th, 17th, 22nd Feb 2020

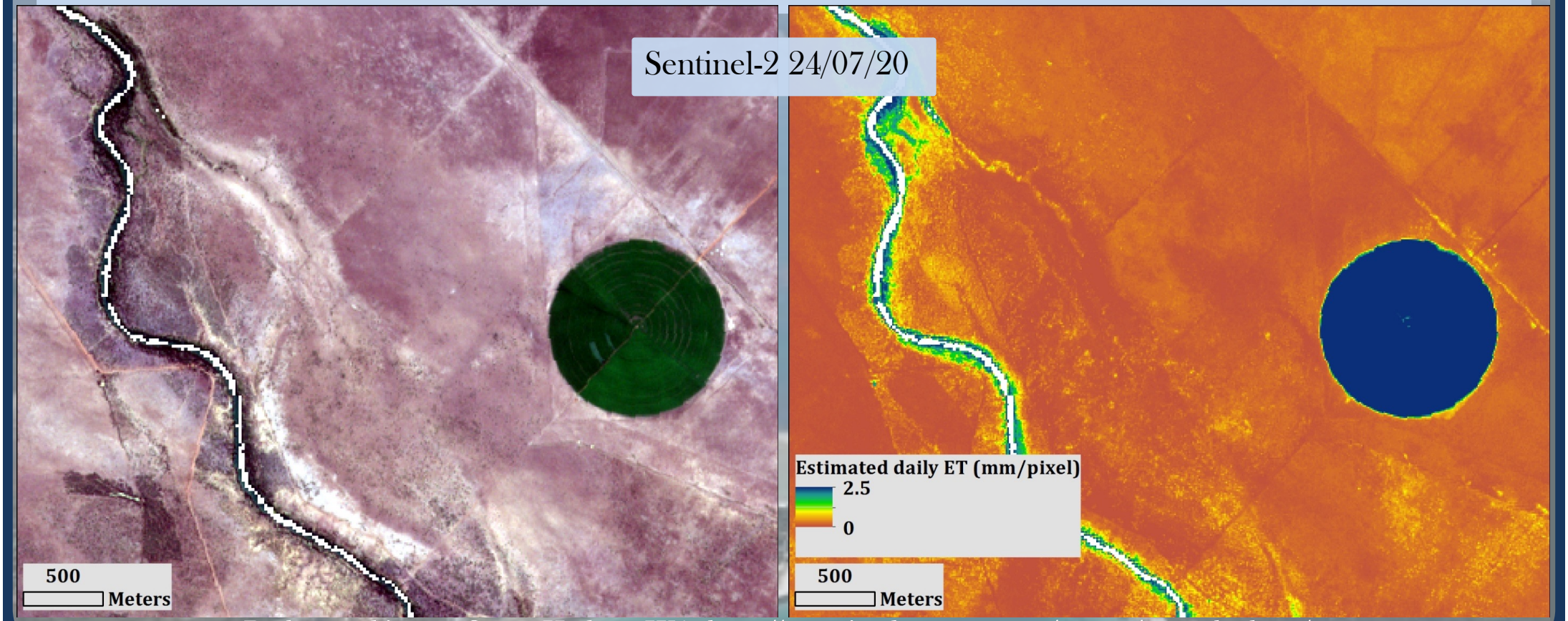
Raparapa / Fitzroy Estuary



Dry season 24th, 26th July 2020

Examples of LULC Water Use

- Irrigated sown grasses.



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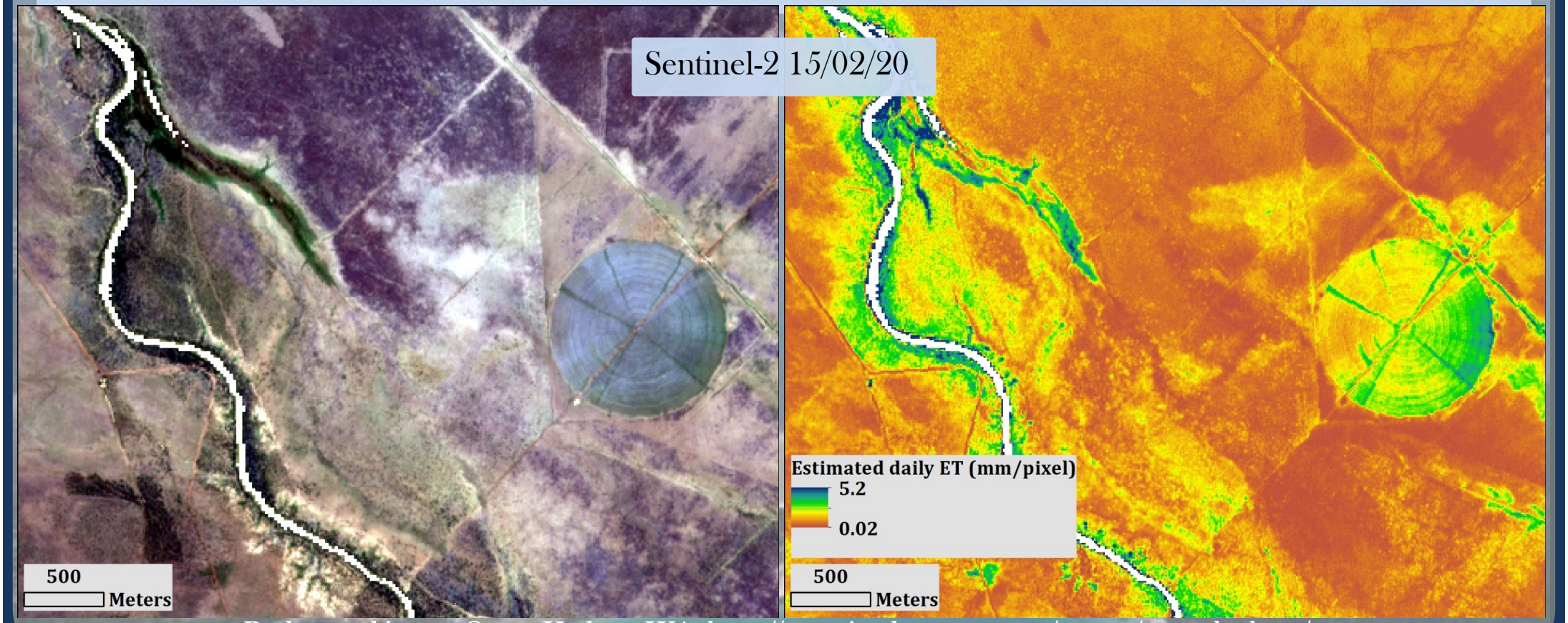

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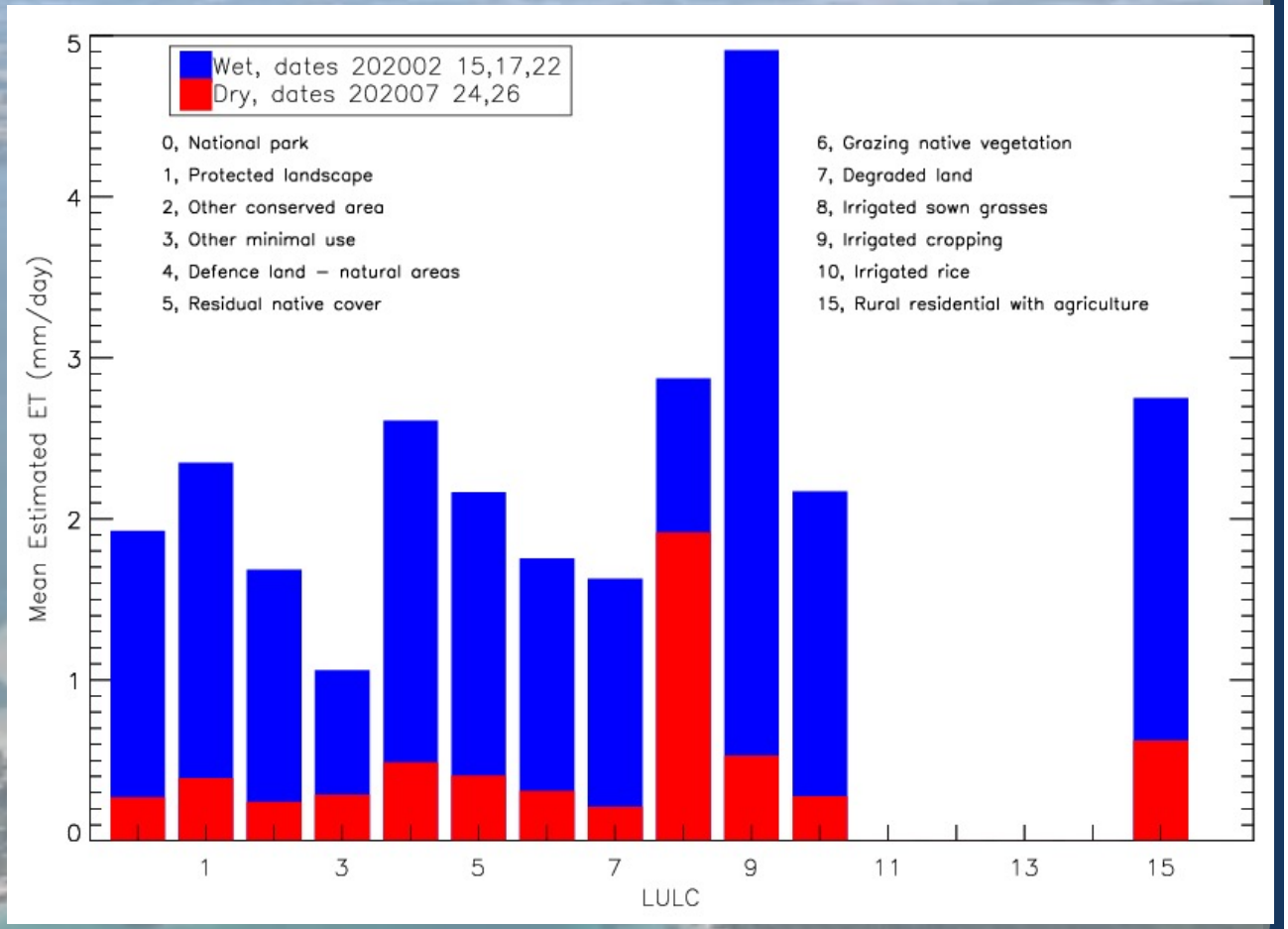
LULC ET Analysis.

- Natural environments categorised by very low dry season ET, and relatively low wet season ET compared to irrigated production categories.

Primary LULC Category	Values
Conservation and natural environments	0,1,2,3,4,5
Production from relatively natural environments	6
Production from dryland agriculture and plantations	7
Production from irrigated agriculture and plantations	8,9,10
Intensive uses	15



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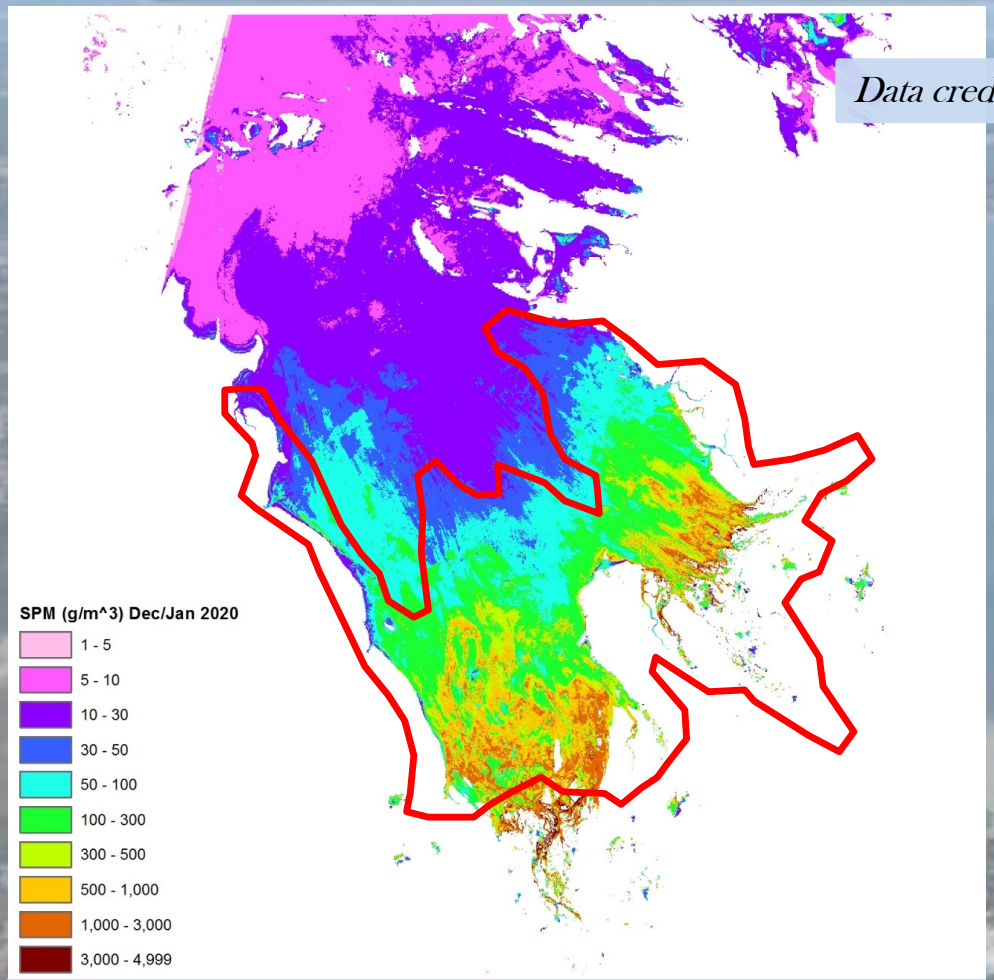
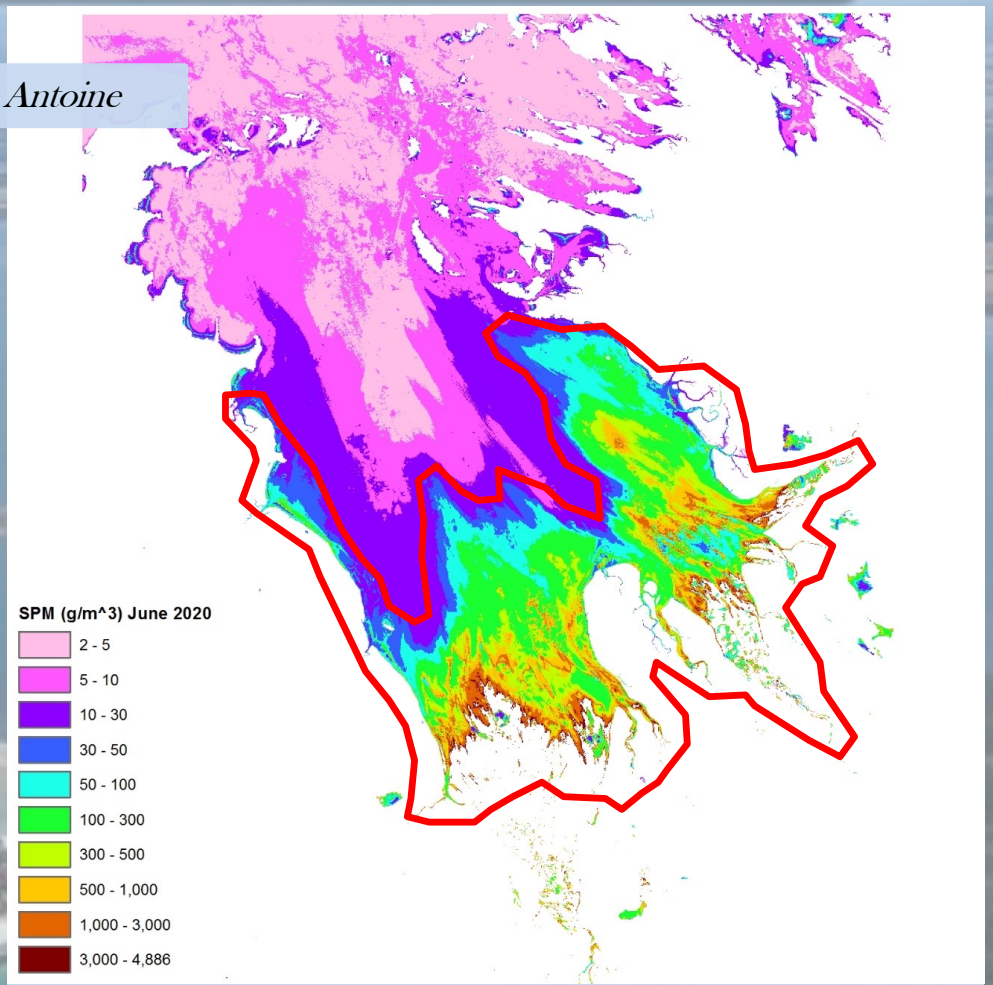
Raparapa / Fitzroy Estuary Water Quality

Data credit: D. Antoine



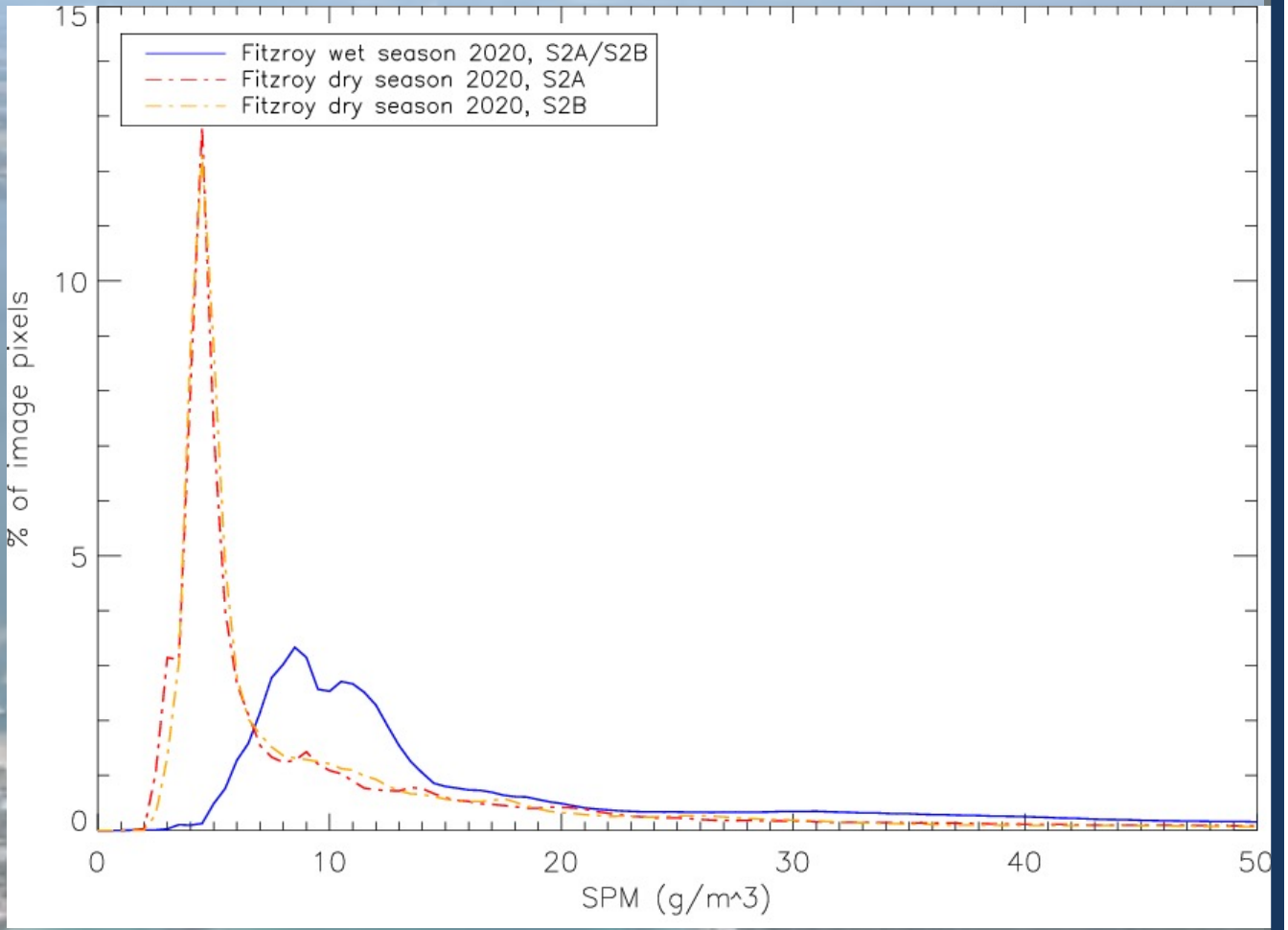
Wet season 2020



Dry season 2020

Water Quality Analysis.

- Compared to dry season, the estuary in the wet season has:
  - a higher mean particulate load in the estuary
  - a broader distribution of sediment concentrations
  - a much larger fraction of estuary pixels with high suspended matter values
- Interpretations:
  - runoff of particulate materials into the estuary driven by the high rainfall events, coupled with large expanses of poorly vegetated/easily mobilised top soil in catchment
  - resuspension by tidal mixing



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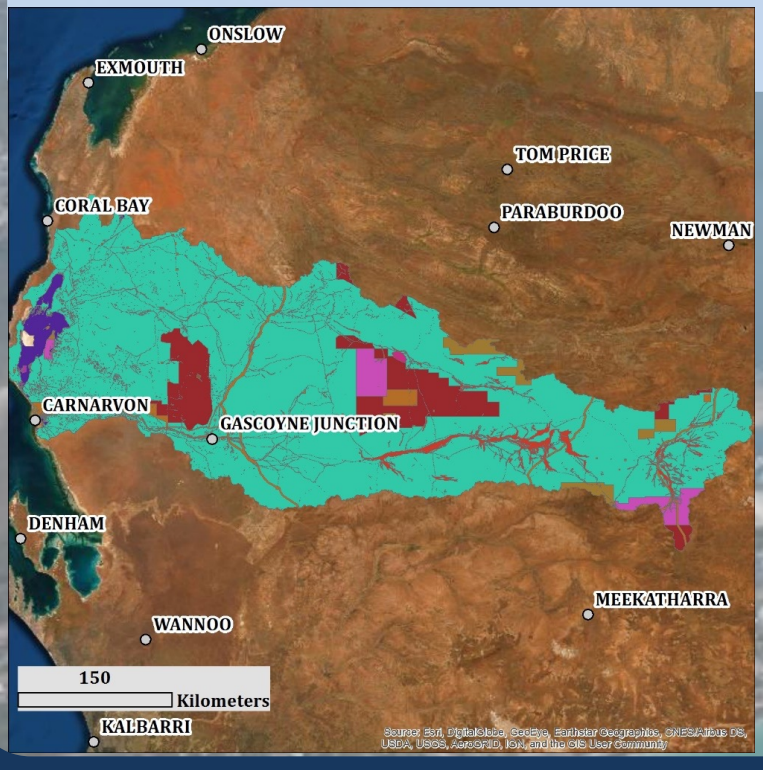
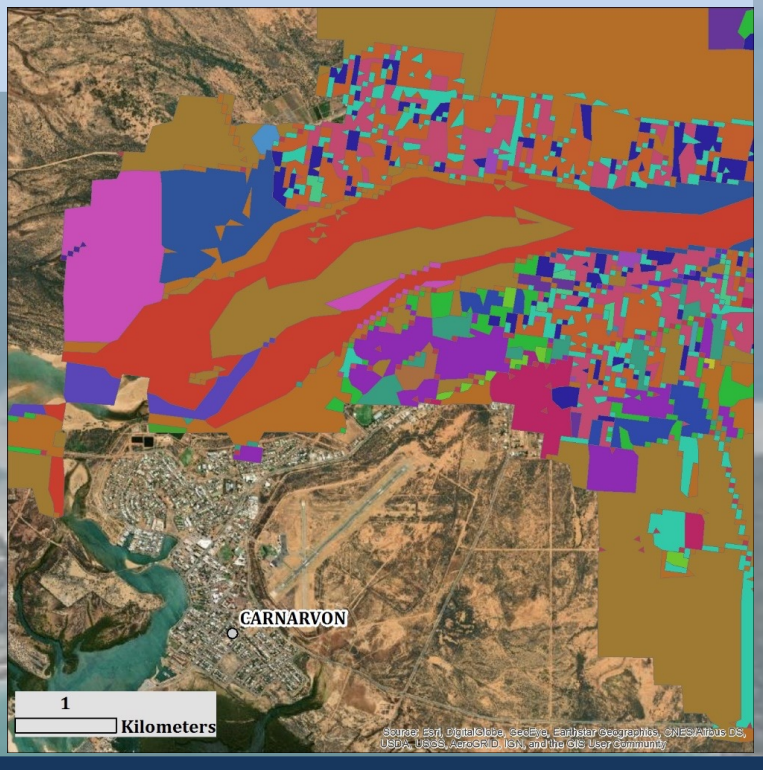
Next Steps...Summary

- Ongoing analysis interaction between LULC and water quality.
- Assessment of tidal impacts.
- **Site 2: Kuwinywardu/Gascoyne**





TERTIARY_V

- 1.1.1 Strict nature reserves
- 1.1.6 Protected landscape
- 1.2.4 Landscape
- 1.3.0 Other minimal use
- 1.3.1 Defence land - natural areas
- 1.3.3 Residual native cover
- 2.1.0 Grazing native vegetation
- 4.4.1 Irrigated tree fruits
- 4.4.5 Irrigated shrub berries and fruits
- 4.4.6 Irrigated perennial flowers and bulbs
- 4.4.8 Irrigated citrus
- 4.4.9 Irrigated grapes
- 4.5.0 Irrigated seasonal horticulture
- 4.5.3 Irrigated seasonal vegetables and herbs
- 4.6.0 Irrigated land in transition
- 4.6.4 No defined use (irrigation)
- 5.3.0 Manufacturing and industrial
- 5.3.5 Abattoirs
- 5.4.1 Urban residential
- 5.4.2 Rural residential with agriculture
- 5.4.3 Rural residential without agriculture
- 5.5.1 Commercial services
- 5.5.2 Public services
- 5.5.3 Recreation and culture
- 5.6.7 Water extraction and transmission
- 5.7.2 Roads
- 5.9.5 Sewage/sewerage
- 6.1.0 Lake
- 6.3.0 River
- 6.3.1 River - conservation
- 6.6.0 Estuary/coastal waters

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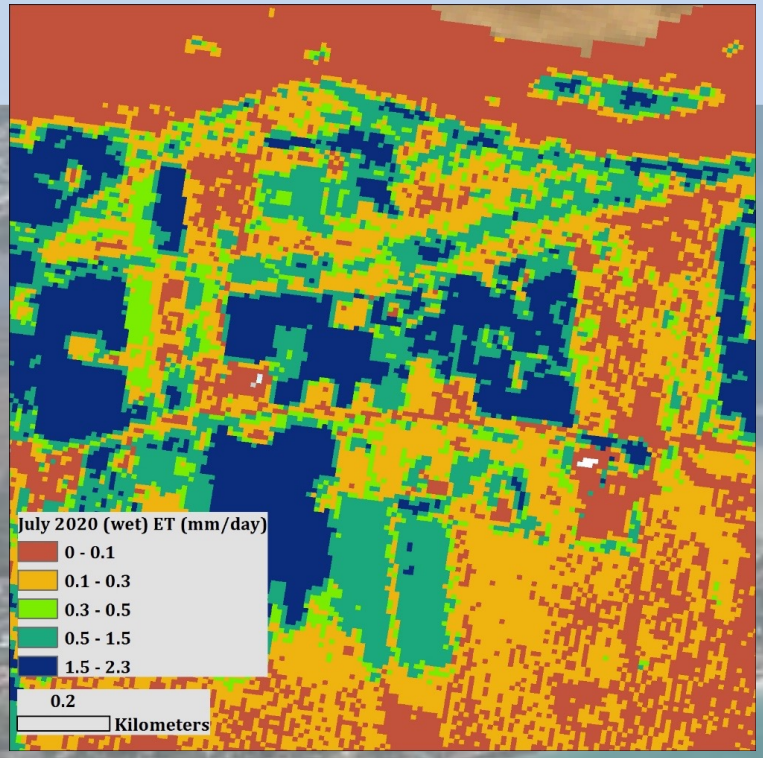

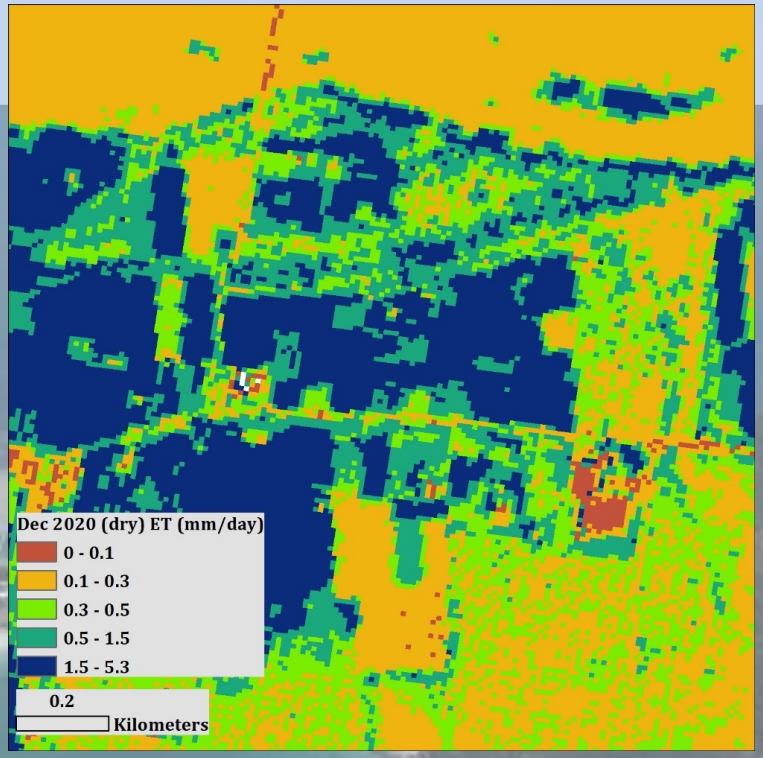


Thank you ♥☯ॐ Questions?
Background image: The Martian; 20th Century Fox.