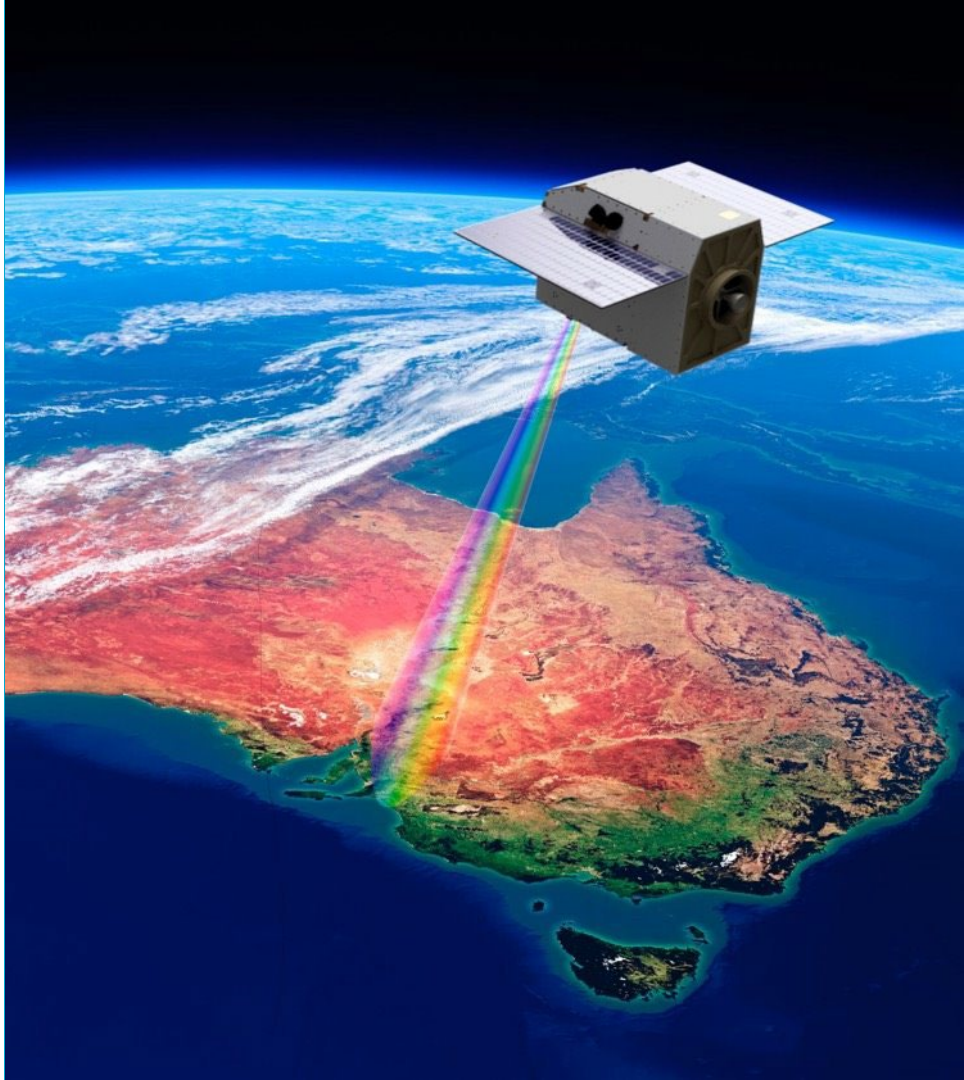
AquaWatch Australia

A ‘weather service’ for water quality

Biospace25| 11 February 2025



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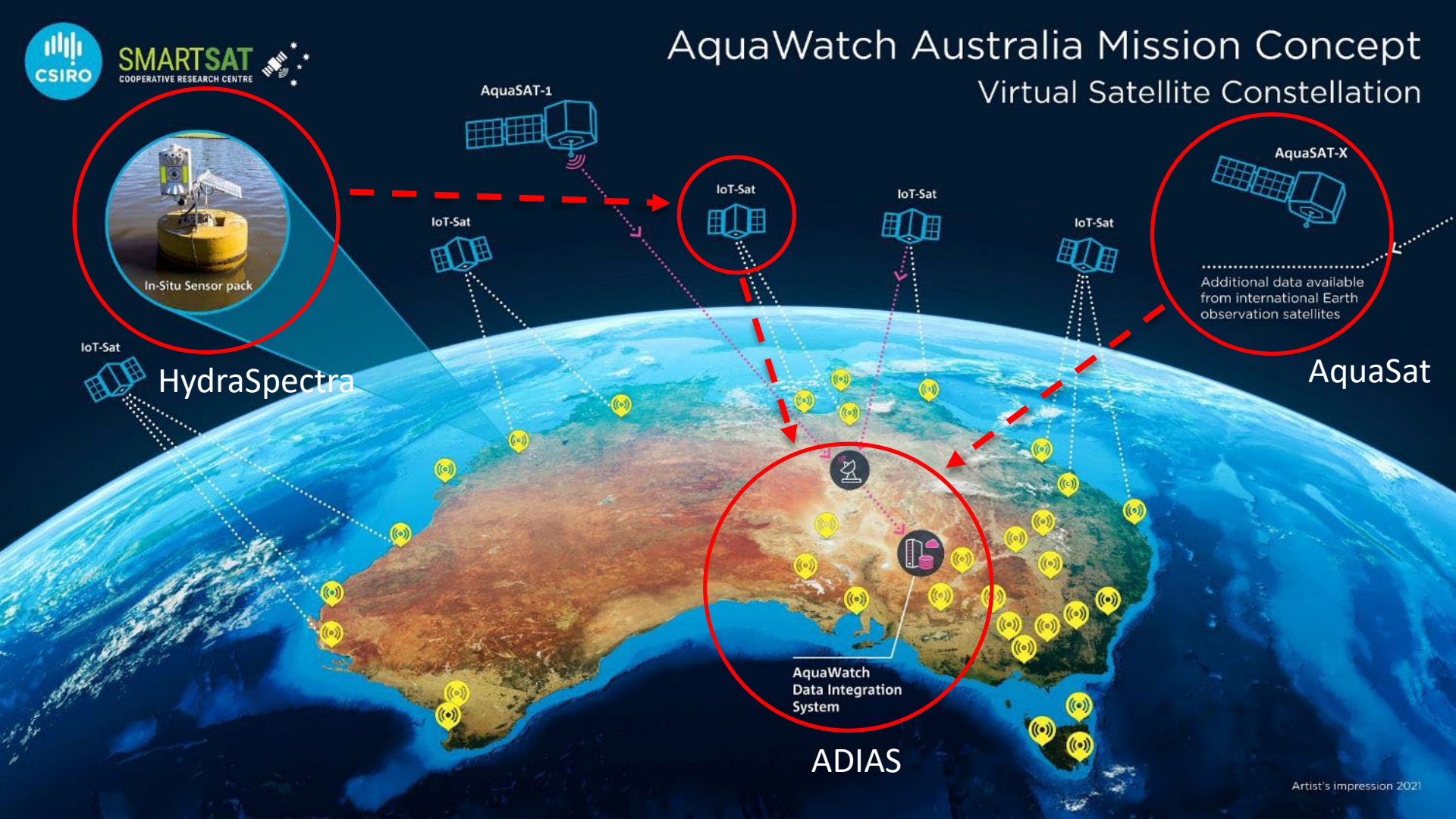
Water Quality: a global challenge

- Over three billion people are at risk of illness from poor water quality due partly to a lack of monitoring (UN, 2023).
- Aquatic ecosystems rapidly degrading: 35% of wetlands and 15% of coral has been lost since 1970 (Convention on Wetlands, 2021; Souter et al., 2021).
- Comprehensive monitoring of inland and coastal waters needed for effective management and conservation.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SMARTSAT
COOPERATIVE RESEARCH CENTRE
AquaWatch Australia Mission Concept
Virtual Satellite Constellation
AquaSAT-1
IoT-Sat
IoT-Sat
IoT-Sat
IoT-Sat
IoT-Sat
AquaSAT-X
In-Situ Sensor pack
HydraSpectra
Additional data available from international Earth observation satellites
AquaSat
AquaWatch Data Integration System
ADIAS
Artist's impression 2021

AquaWatch Australia

Water quality sensors:
In-situ sensors provide highly accurate measurements used to validate satellite data.
Establish regional sensor networks.

Earth observation (EO):
Data from satellites is used to extrapolate across entire continents.

Co-Design demonstration sites:
Building partnerships with national and international organisations.

Data systems:
Data is processed using our advanced analytics platform.
AI inversion modelling is applied to suit the end users.

Water quality modelling:
Data is integrated to make predictions about water quality.
AI can help scale-up local forecasting models to regional & continental coverage.

Science and Applications Traceability Matrix:
Ensuring AquaWatch is driven by end user requirements informed by science.

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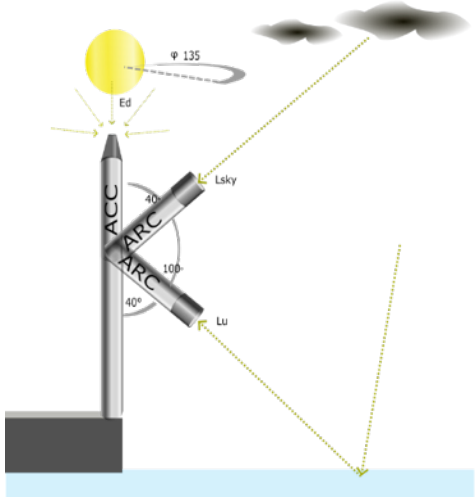
Pilot Site Instrumentation Stations for In-situ Water Quality Measurement and Satellite Data Validation

Instruments include:

- CSIRO HydraSpectra
- Optical Radiometers
- Pan/tilt unit
- Thermal Radiometers
- Weather station
- Cameras horizontal and forward-looking
- Water temperature profile

HydraSpectra Mk IV



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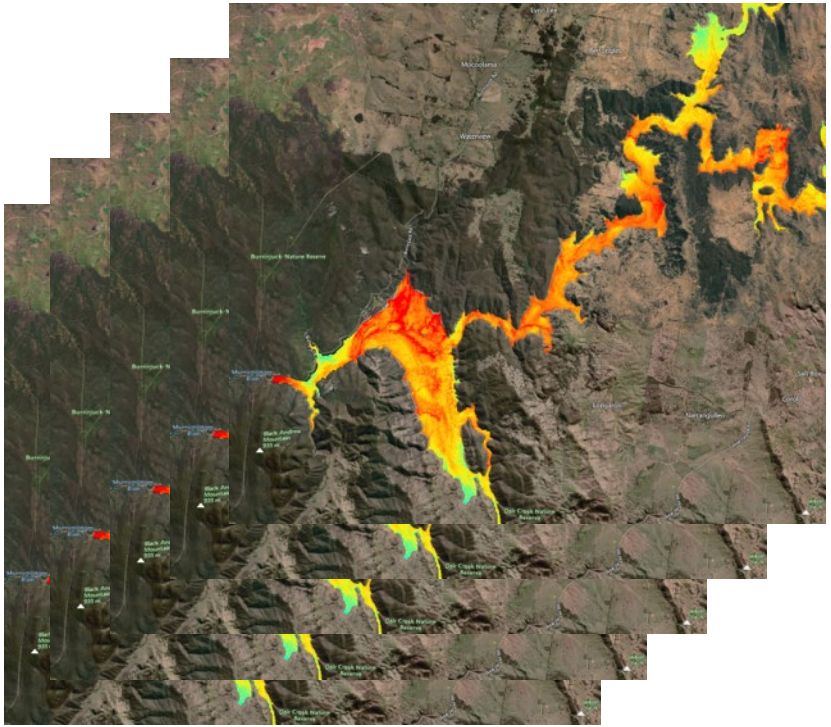
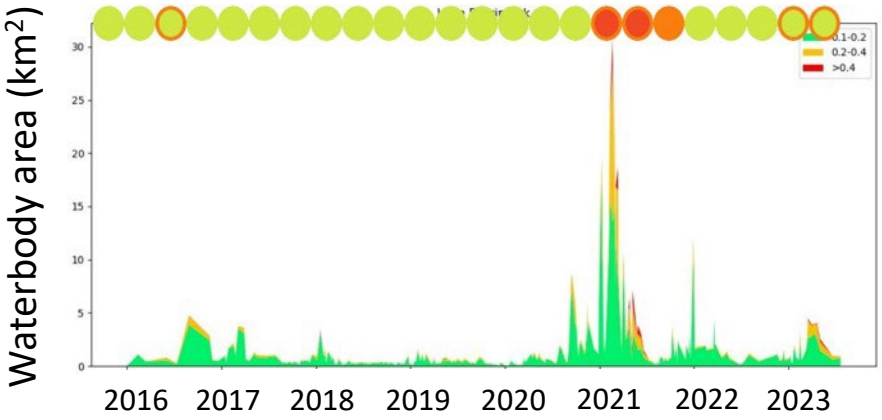
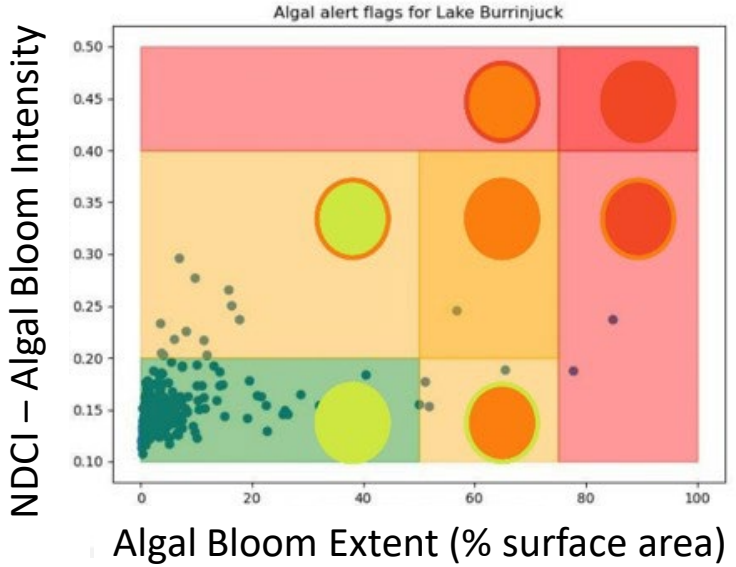
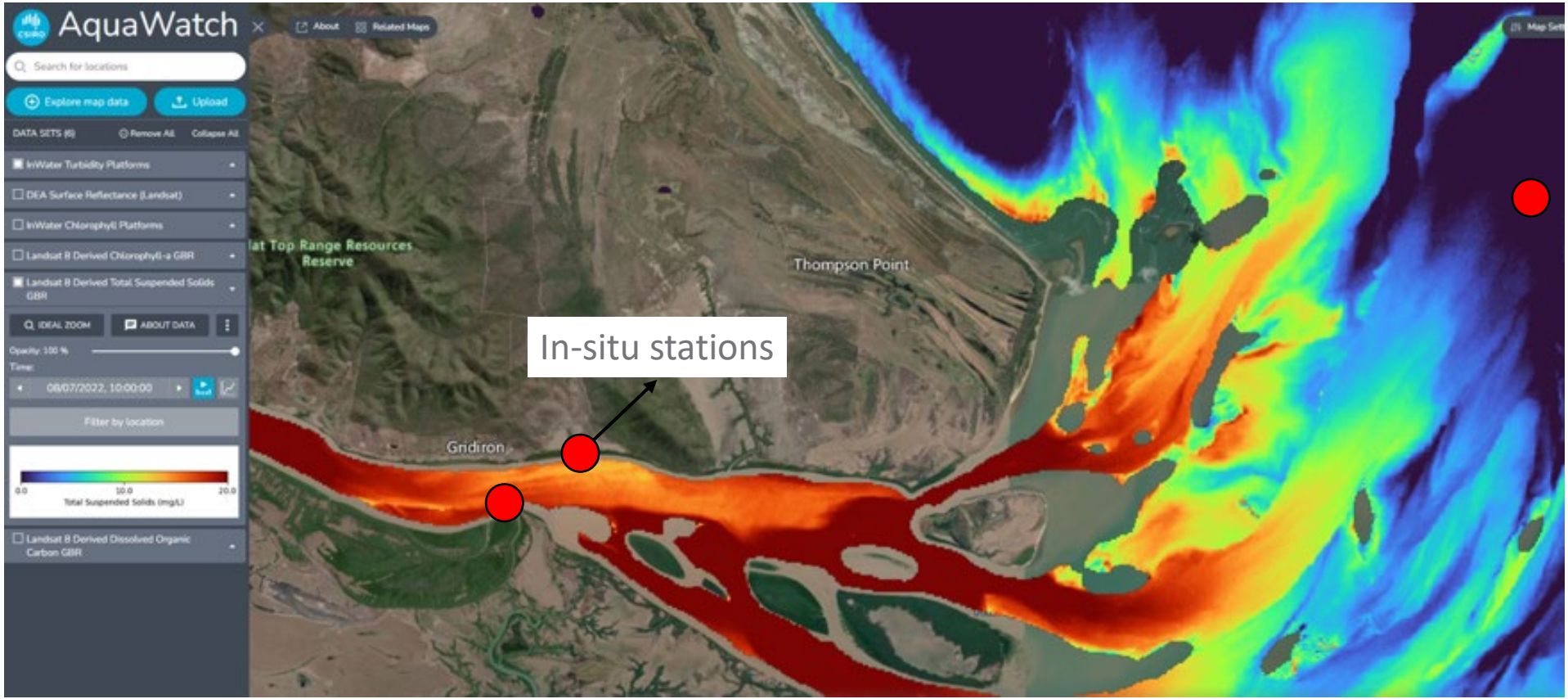
Extent and severity of Algal blooms







Verification with in-water sensors



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Co-Design:

Building new partnerships to test and validate system

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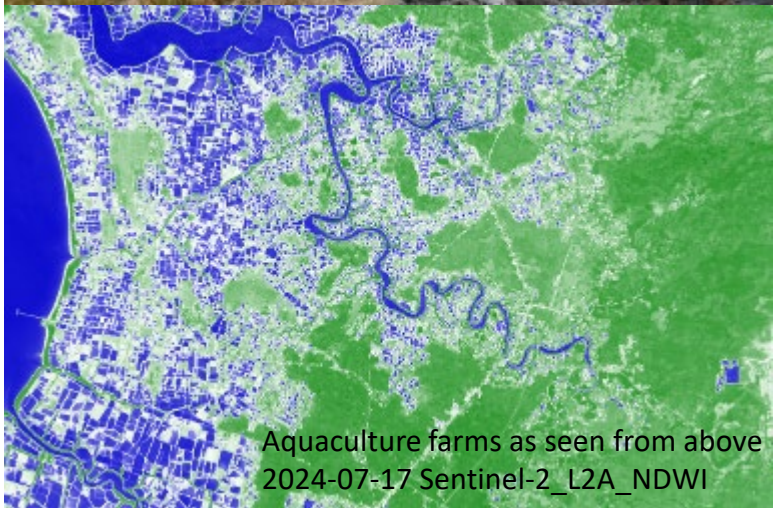
Working with local experts and communities

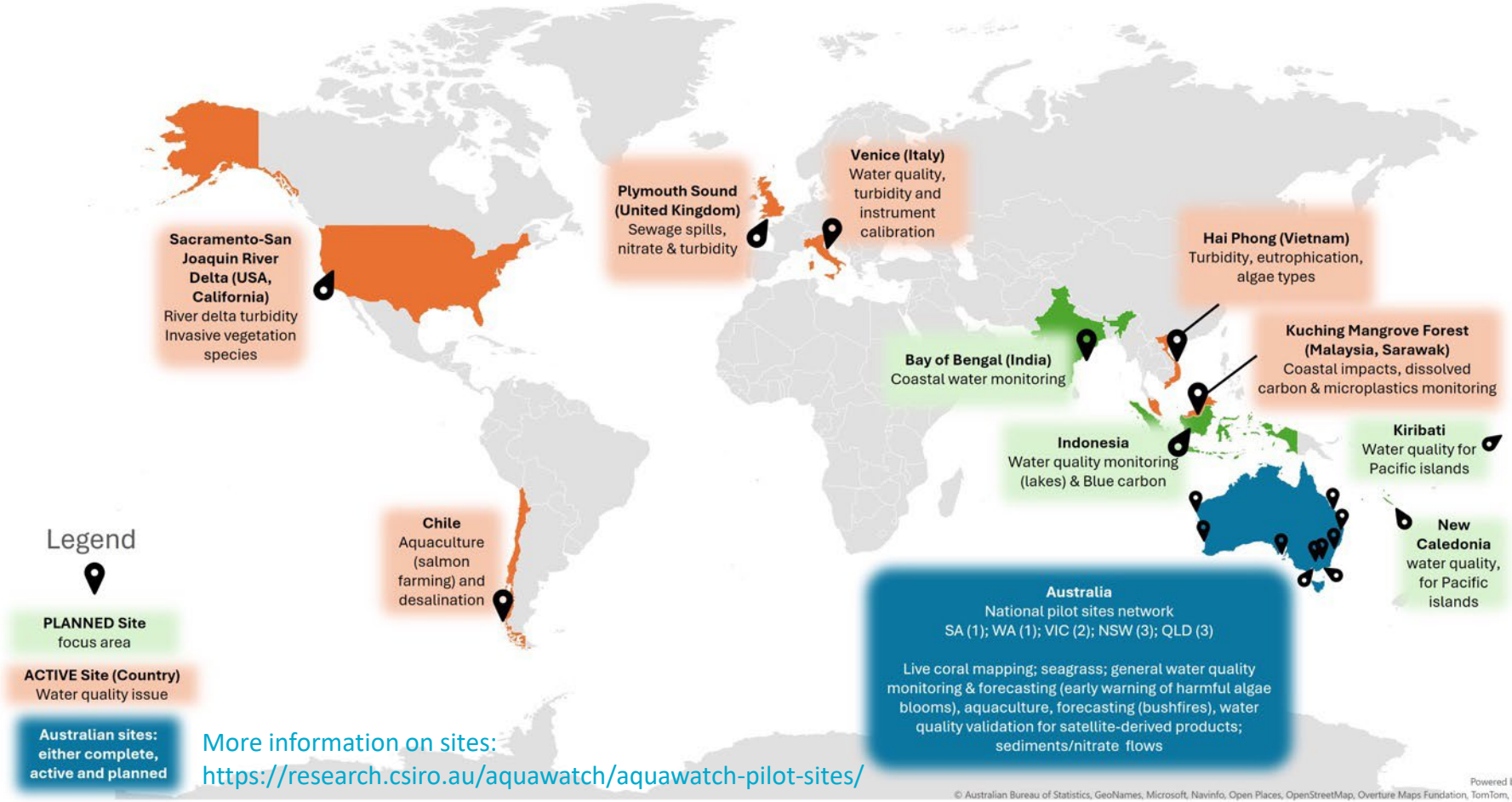
- Need to connect satellite technologies with local knowledges, needs, and ground-based measurements:
  - Co-design with technical partners and local communities.
  - Grounding data collection in local/stakeholder needs.
  - Ensuring data is accessible by the non-expert in a useable platform.
  - Protecting privacy and Indigenous data governance.

Aquaculture farms as seen from the ground (South Sulawesi, Indonesia)



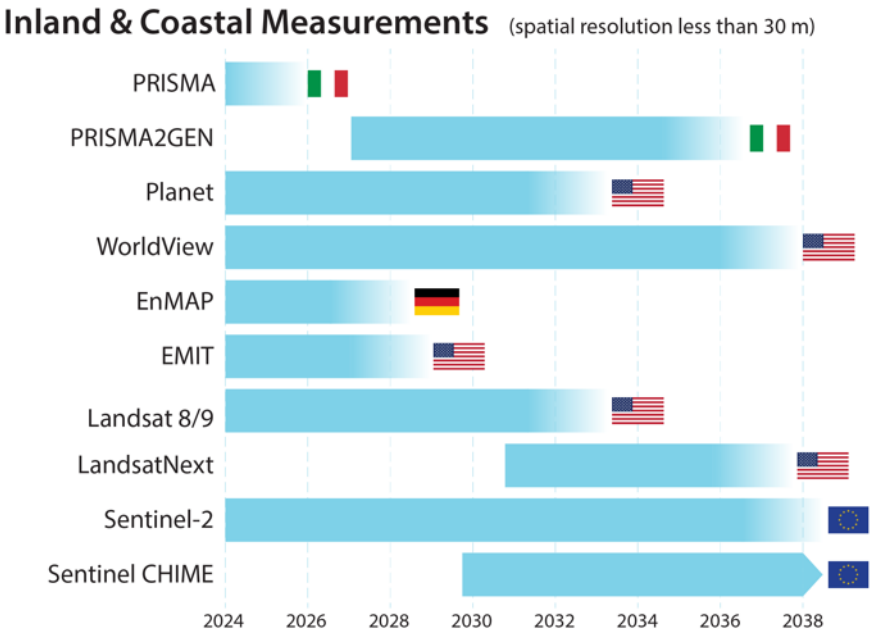
Aquaculture farms as seen from above 2024-07-17 Sentinel-2_L2A_NDWI

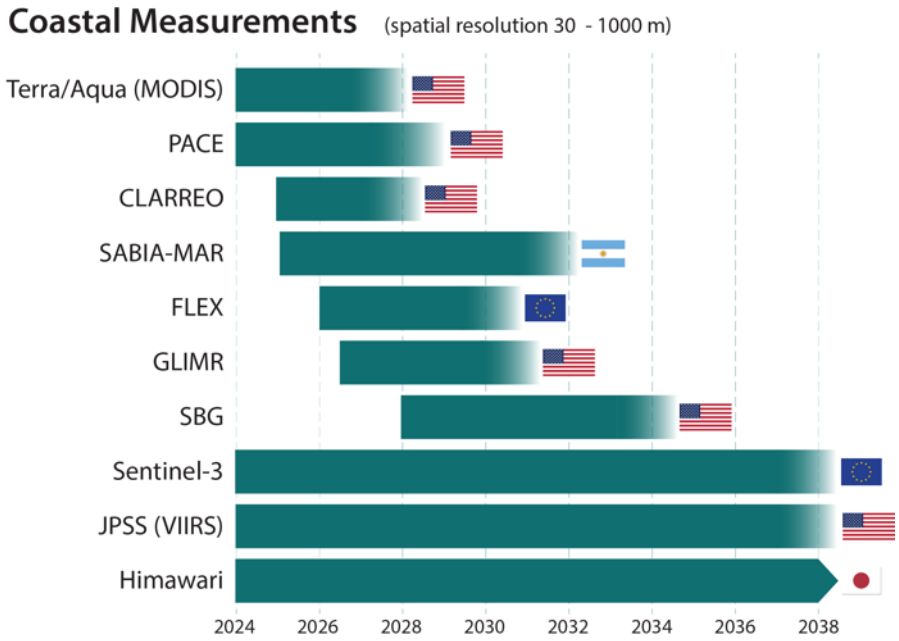
AquaWatch pilot sites across the world



More information on sites:
https://research.csiro.au/aquawatch/aquawatch-pilot-sites/

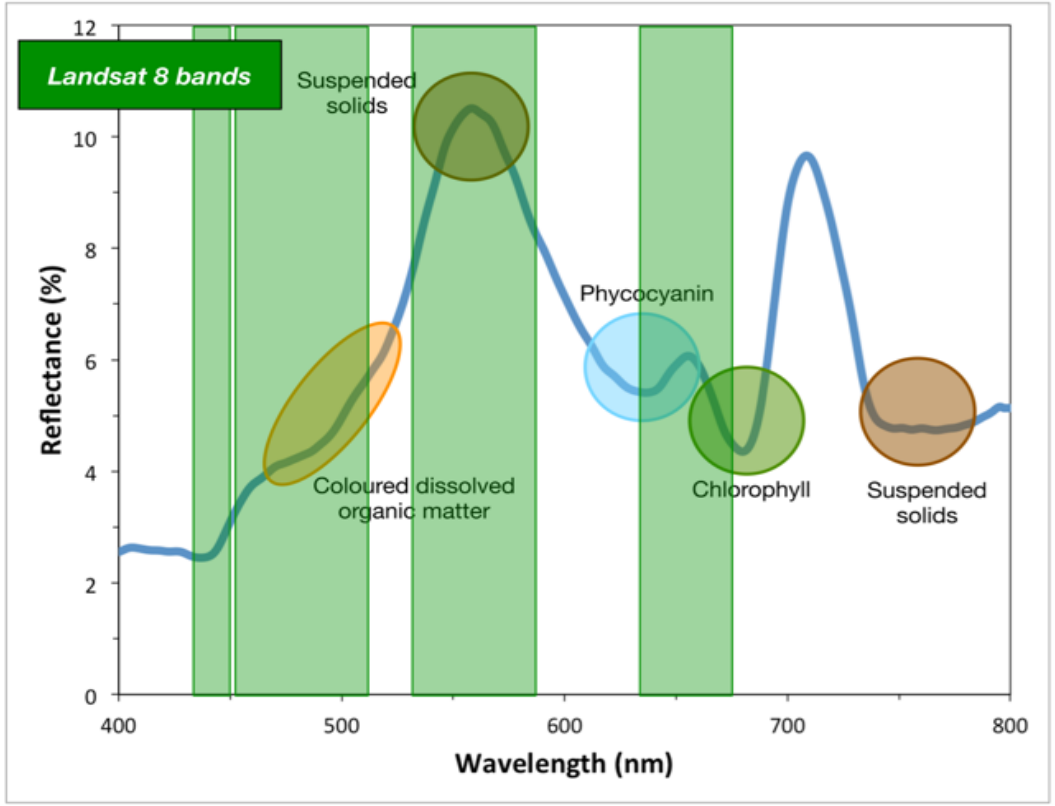
Virtual Satellite Constellation of EO data for AquaWatch

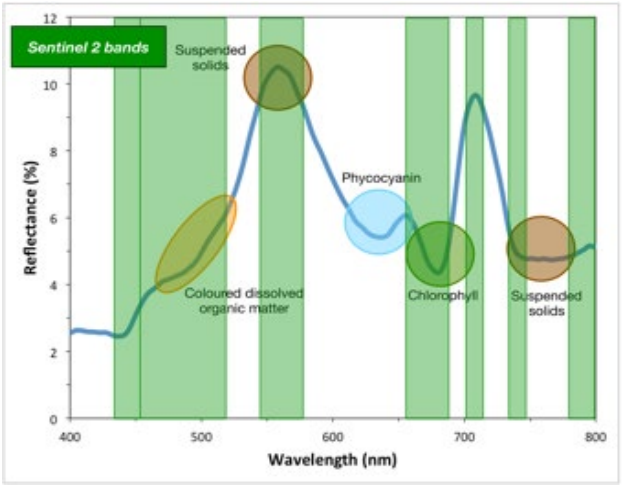


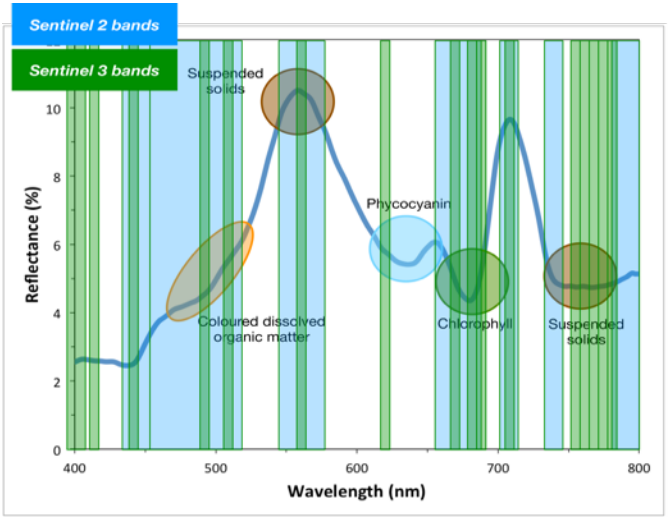


Extra EO Data for Water Quality Modelling: SWOT, Trishna, ..

Current Satellite spectral Characteristics







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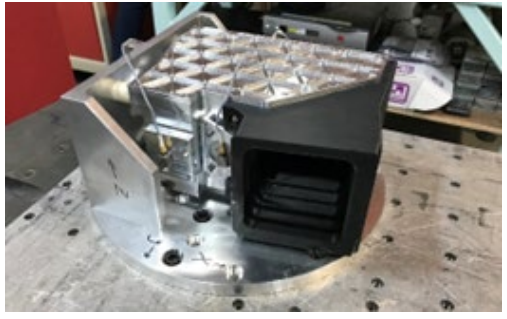
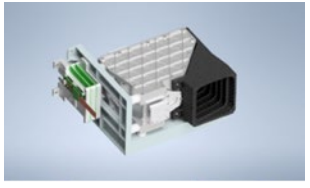
AquaSAT-1 Feasibility study, with NASA JPL

- **Joint 18-month project completed**
- **Orbit:** sun-synchronous, ~noon crossing time, ~400 km altitude (trade study: 600 km altitude)
- **GSD:** 18 m
- **Imaging coverage:** target sites (key lakes, rivers, estuaries, coral reefs in Australia and the US West)
- **Revisit:** 5 days with +/- 30 deg cross-track slew (not accounting for cloud cover, sunglint, target site conflicts, etc.)
- Dyson imaging spectrometer (350 to 1050 nm, 9.6 nm FWHM)

CSIRO's CyanoSense hyperspectral imager

- Custom hyperspectral imaging payload developed by CSIRO for the detection of potentially harmful algal blooms in inland waterbodies.
- It integrates a custom optical system with a compute module for on-board data processing
- Features a low power supervisor with multiple electrical interfaces for communication with different spacecraft buses.





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