Applying attribute-based classification and typology

to enrich intertidal and seabed mapping in Queensland

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Queensland Wetlands Program

Queensland Government

Why map and classify ecosystems?

- For seamless ecosystem-based management
- To understand intertidal and subtidal ecosystem nature and extent
- To understand the biological, physical & chemical factors influencing them
- To unify hundreds of mapping datasets, all collecting different parameters
- To extend the usefulness of mapping data to a range of different purposes and potential uses
- To identify knowledge gaps, reduce redundancy, target future inventory

Photo by Gary Cranitch, Queensland Museum

The Queensland Intertidal & Subtidal Ecosystem Classification Scheme

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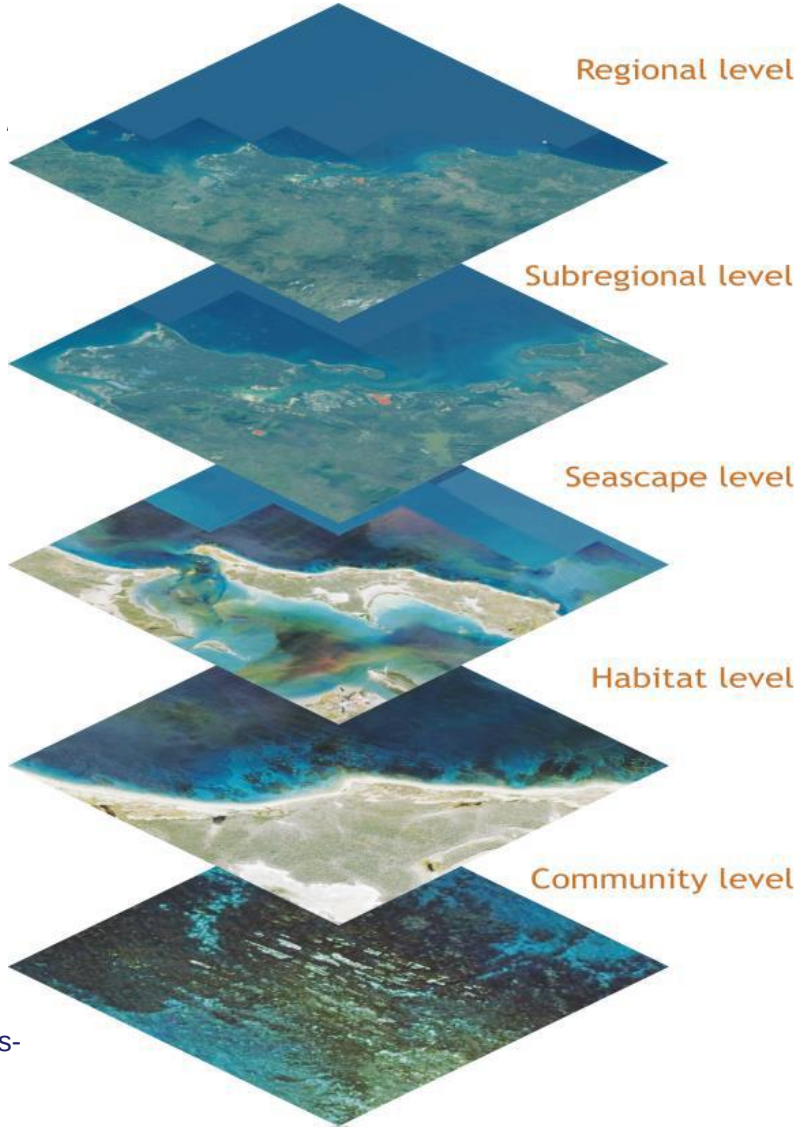
PRINCIPLES & STANDARDS

- Compatible with national ANAE / NISB classification standards
- Compatible with Qld Regional Ecosystems and Wetlands frameworks
- 5 Level spatial hierarchy
- Attributes of the Scheme reflect the factors that underpin the nature & extent of ecosystems



https://wetlandinfo.des.qld.gov.au/wetlands/what-are-wetlands/definitions-classification/classification-systems-background/intertidal-subtidal/

The Scheme's Structure and Documentation

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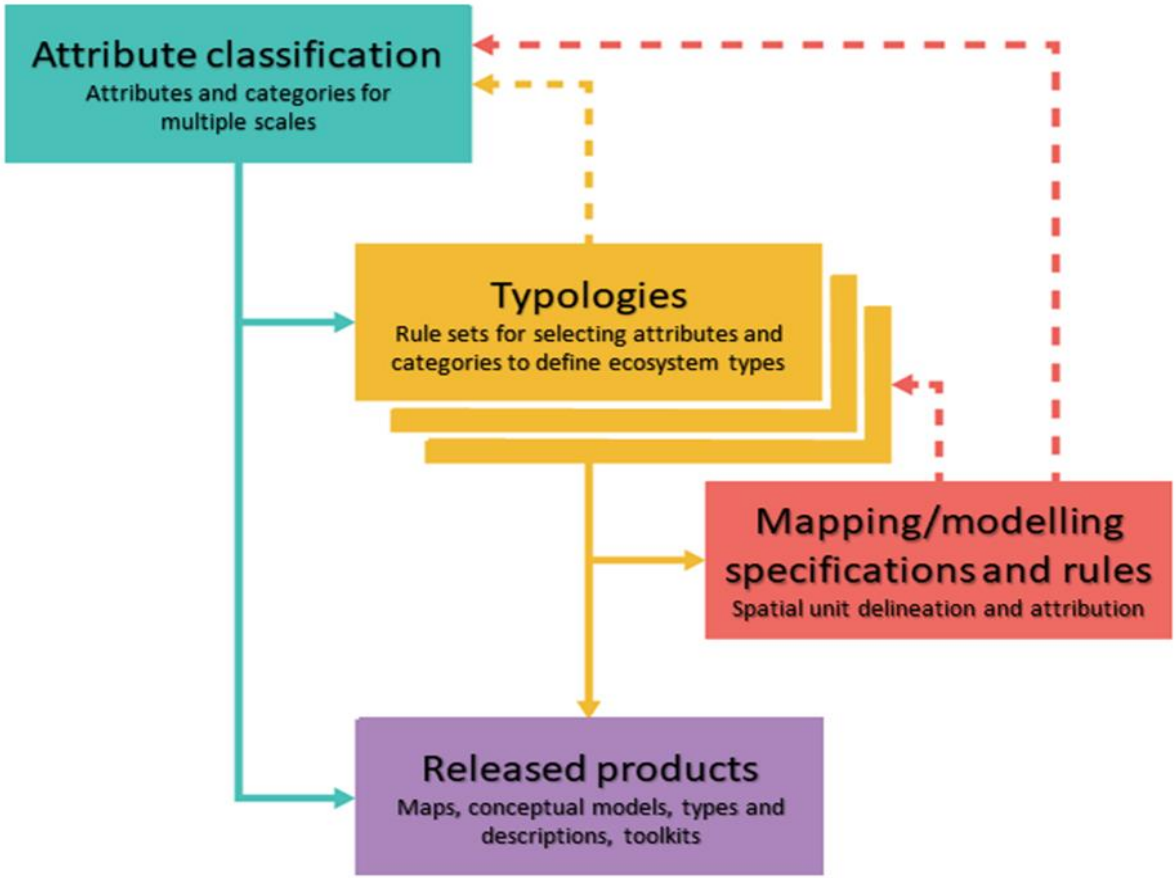
- Distinguishes between attribute classification, typology and mapping steps

MODULE DOCUMENTATION

- Module 1: Introduction to the intertidal and subtidal ecosystem classification scheme
- Module 2: Literature review of intertidal and subtidal classification
- Module 3: Attributes, categories, and metrics for the intertidal and subtidal ecosystem (as Attributes web pages)
- Module 4: Mapping method



Crosswalking - ways to apply

source datasets to attributes & categories

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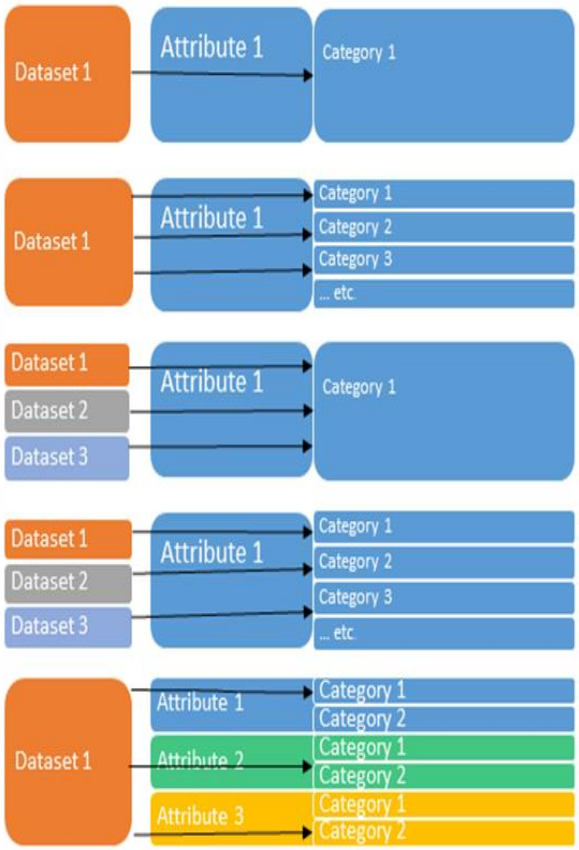
Crosswalking - ways to apply
source datasets to attributes & categories

	Surrogate datasets	Attributes & Categories
a)	One	One attribute, one category
b)	One	One attribute, many categories
c)	Many	One attribute, one category
d)	Many	One attribute, many categories
e)	One	Many attributes with many categories



Crosswalking - ways to apply source datasets to attributes & categories

- Bathymetry underpins :
  - Benthic depth
  - Terrain slope
  - Terrain roughness
  - Terrain relative relief
  - Terrain morphology
  - Substrate consolidation
  - Substrate grain size / sediment texture (e.g. using MBES)
  - Structural macrobiota
  - Water column attributes e.g. energy magnitude, water clarity (benthic irradiance), attributes to extract from 3D / 4D hydrodynamic models

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Intertidal & Subtidal Seascape Level Ecosystem Mapping

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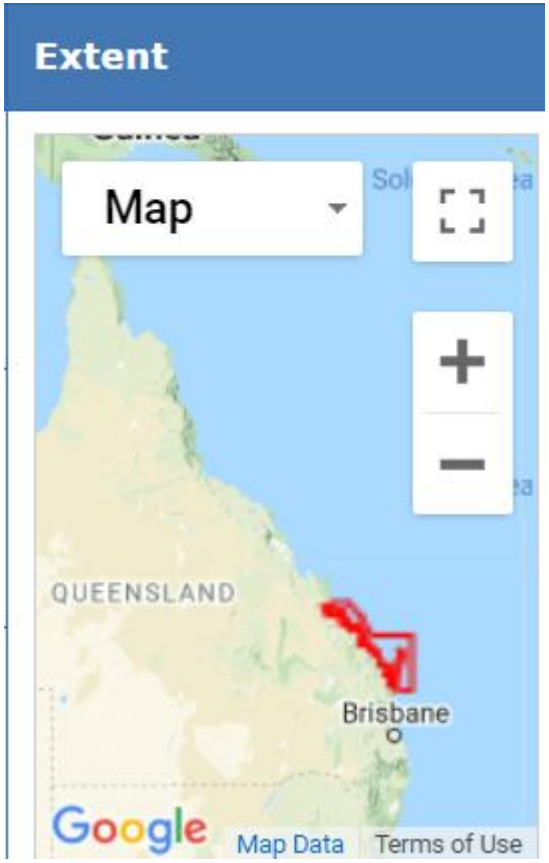

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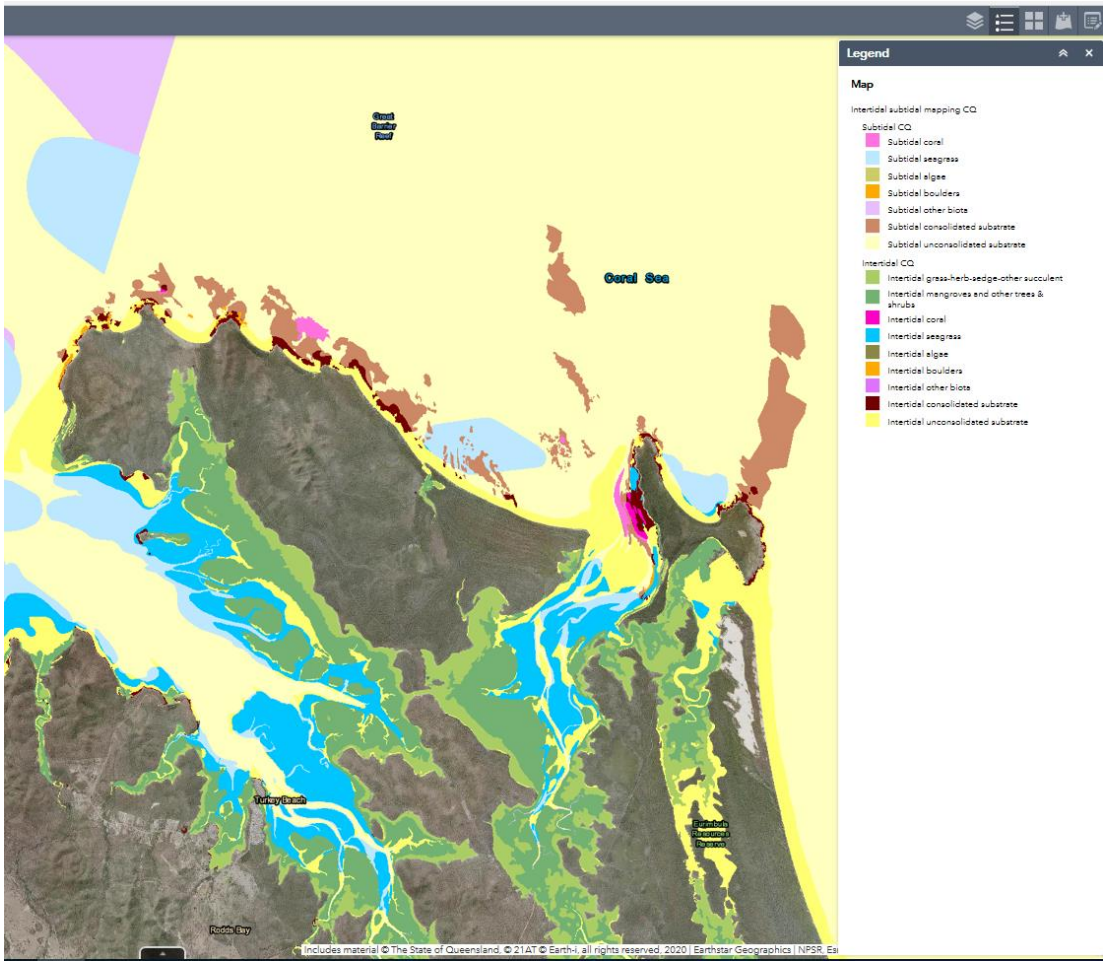

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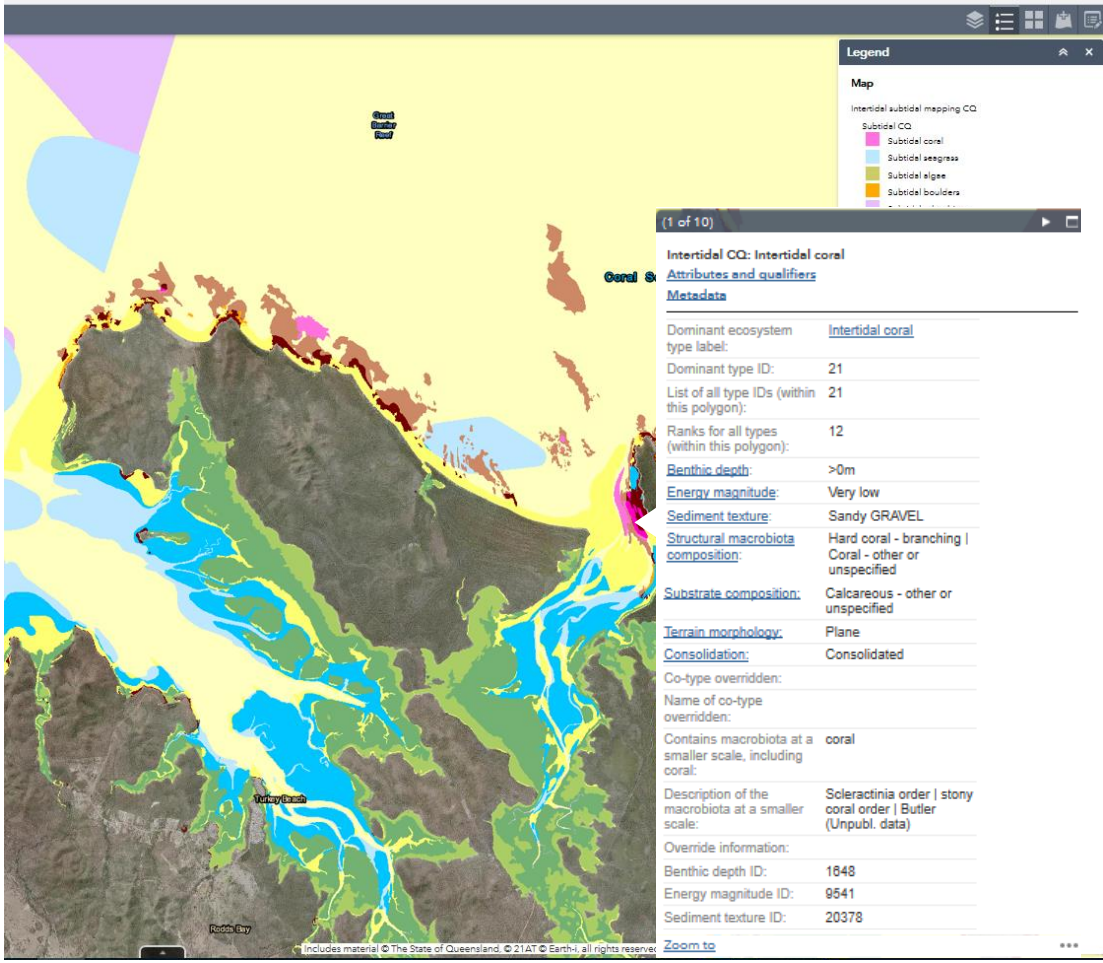

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Short description

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Point Vernon, Queensland. Photo by Maria Zann

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Sea levels control the level to which coral growth can occur, with corals either growing to the surface or becoming submerged in response to changing sea levels. Well-developed, fringing reefs have a reef flat with corals that are growing close to the surface and are limited by tidal inundation[16]. Intertidal corals usually occur well below mean sea level, where they are only emergent during spring tides, and occasionally in tidal pools higher up the shore. Refer to type (100) for a diagram comparing well-developed fringing reefs with submerged reefs and rock with coral growth[16].

Intertidal branching hard corals often experience some wave action and can disperse vegetatively where pieces are broken off by a storm. Generally, branching corals are indicative of slightly clearer waters. Species diversity of the genus *Acropora* is highest in north Queensland and on the offshore reefs of the Great Barrier Reef, and also on coral rocky communities of the East Australian Current further south. Inner shelf and fringing reefs have a lower species diversity, especially towards their range limits where high latitude specialists, such as *Acropora bushyensis* occur[9]. Some shallow water *Acropora* spp. are depth generalists, also found in mesophotic coral ecosystems (MCEs. i.e. low light coral ecosystems).

Intertidal non-branching hard corals include massive, submassive, plate/table, bushy, vase/foliose or encrusting growth forms. Growth forms of coral are influenced by biophysical factors including depth, light, current etc.[9]. Non-branching coral ecosystems can be quite high in species diversity, within the subtropics including both tropical and temperate species at the limit of their range[4]. Non-branching corals of inshore waters can also be significant reef-builders. Massive corals can live for hundreds of years and grow to several metres in diameter. Generally, non-branching corals tolerate more turbid waters than branching corals, with the Dendrophyllidae and Faviidae families typically tolerating the low light and high nutrient conditions experienced on nearshore fringing reefs. Turbid water specialists of the inner Great Barrier Reef are capable of rapid growth, forming monospecific stands of many hectares, including foliose, cabbage-like *Turbinaria* spp. corals and the flower-like submassive *Goniopora* spp. whose polyps are emergent in the daytime and are often mistaken for soft corals[9][17]. Both genera are heterotrophic, i.e. capturing planktonic prey as an alternative to photosynthesis, a distinct advantage in turbid waters[2]. Massive brain corals (Merulinidae, formerly Faviidae) are characteristic of Moreton Bay coral communities growing on rocky substrate and on old limestone reefs, but do not form significant reefs today[10][13].

Intertidal soft coral biota includes Alcyonarian soft corals (e.g. *Cladiella*, *Klyxum*, *Sinularia*, *Lobophytum*, *Sarcophyton* and *Dendronephthya* spp.) and other octocorallians* which can be subdominant with other taxa include sponges, zoanthids, ascidians and hydroids. Alcyonarian soft corals will grow on the more persistent coffee rock substrates that are alternately covered over by sediments and exposed, and are more likely to have biota typical of reefal gardens (Andrew Olds, 2018, pers comm.). Some soft corals possess endosymbiotic dinoflagellates (e.g. zooxanthellae) and can photosynthesise, these will often be found in shallower water (e.g. families Nephtheidae, Alcyoniidae and Xeniidae).

*Octocorallia is a subclass of the class Anthozoa in the phylum Cnidaria, and include soft corals, gorgonians, sea whips, sea pens, sea fans and octocorals. Like some of the many other anthozoans, octocorallians are sessile polyp-bearing animals with a mobile larval phase. Octocorallians are distinguished by the eight (i.e. octo) tentacles in each polyp. Most octocorallians do not deposit a rigid calcium carbonate exoskeleton, and therefore tend to attach to reefs rather than contribute to reefal frameworks as per the reef building Scleractinian (hard) corals[9].

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The Reef - Great Barrier Reef Marine Park Authority
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1. * Alquezar, R, Scannell, J & Boyd, W 2011, *Coastal fringing reefs of the Burnett Mary Region 2011. A report to the Burnett-Mary Regional Group.*, Centre for Environmental Management, Central Queensland University, Gladstone, Queensland.

Intertidal & Subtidal Seascape Level Ecosystem Mapping

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- Links to 94 ecosystem types
- Types a combination of 8 attributes, each a data synthesis layer

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1. * Alquezar, R, Scannell, J & Boyd, W 2011, *Coastal fringing reefs of the Burnett Mary Region 2011. A report to the Burnett-Mary Regional Group.*, Centre for Environmental Management, Central Queensland University, Gladstone, Queensland.

Where to next?

Queensland Wetlands Program

- **Inventory Guideline** & **Attribute Pages** to inform collection / collation of attribute-compatible intertidal and subtidal data to harmonize with current ecosystem mapping

- **Collaborative studies** with stakeholders to develop **input/ core datasets** and establish variability for intertidal mapping (e.g. Geosciences Australia - tidal extent delineation, greenness etc.)

- **Case studies** with stakeholder mapping inventory projects to ensure compatibility with the attribute-based approach

- **Paper** on the Scheme and its advantages

Photo by Maria Zann