Organic C stocks in Australia's terrestrial and coastal marine biomes

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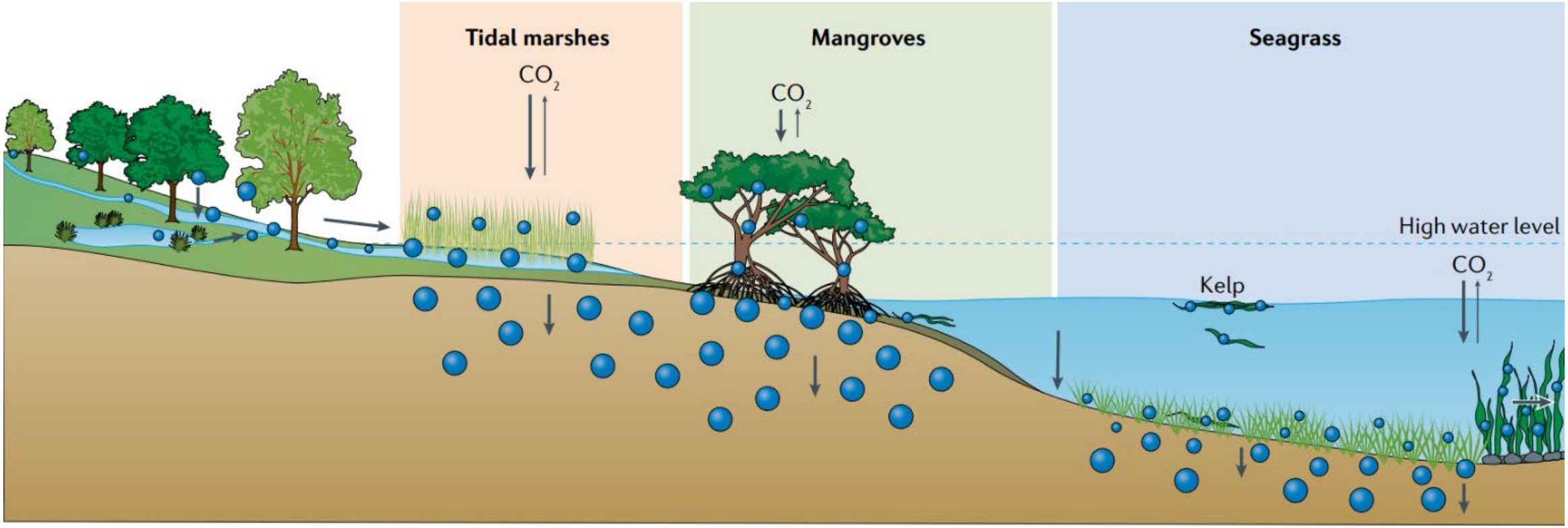
Background

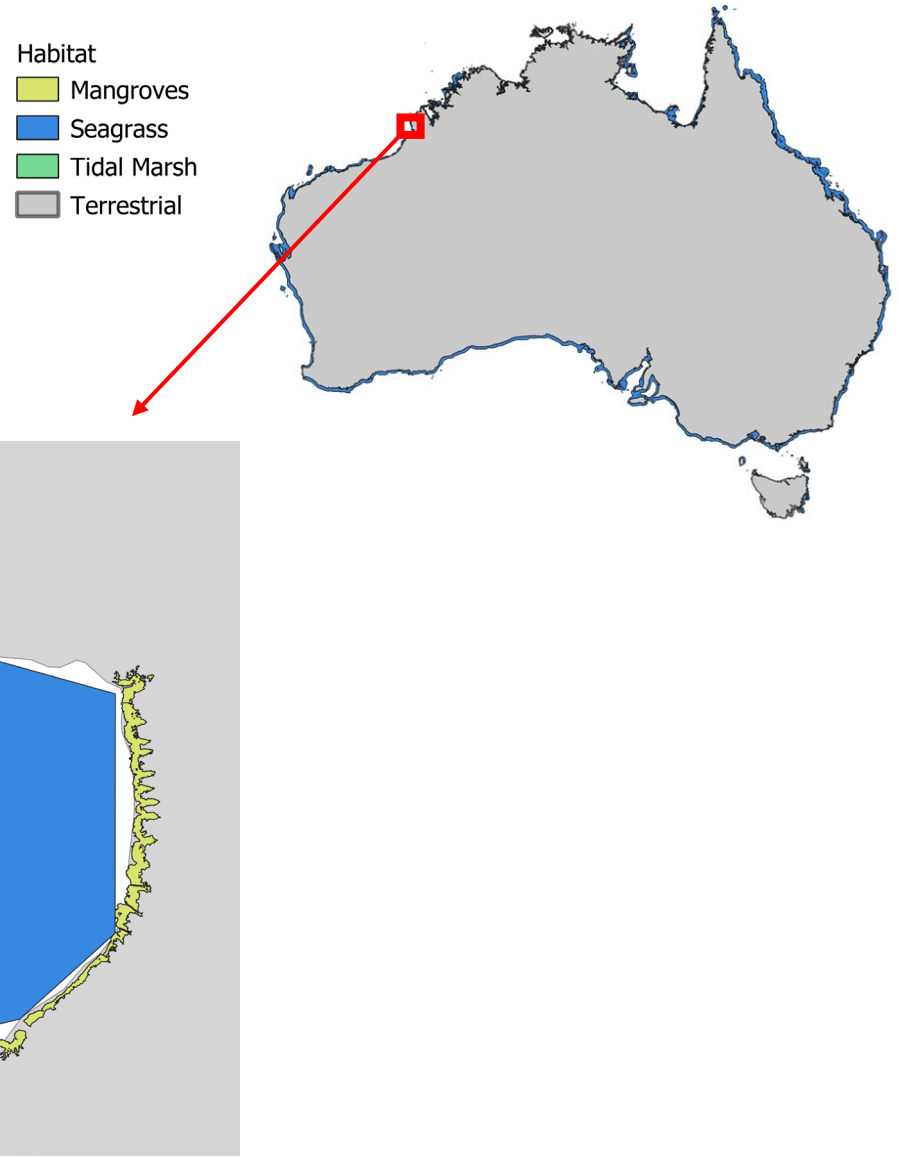
- Blue carbon ecosystems (BCE) include Tidal marshes, Mangroves, and Seagrasses
- Cover 0.2% of ocean surface and contribute ~50% of carbon (C) burial in marine sediments



Macreadie *et al.* (2022)

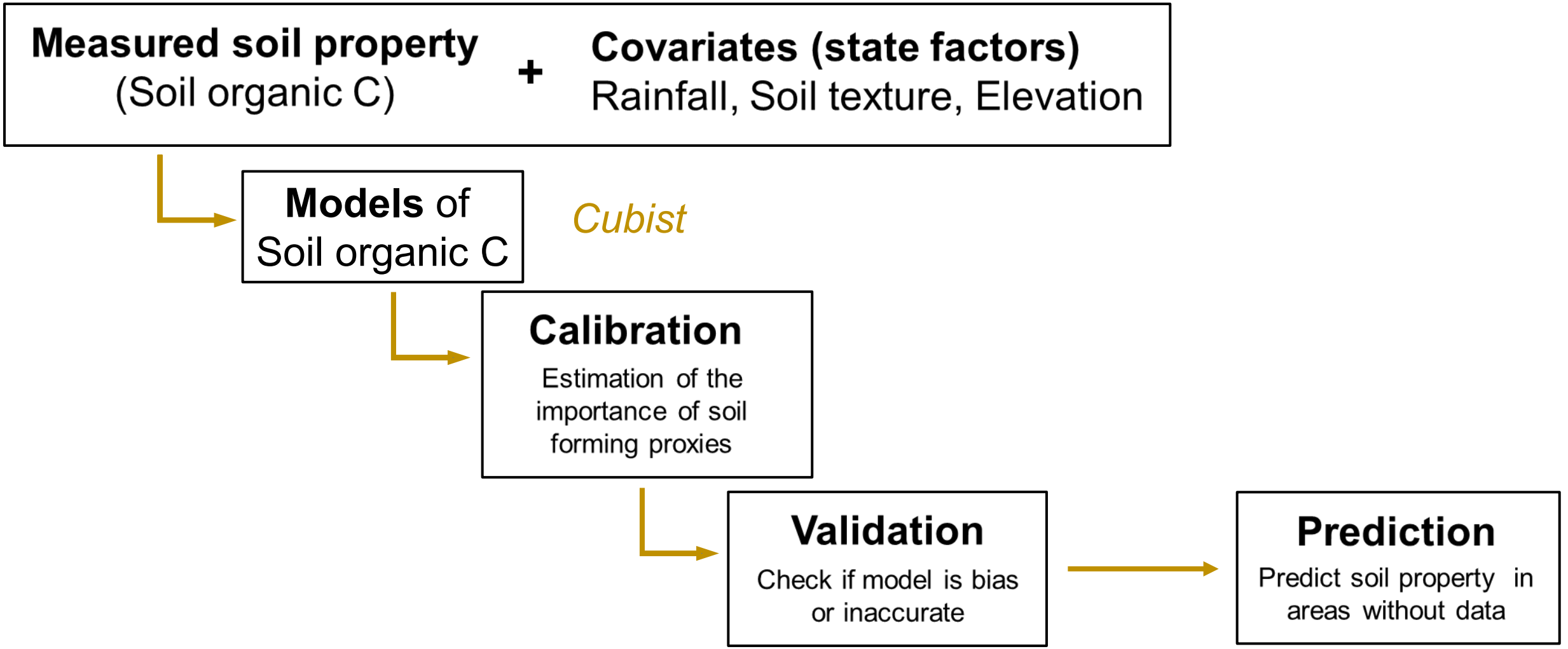
Blue carbon ecosystems - Australia

- Current continental C baselines do not include BCE
- Estimate the 0—30cm layer SOC stocks of Australia
- Digitally map the SOC stock and uncertainty

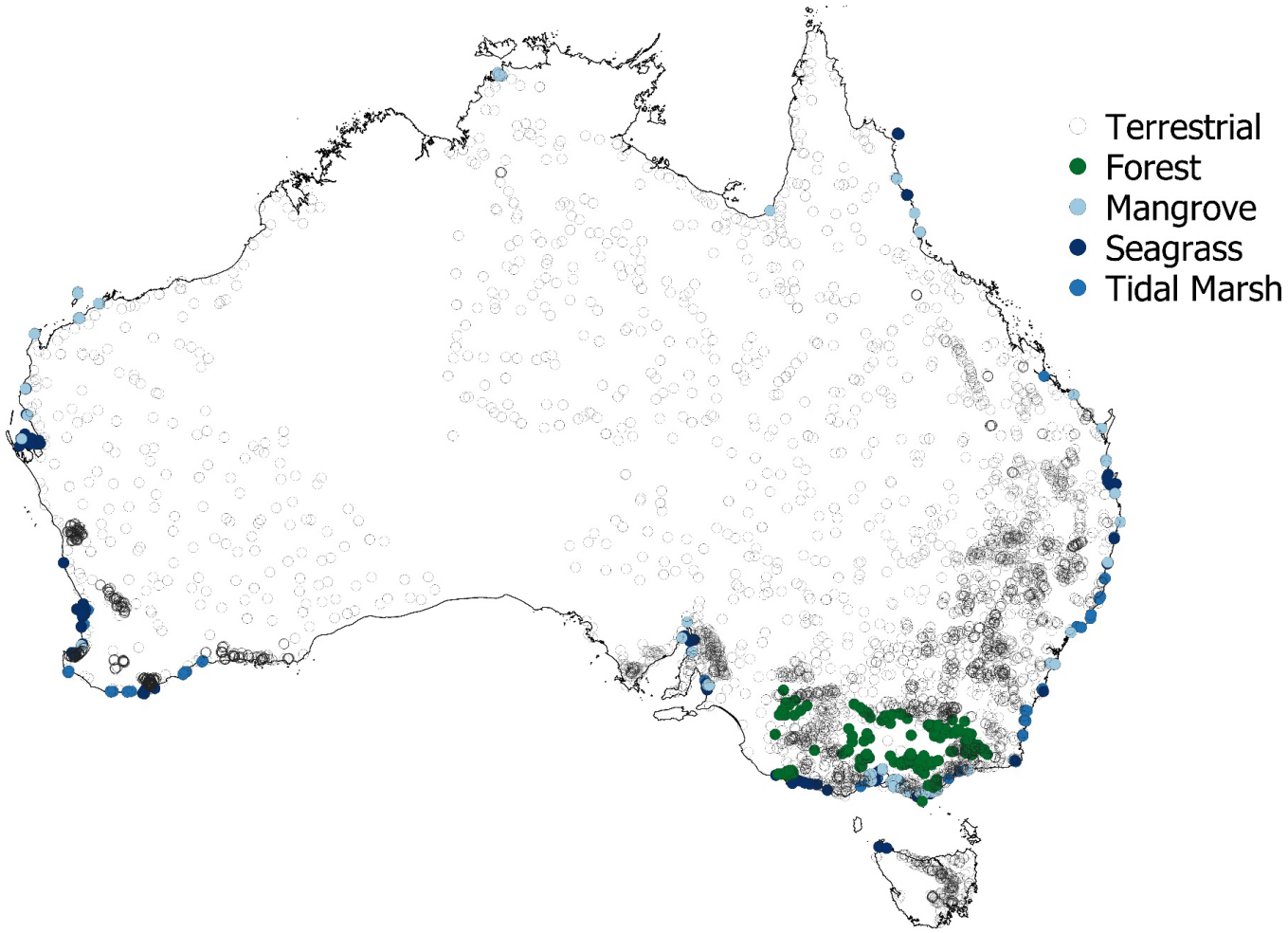


Habitat	*Area (km^2)*
Seagrass	22,322
Tidal Marsh	22,014
Mangrove	10,180

Regression modelling



Numbers of samples and spatial distribution



Habitat	N
Terrestrial	5691
Coastal and marine	824
Forest	252
TOTAL	**6767**

Blue Carbon habitat	N
Tidal Marsh	335
Mangrove	204
Seagrass	285
TOTAL	**824**

Conceptual model of environmental correlation and covariates

- Conceptual state-factor model:

$$S_C = f(Cl, O, R, S, P, Oc) + e$$

- Spatially explicit proxies for the factors in the model:

Climate (Cl)
Prescott Index
Rainfall
Solar radiation
Evapotranspiration

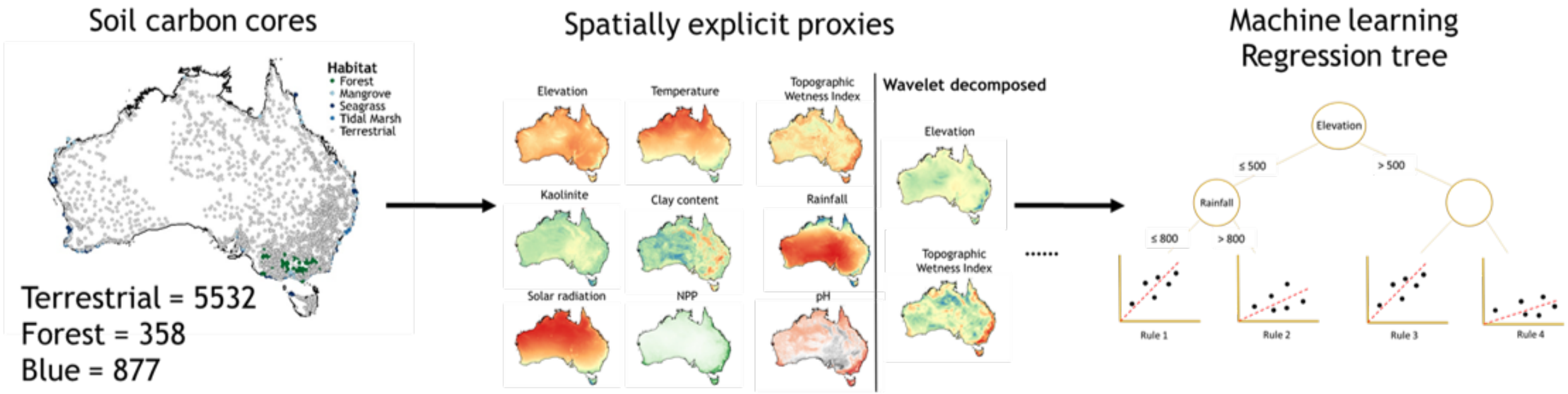
Organisms (O)
Net primary productivity
NDCI + NDVI
Fraction of Photosynthetic Active Radiation (F-par)

Relief (R)
Elevation
Aspect
Slope
Topographic wetness index

Soil (S), Parent material (P)
Clay content
Illite
Kaolinite
Smectite
Soil pH
Phosphorus

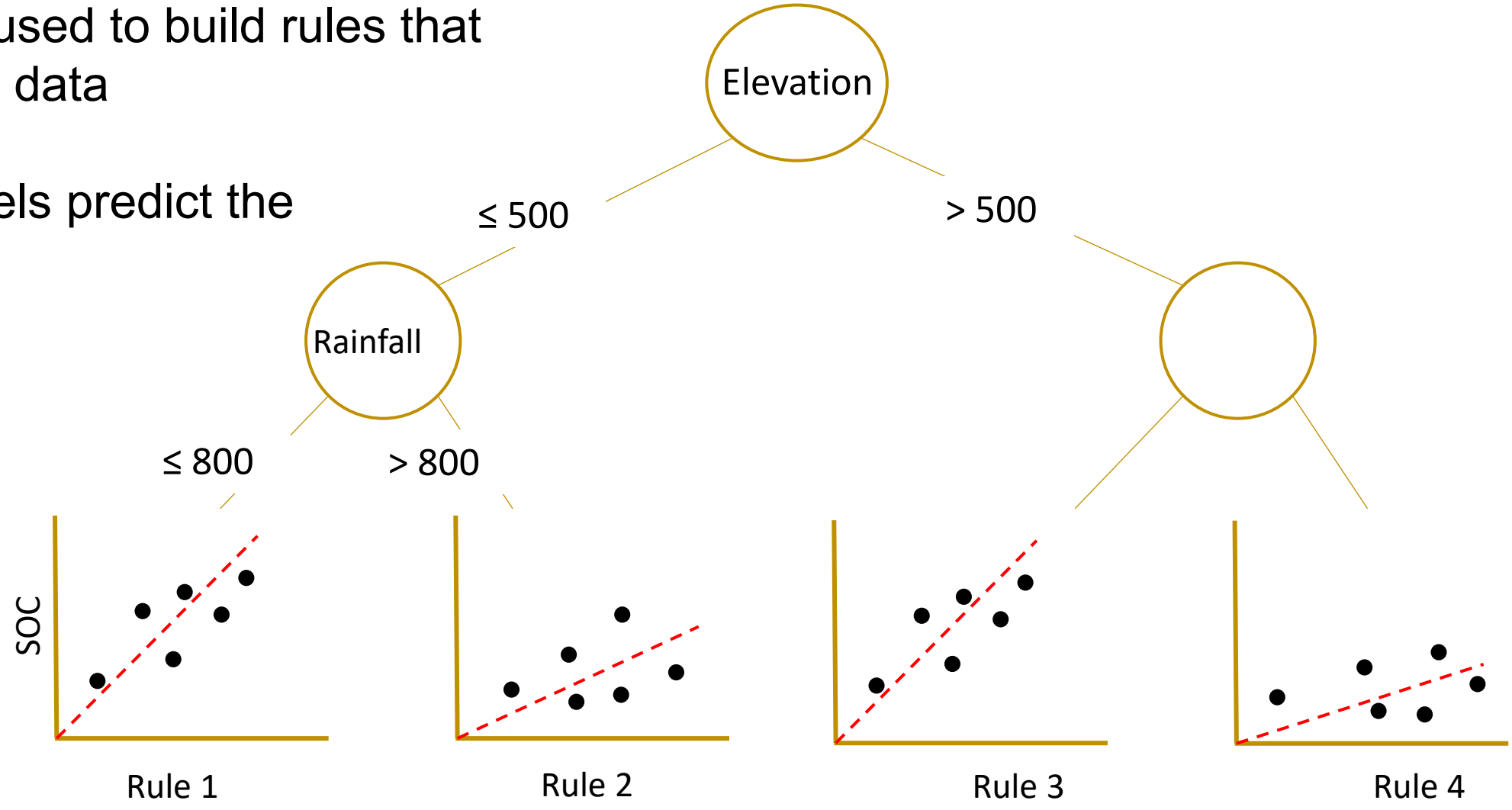
Oceanographic (Oc)
Tidal range
Wave energy
Wave height

Extraction workflow



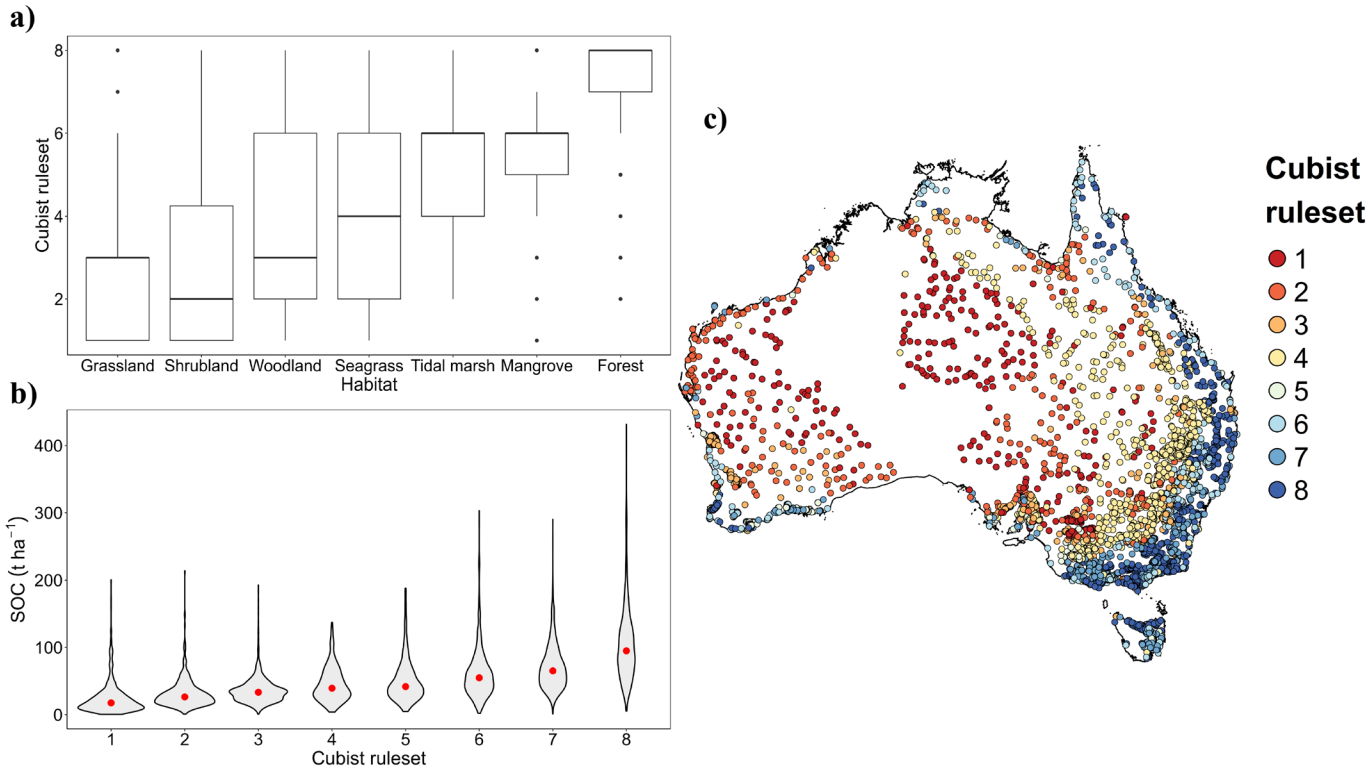
Briefly, how Cubist works

- Conditions used to build rules that partition the data
- Linear models predict the response

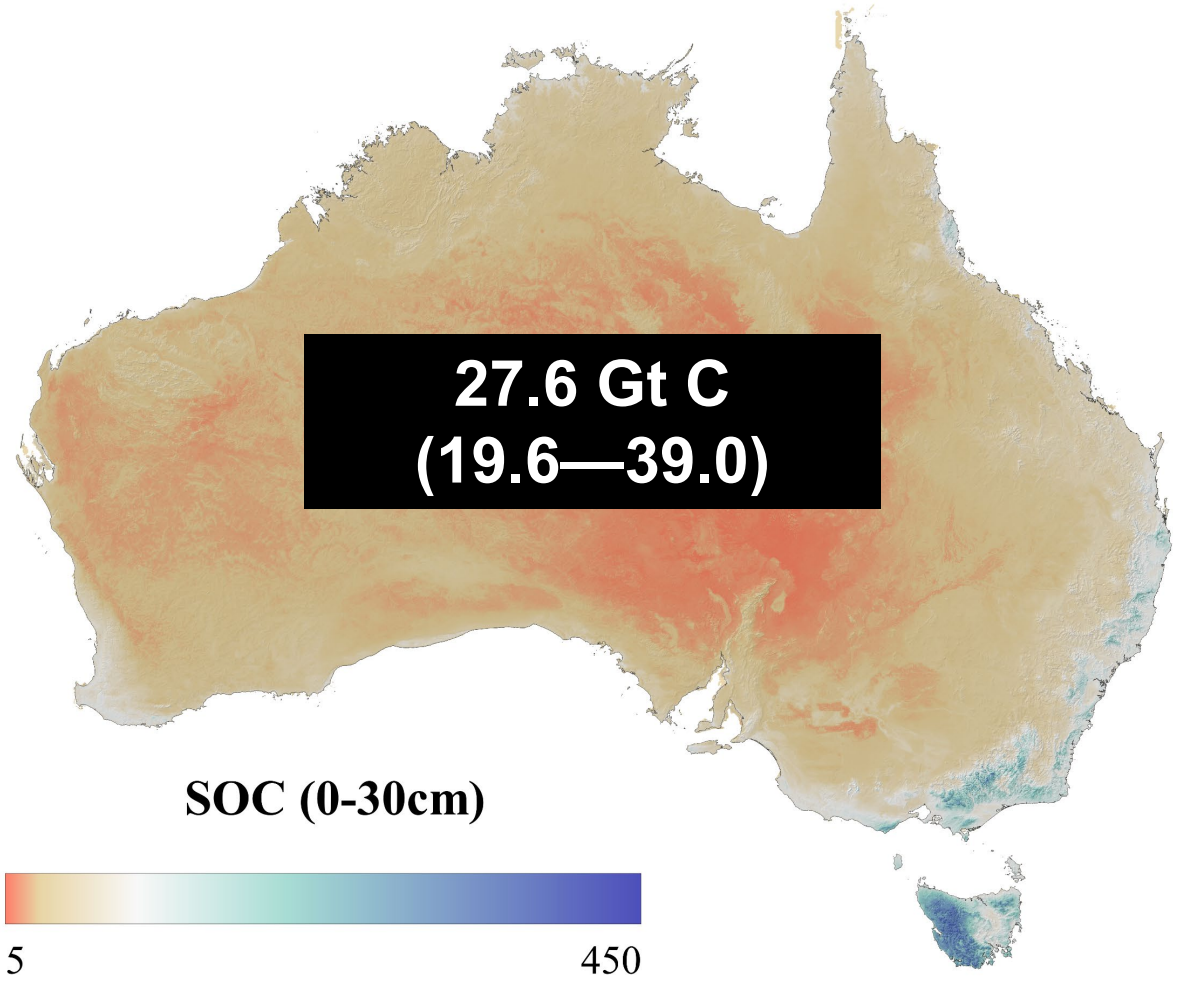


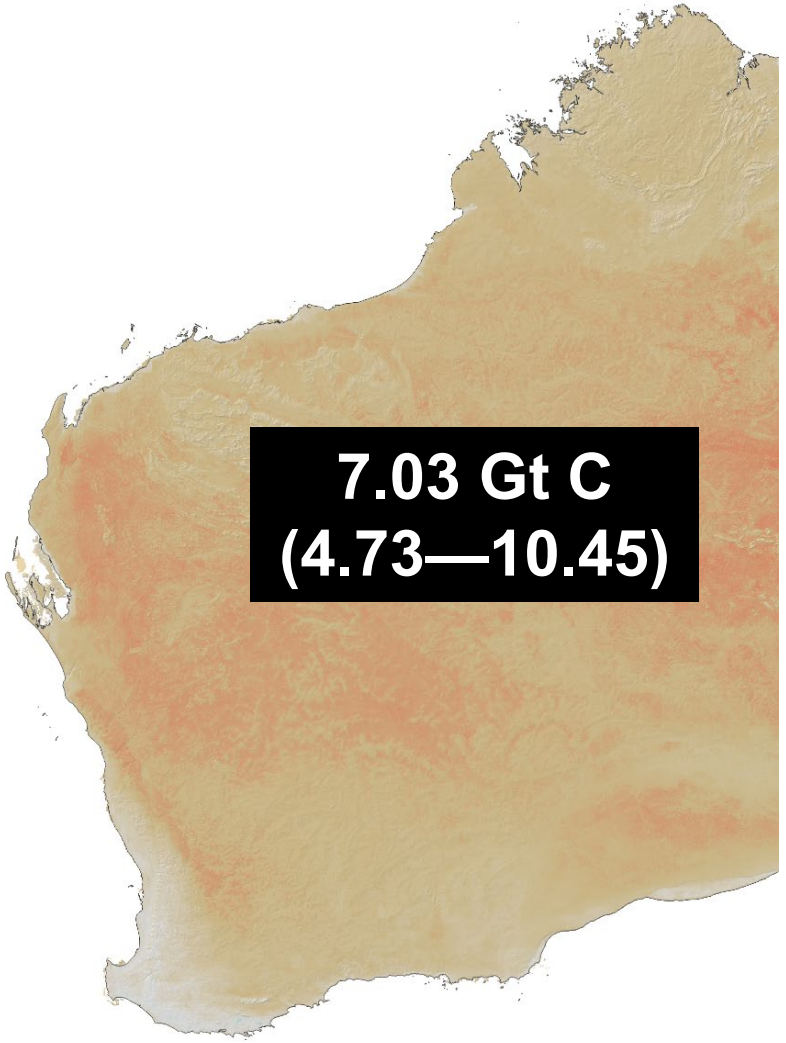
Results: Cubist rulesets SOC

- Cubist separated samples based on SOC content
- Rulesets corresponded to habitat type and climate zone
- Mangrove forests comparable to terrestrial forests

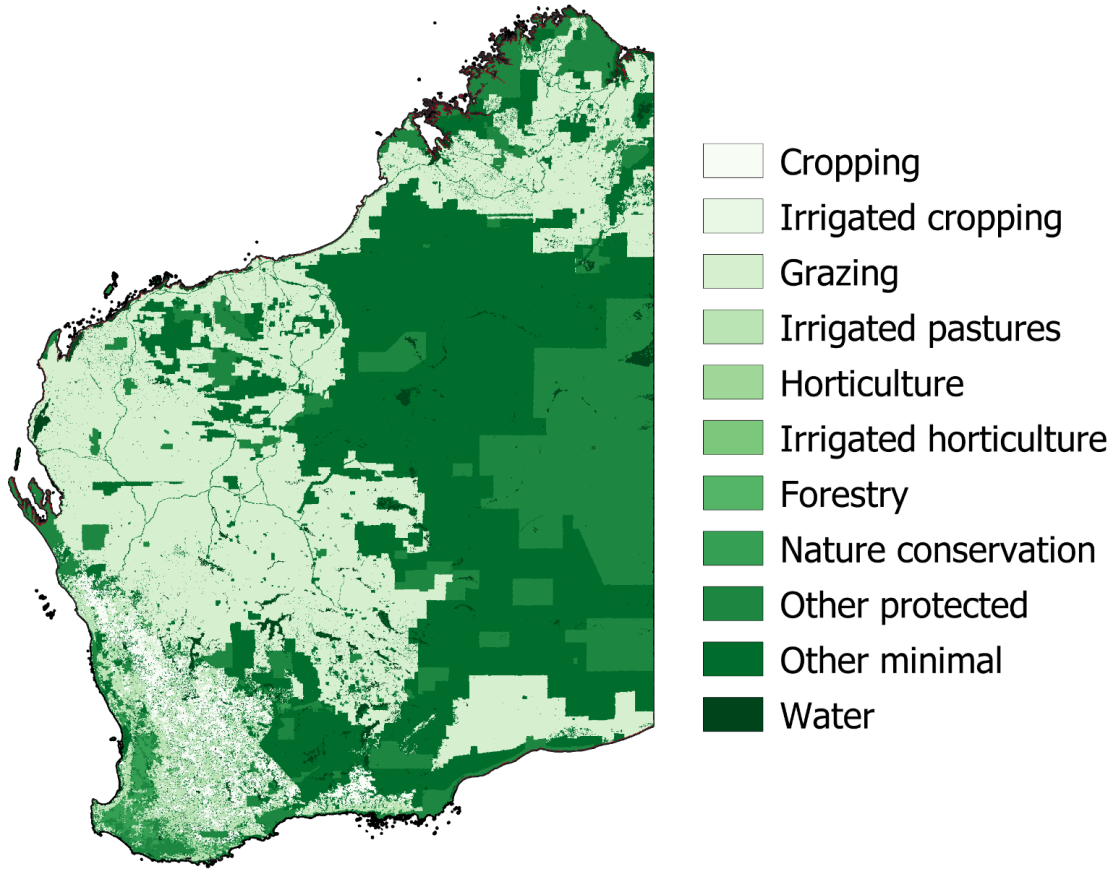


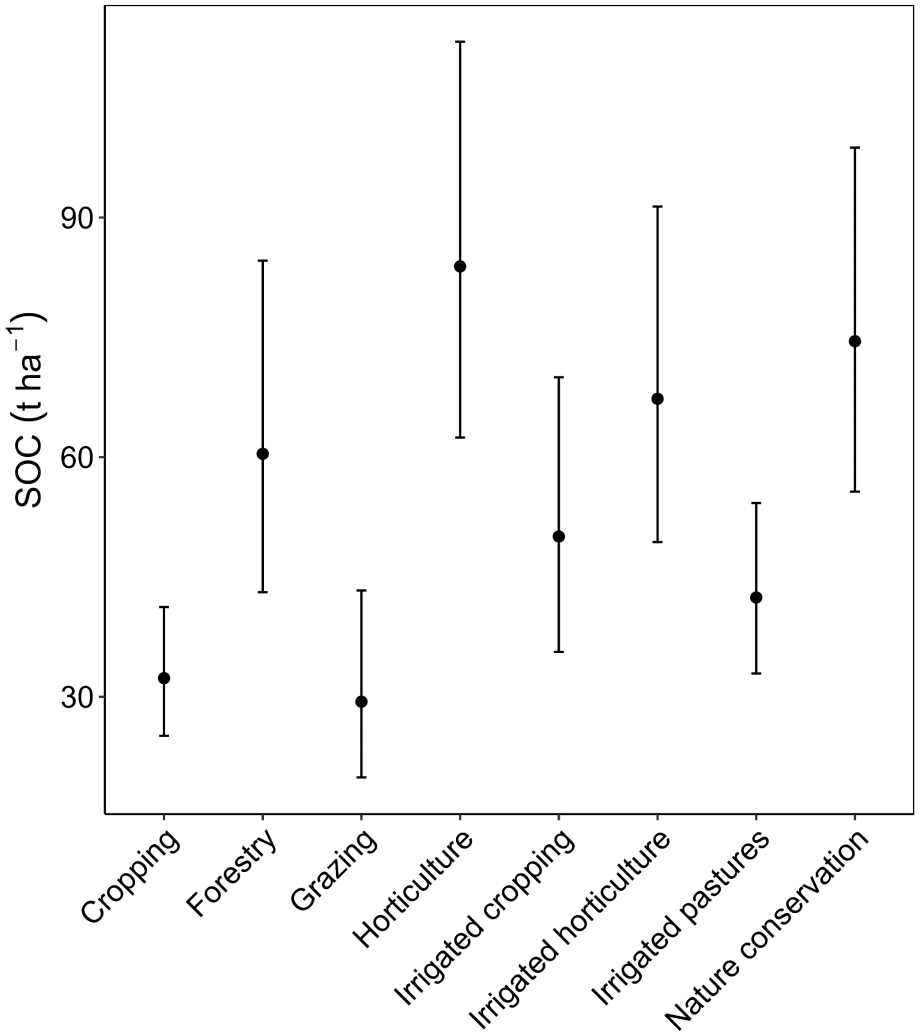
Continental maps and estimates of C stocks





C stocks of land uses of WA





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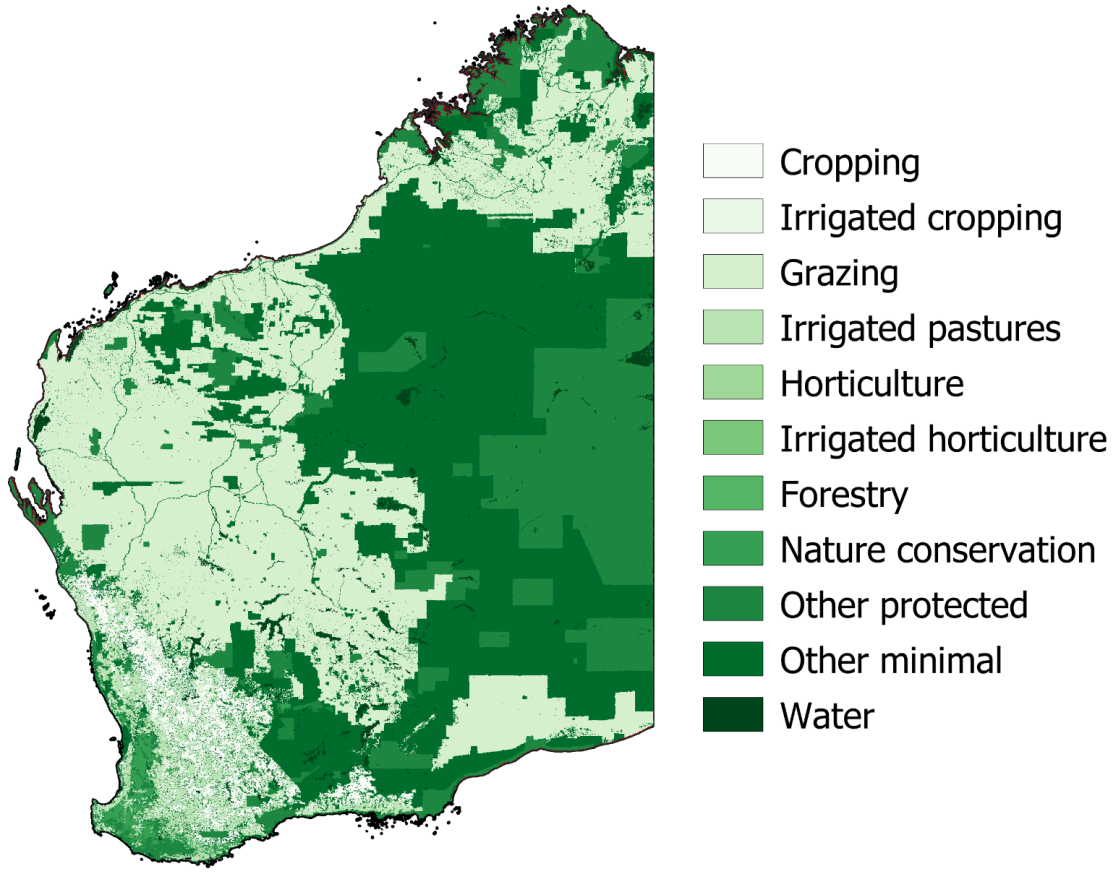
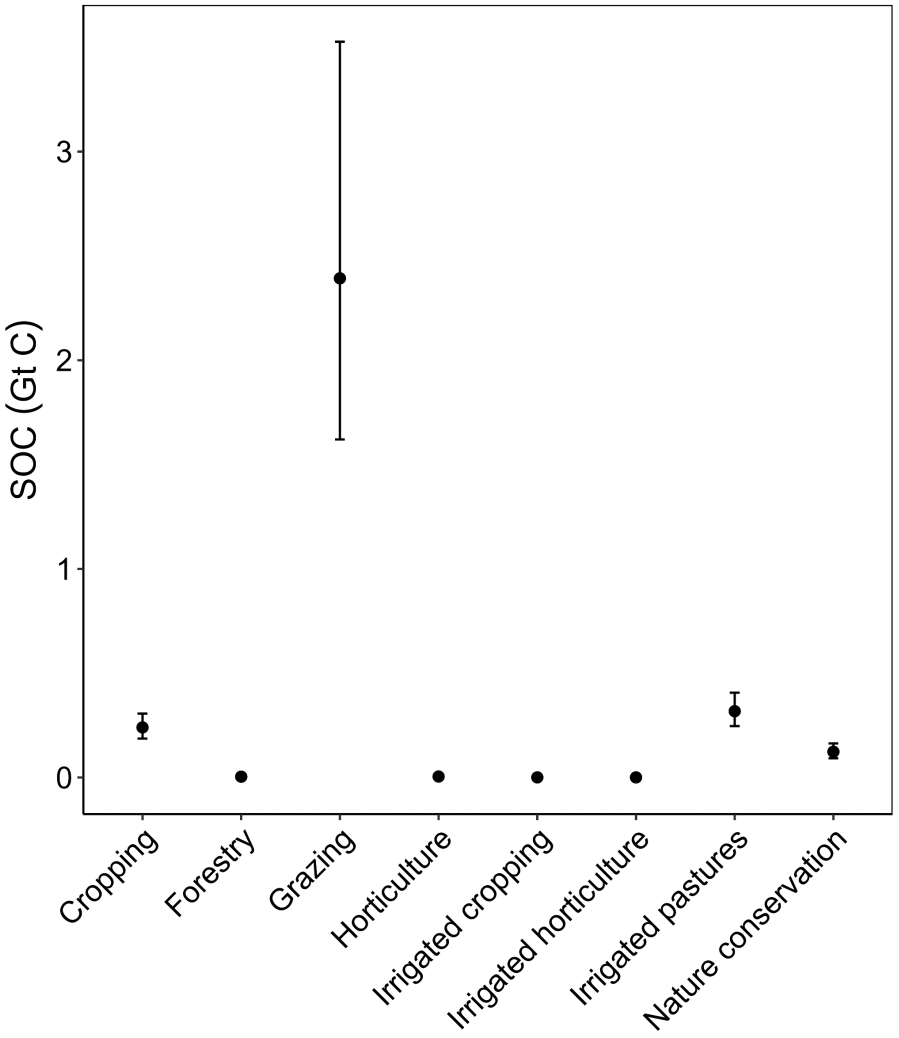
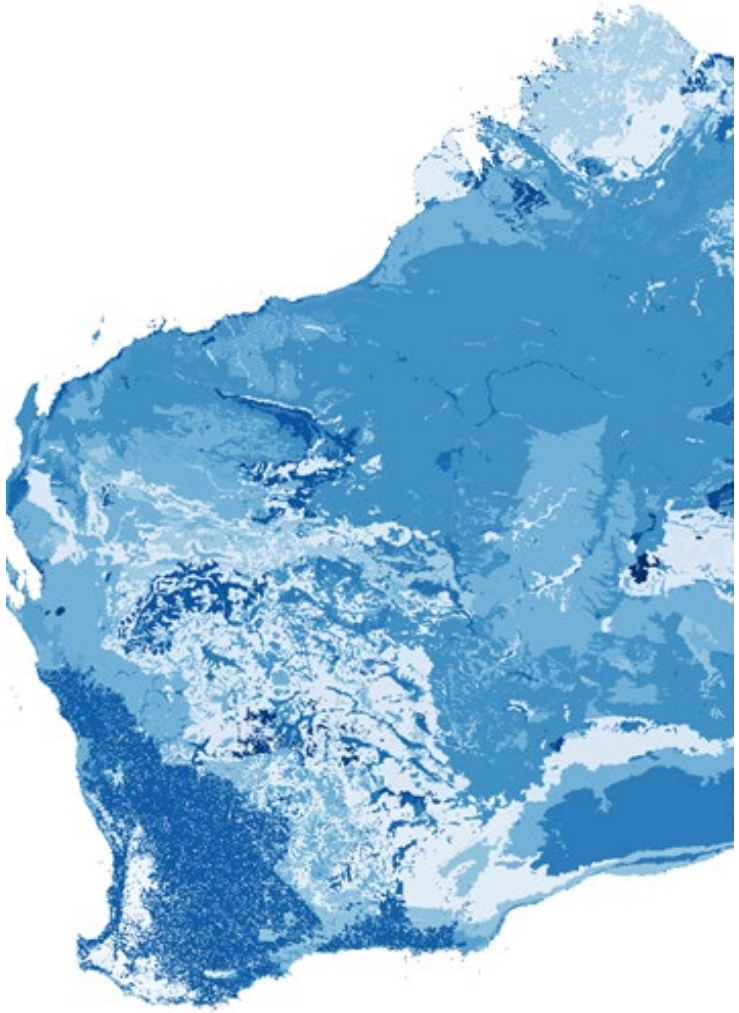
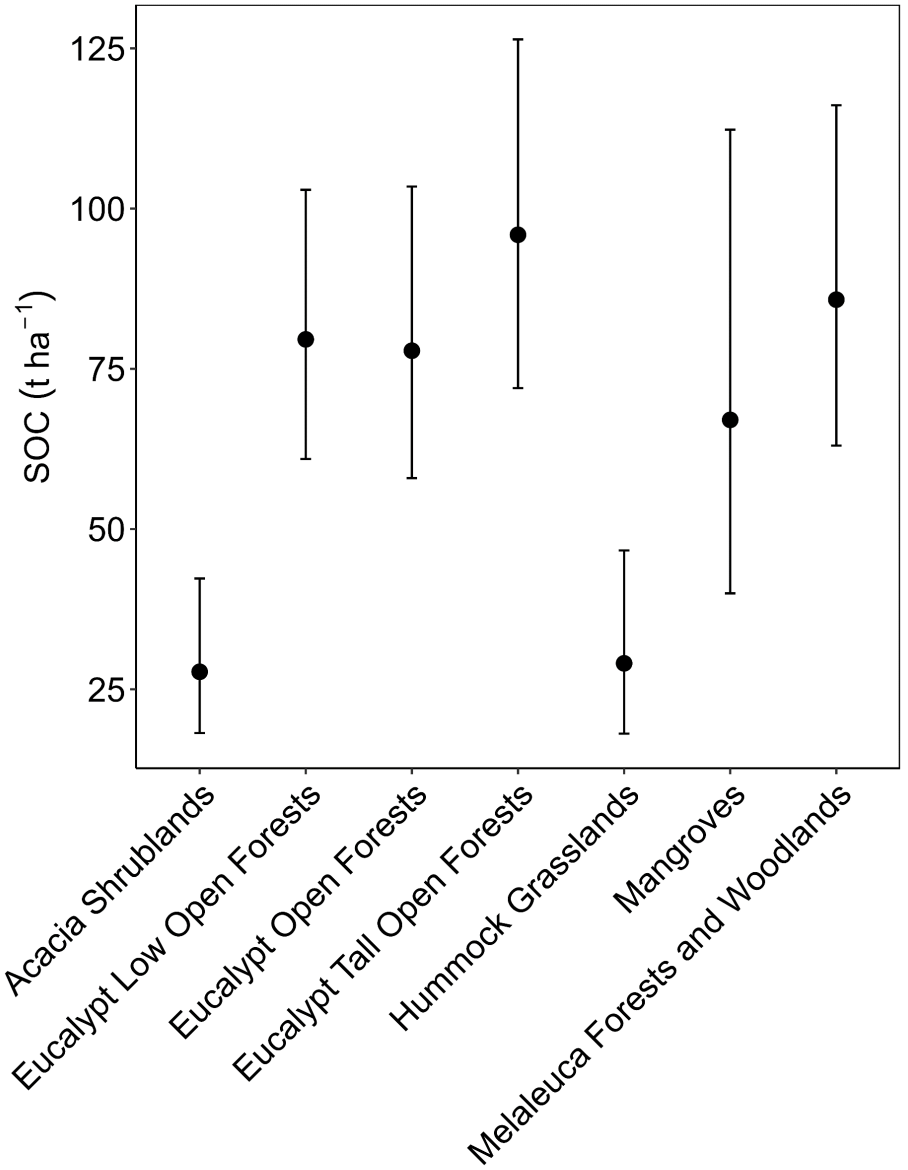




Vegetation systems of WA



National Vegetation Information system 6



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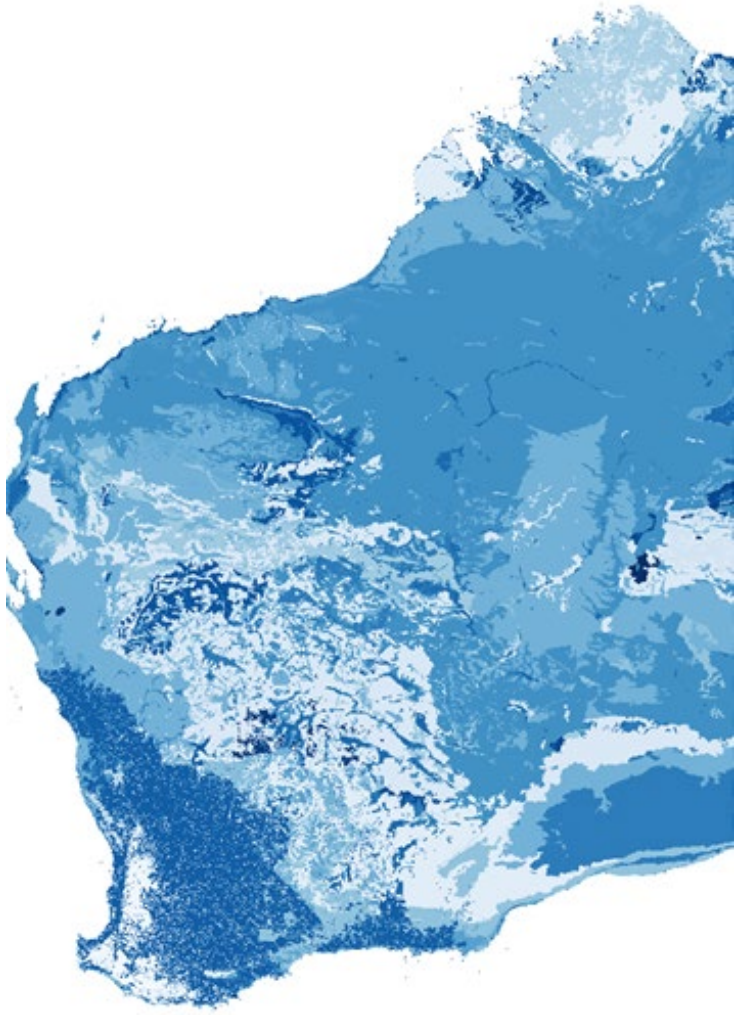

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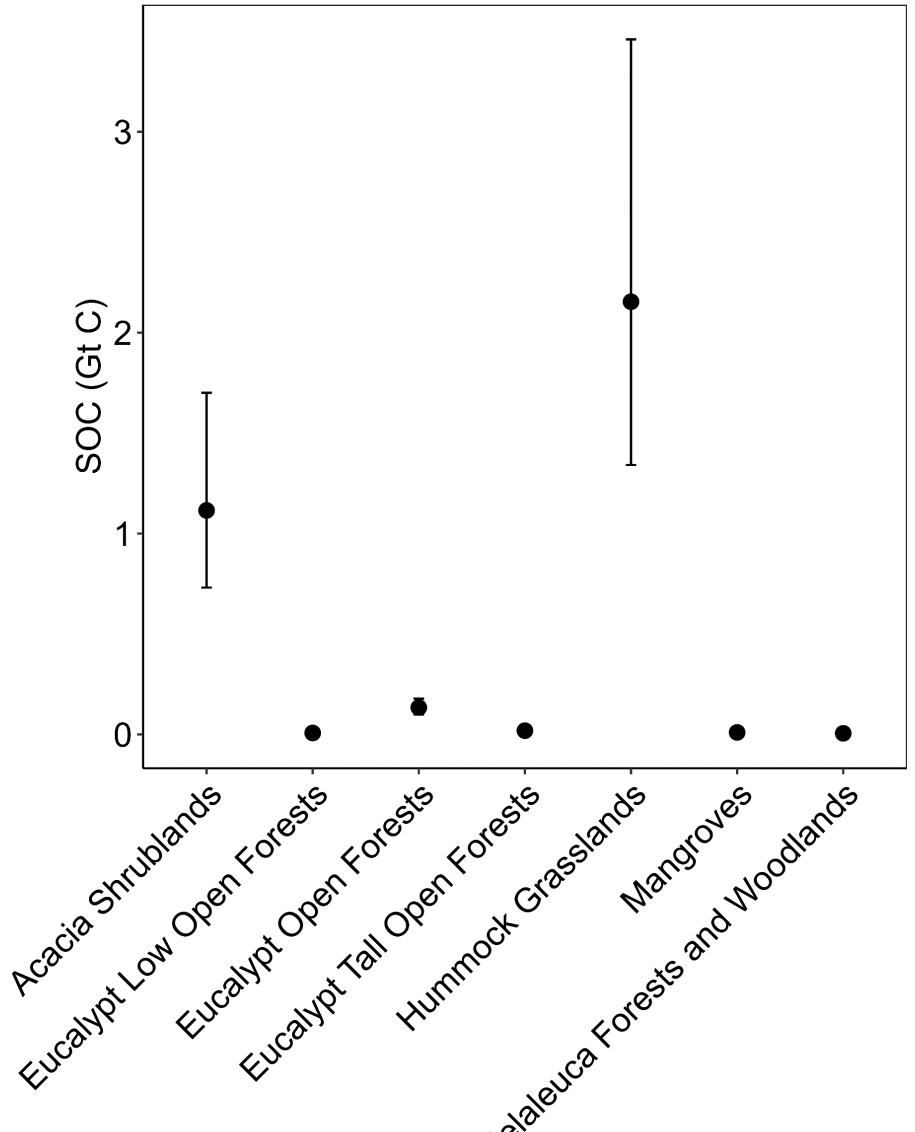

Veg system	km²
Hummock	834,112
Acacia Shrublands	452,399
Eucalypt open forest	19, 371
Eucalypt Tall open	2205
Melaleuaca forest	743

Final remarks

- Modelled terrestrial and blue carbon simultaneously using a consistent methodology
- The model partitioned the space to produce local habitat-specific predictions
- Total stocks of **27.6 Gt C (19.6- 39.0 Gt C 95% CI)**
- Native habitats have the highest soil organic carbon density and may be the most vulnerable to carbon loss with climate change and land management.
- Soils with smaller mean carbon density typically occur in the semi-arid and arid regions of the country and cover much larger extents had higher total stocks
- Seagrasses have a smaller mean C stock compared to tidal marshes and mangroves, but they hold larger total stocks because they occupy larger areas.