

WHAT IS THE CARBON SEQUESTRATION POTENTIAL OF AUSTRALIA'S COASTAL FLOODPLAIN FORESTS?

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Overview

1. Australia's CFFs
2. The conceptual case for 'blue carbon'
3. Preliminary data



1. Australia's Coastal Floodplain Forests (CFFs)

- 1) in upper intertidal to supratidal elevations** with estuarine connection (often abutting or transitioning from adjacent saltmarsh or mangrove at lower elevations);
- 2) in upper estuarine areas** where salinities are low, with occasional to frequent inundation (i.e. upper intertidal elevation) by brackish tidal water.
- 3) low-lying coastal floodplains which were formed through estuarine processes, but have since been disconnected from tidal inundation.

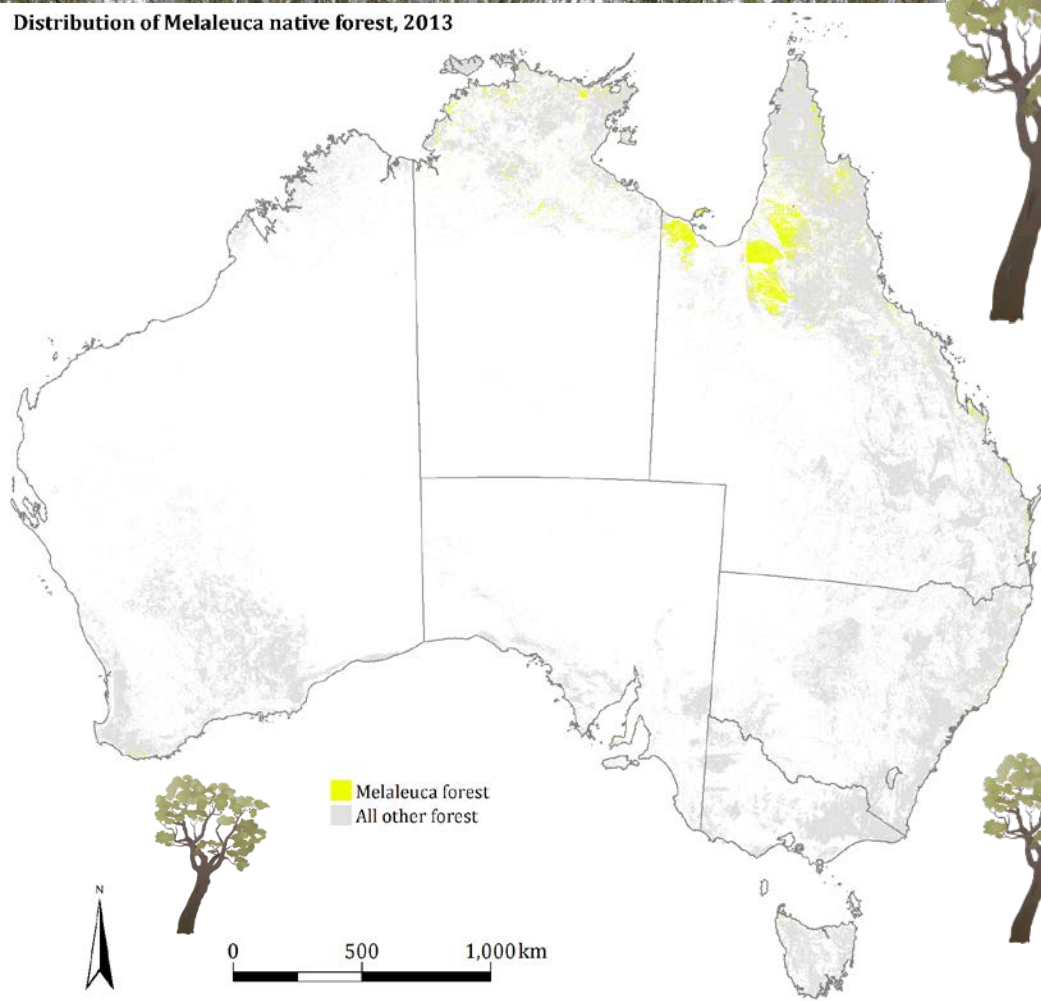
→ **'NON-MANGROVE ESTUARINE FORESTS'**

Melaleuca CFFs



Melaleuca CFFs

Distribution of Melaleuca native forest, 2013



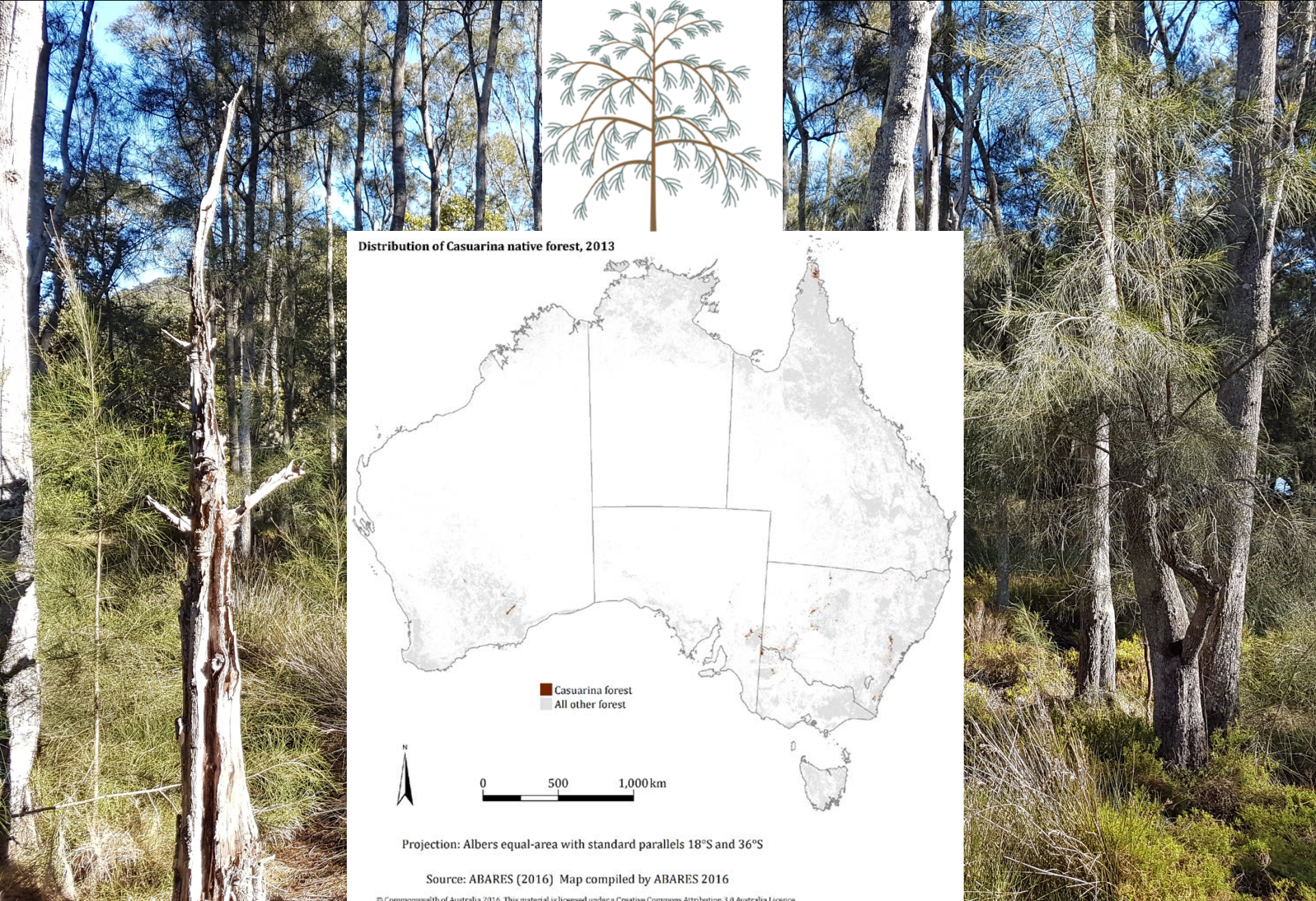
Source: ABARES (2016) Map compiled by ABARES 2016

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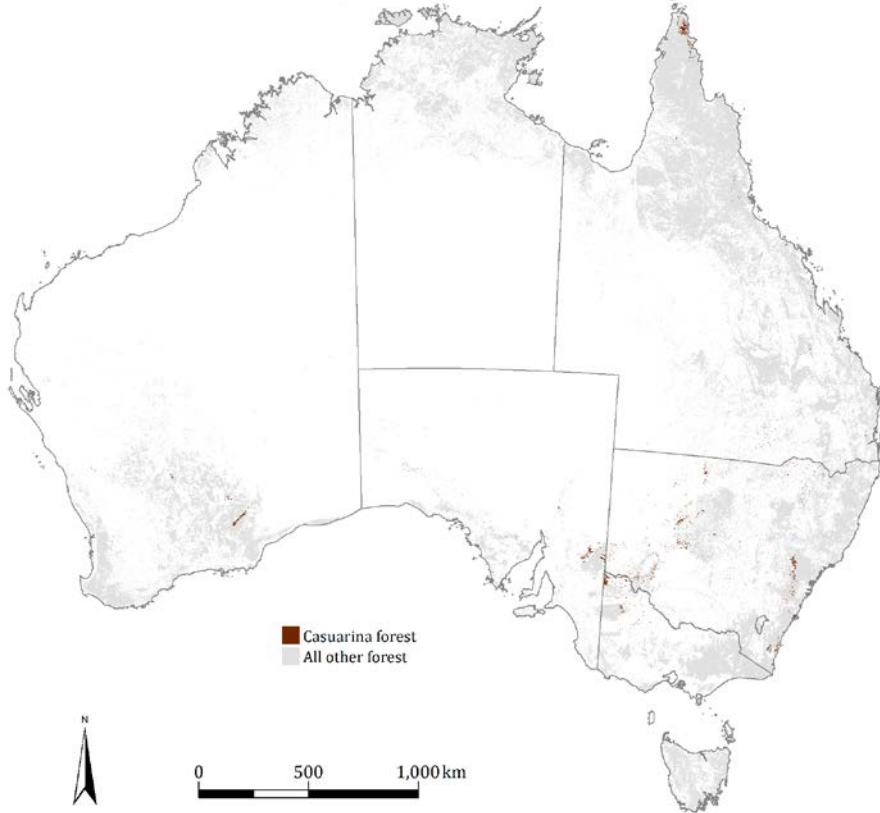
Swamp Oak (*Casuarina*) CFFs



Swamp Oak (*Casuarina*) CFFs



Distribution of *Casuarina* native forest, 2013



Projection: Albers equal-area with standard parallels 18°S and 36°S

Source: ABARES (2016) Map compiled by ABARES 2016

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Other CFFs



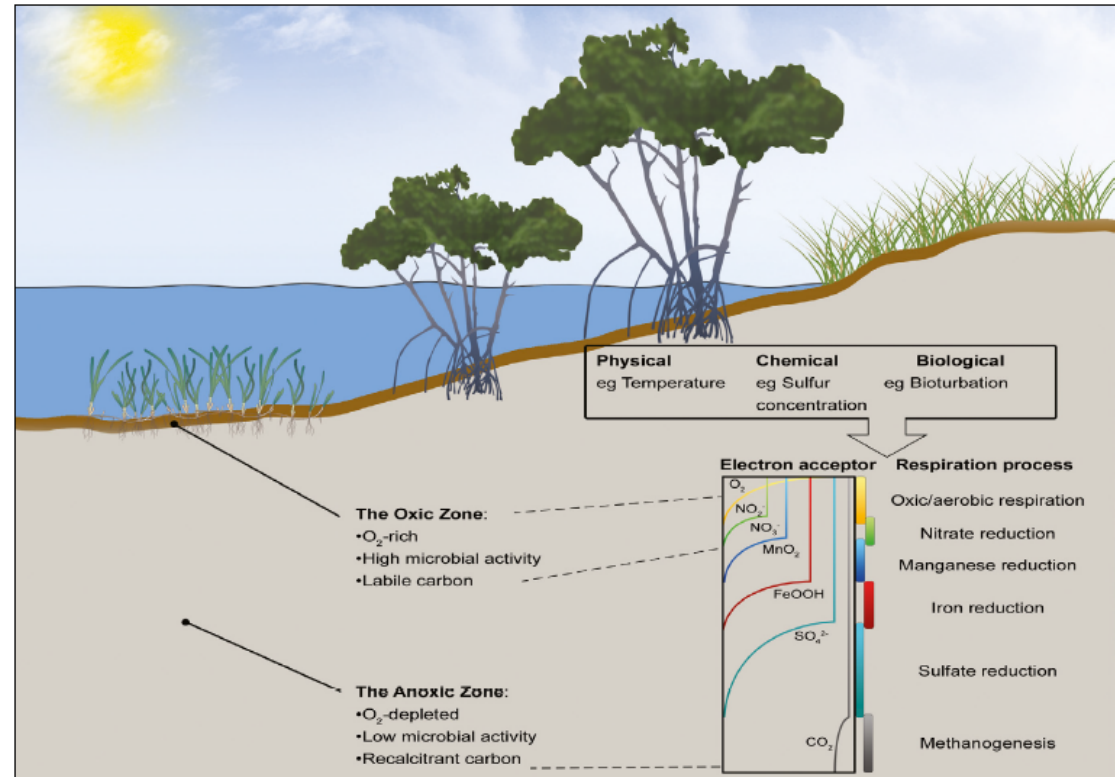
Swamp sclerophyll forest (EEC)



2. The conceptual case for 'blue carbon'

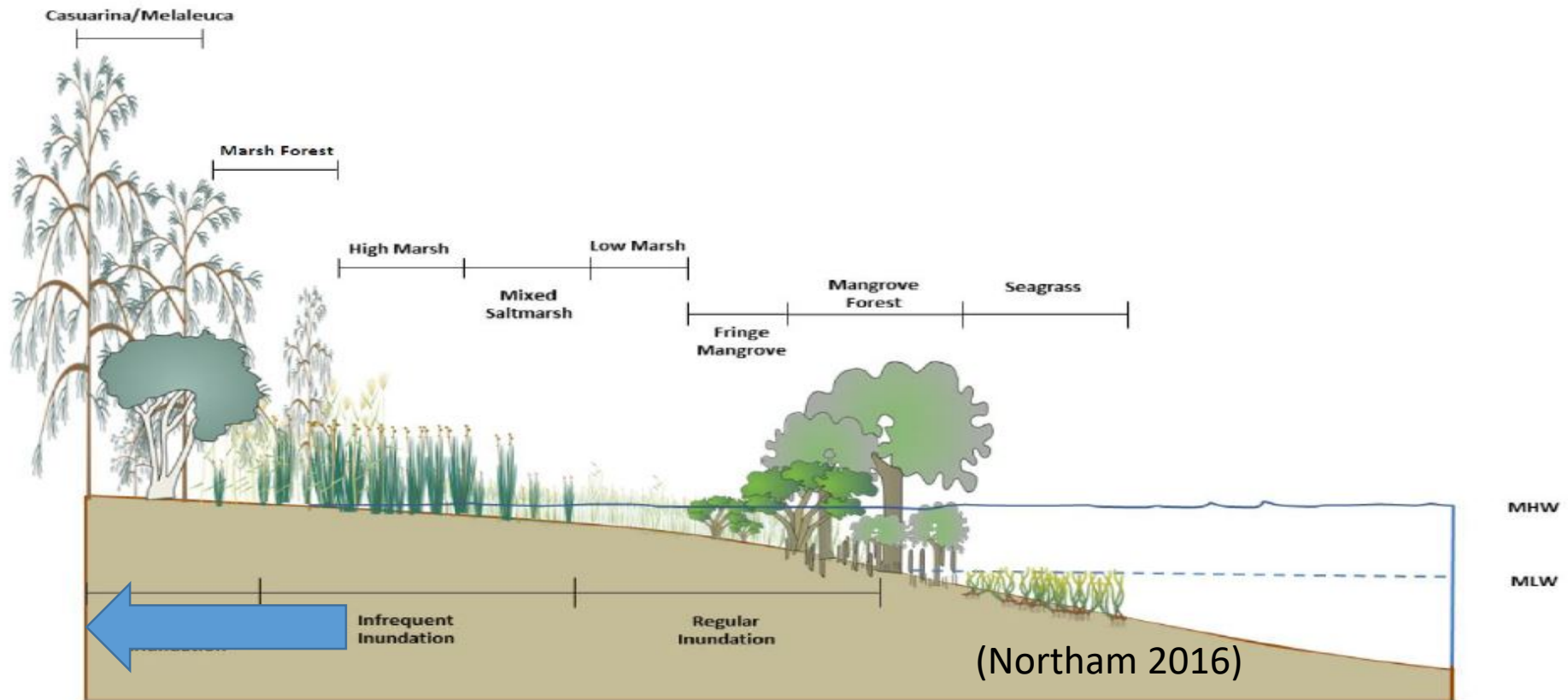
1. Contemporary estuarine processes

2. Holocene evolution

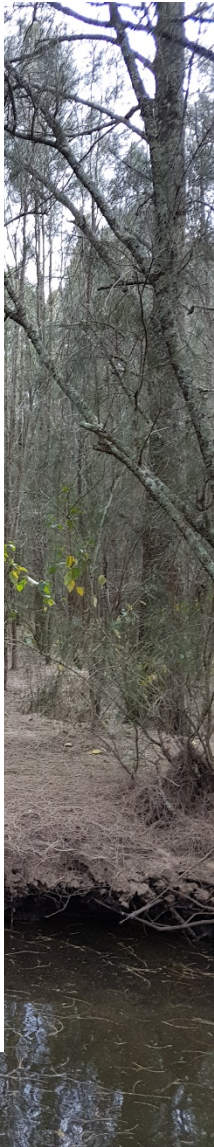
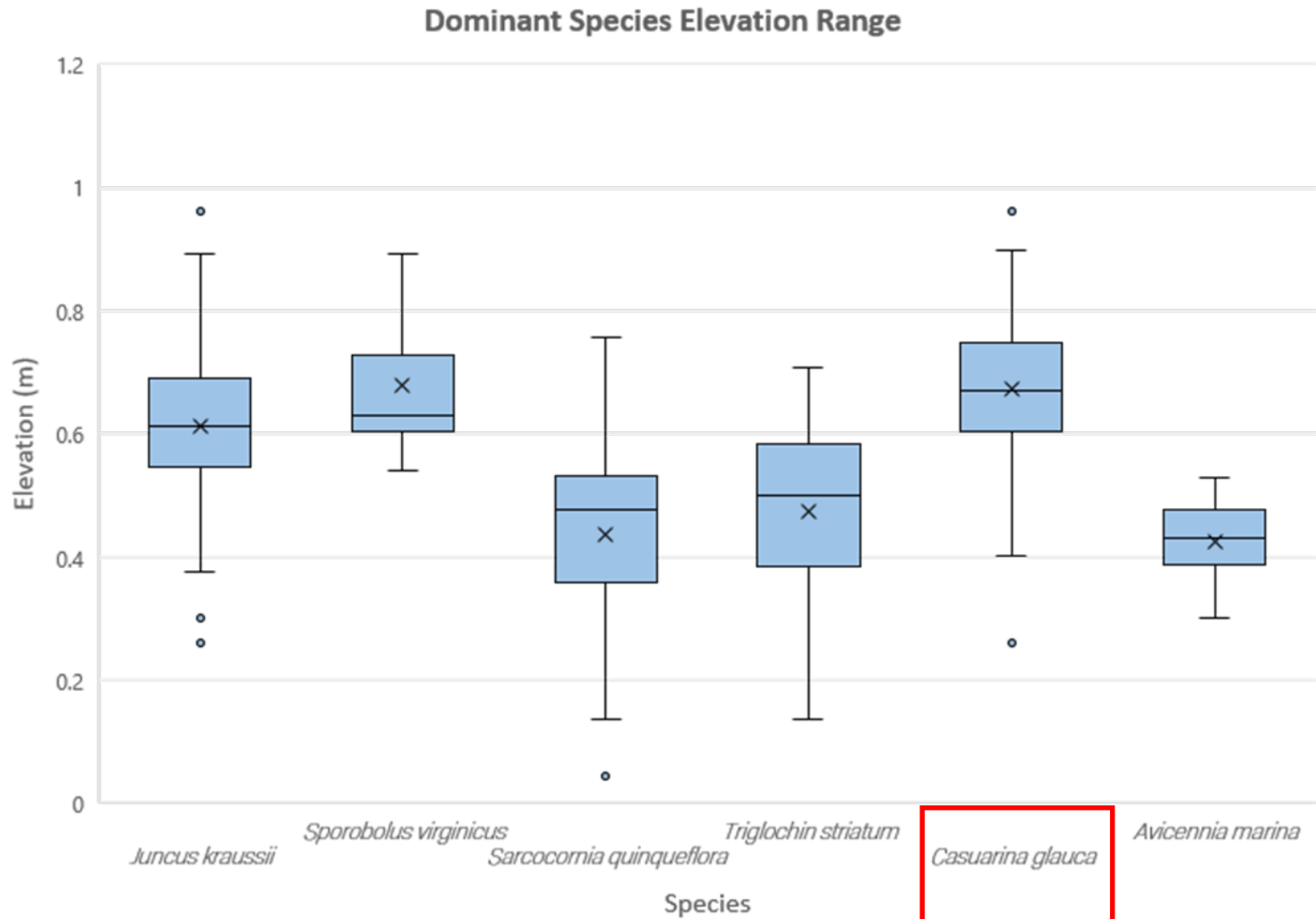


(Macreadie et al. 2017 Frontiers in Ecology & Evolution)

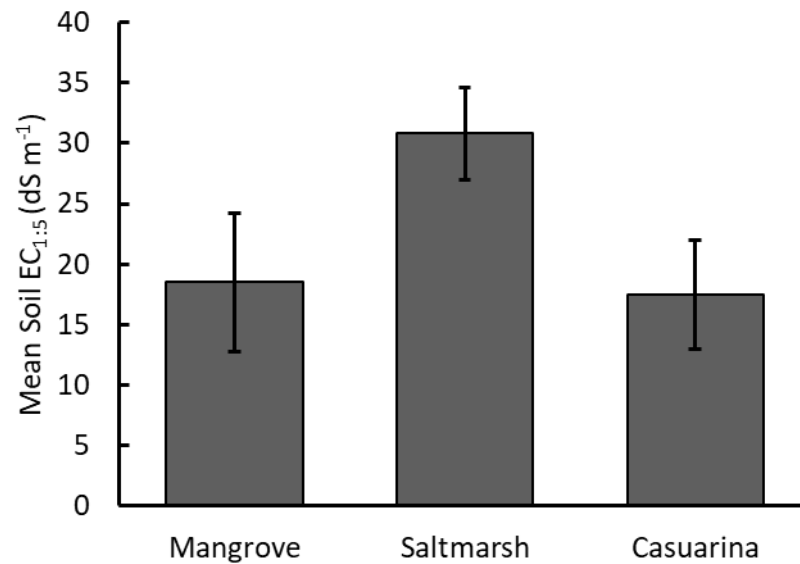
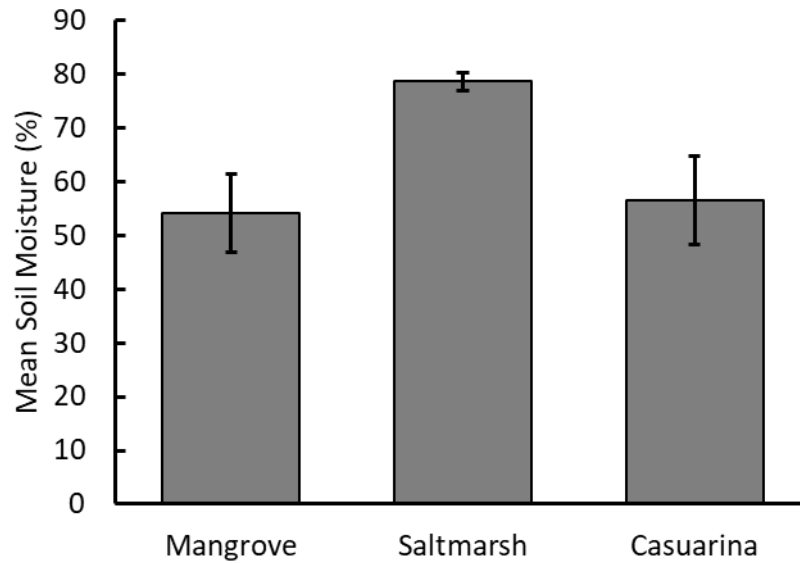
Estuarine connectivity



Estuarine connectivity



Estuarine processes



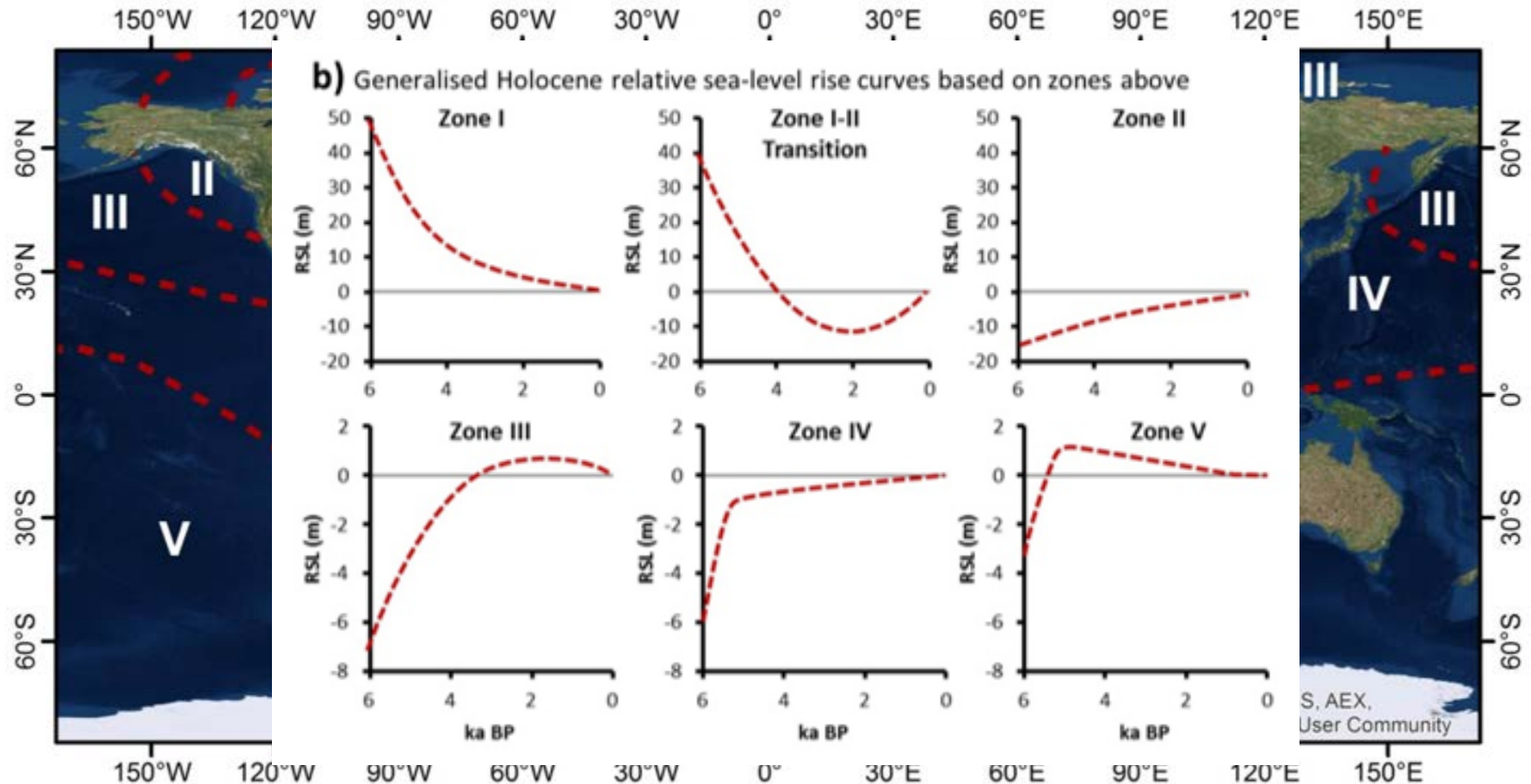
Estuarine connectivity



Contemporary sea-level rise

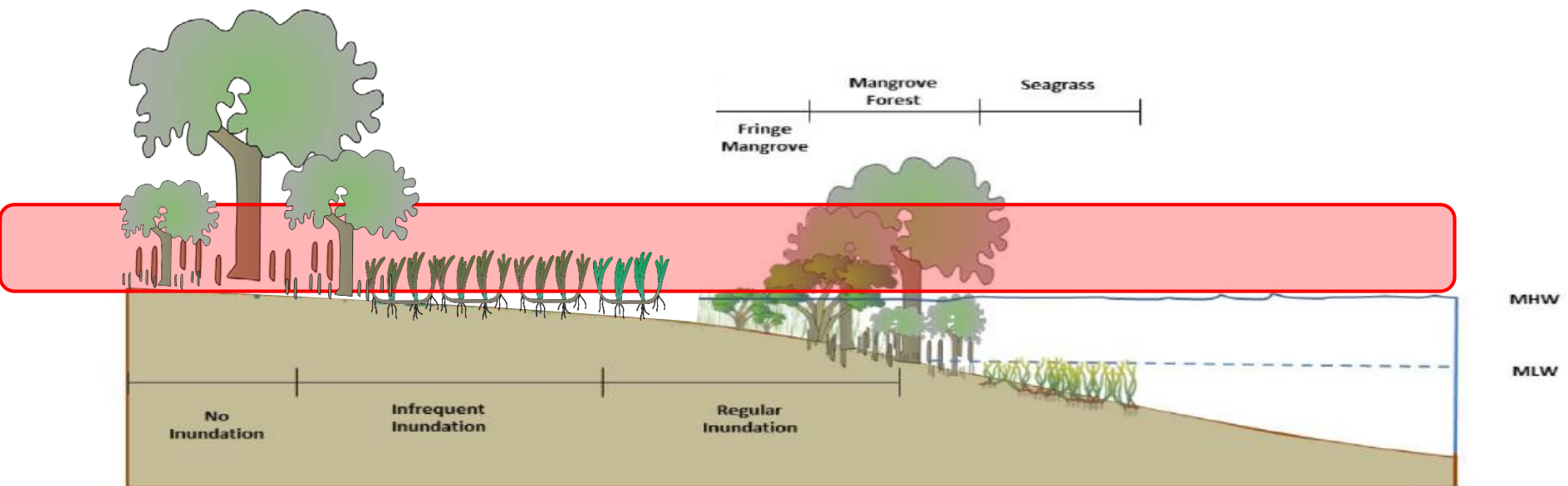


Holocene Sea-Level History

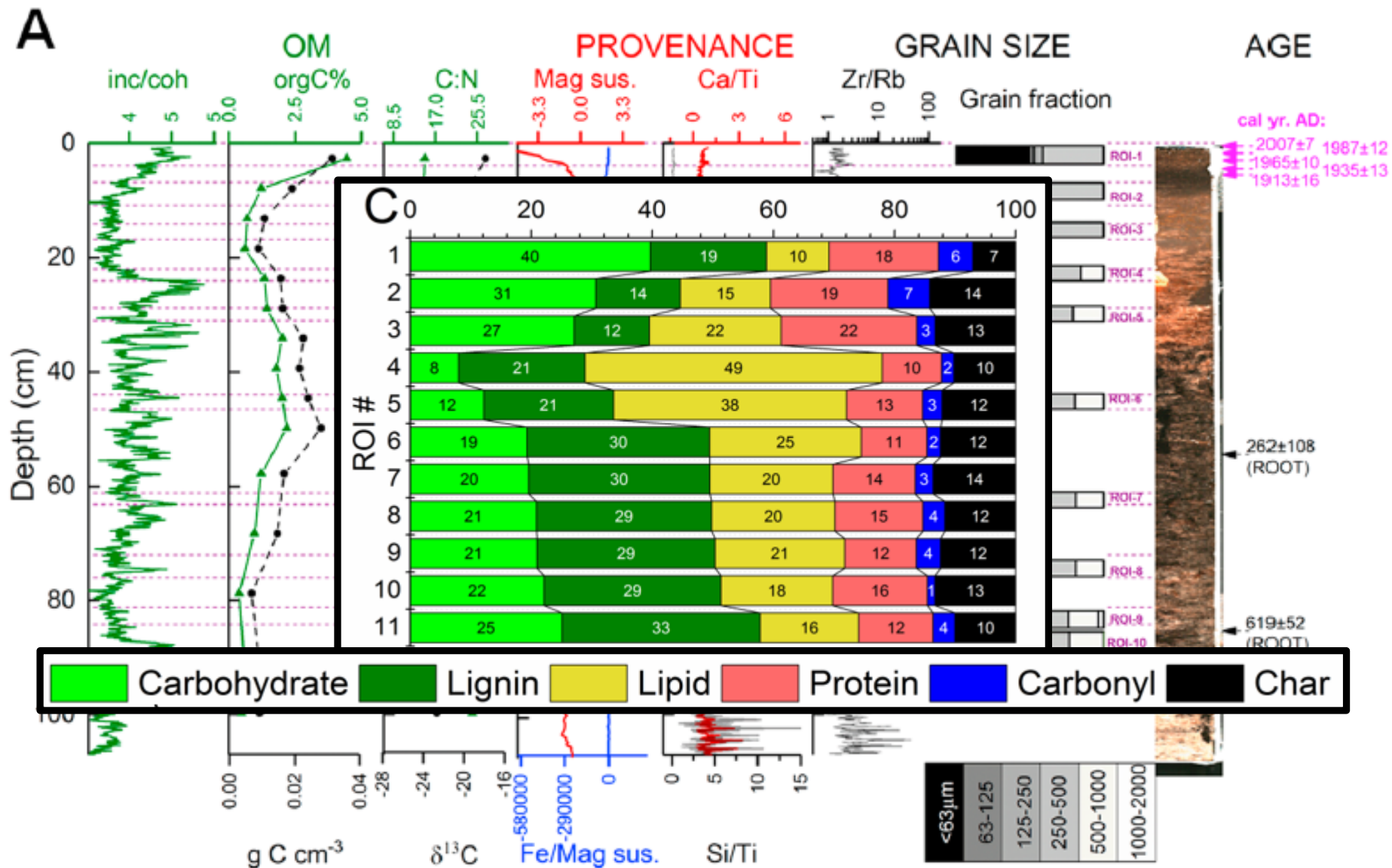


(adapted from Clarke *et al.* 1978 Quaternary Research)

Holocene Sea-Level History



Holocene Sea-Level History



Holocene Sea-Level History

NATURE VOL. 317 24 OCTOBER 1985

LETTERSTONATURE

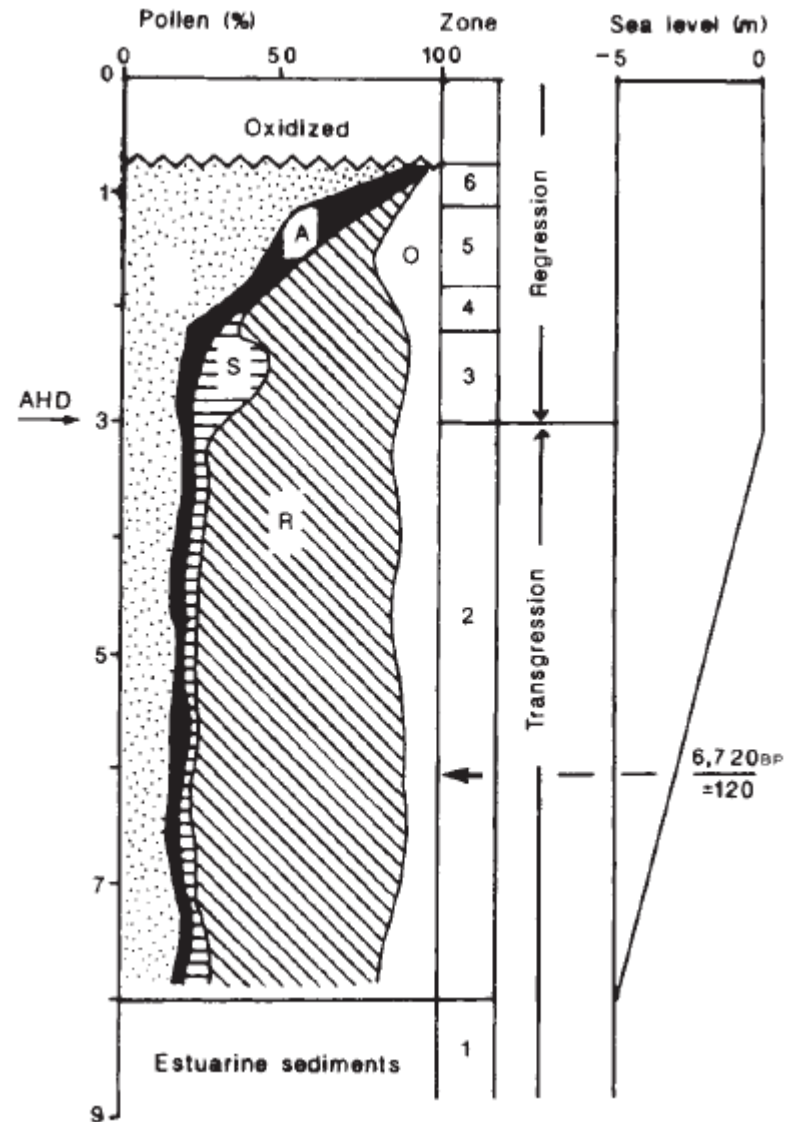
Development of widespread mangrove swamps in mid-Holocene times in northern Australia

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& John Chappell‡

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† Geography Department, Sydney University, Australia

‡ Biogeography and Geomorphology, Australian National University,
Canberra ACT 2600, Australia



3. Preliminary data



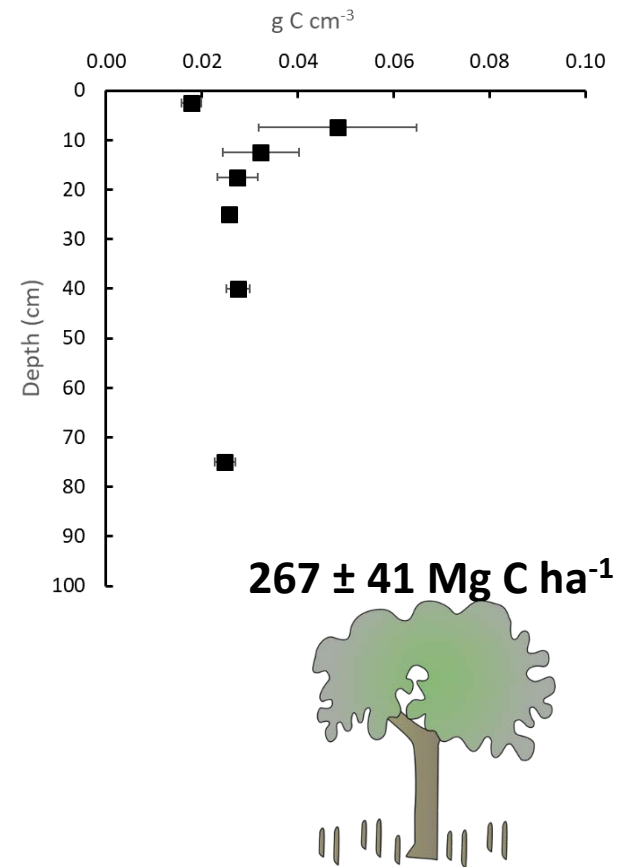
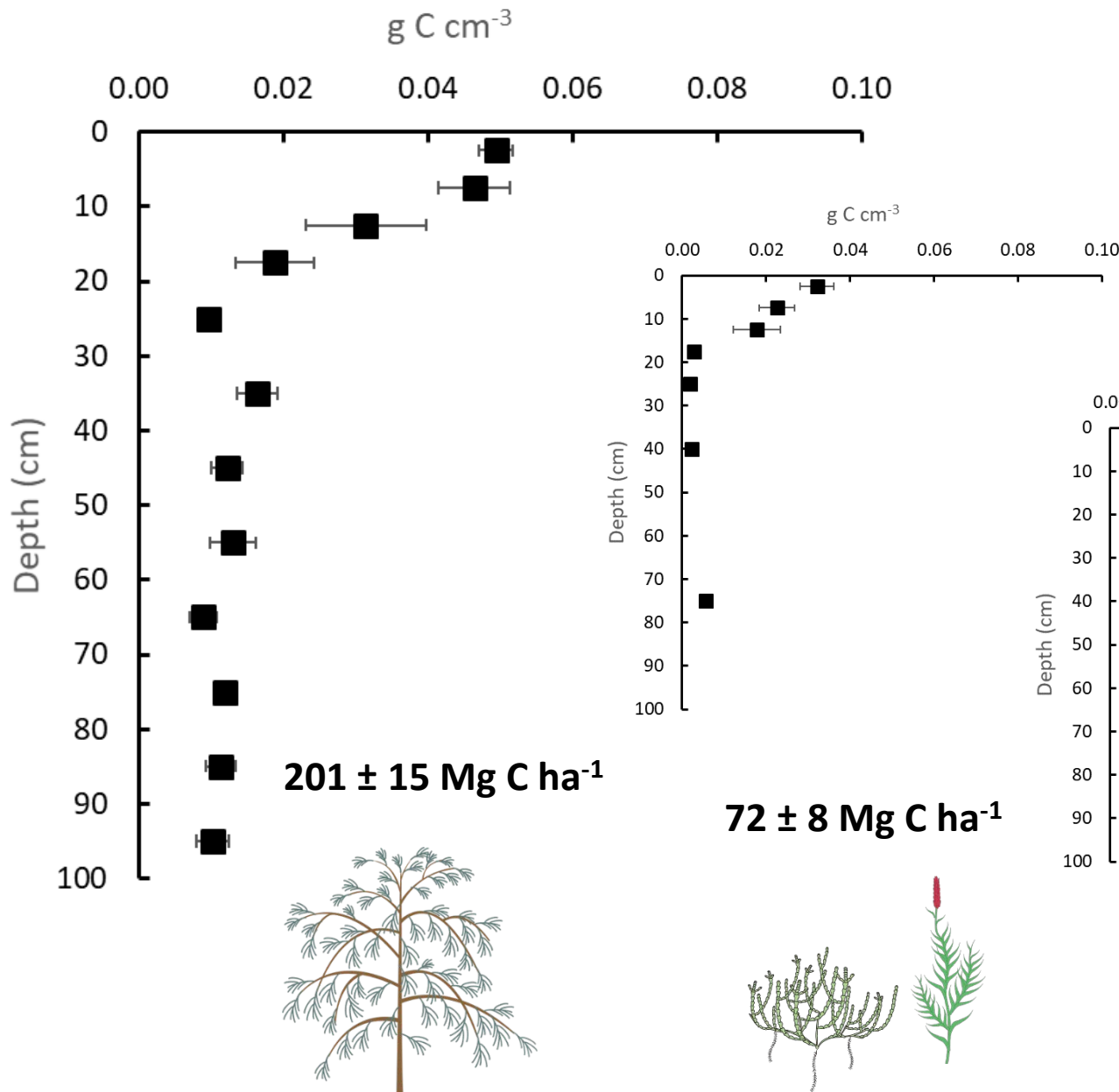
C STOCKS

C ACCUMULATION

**DECOMPOSITION
(TEA COMPOSITION
 H_2O)**

ATMOSPHERIC FLUX

Towra Point (marine)



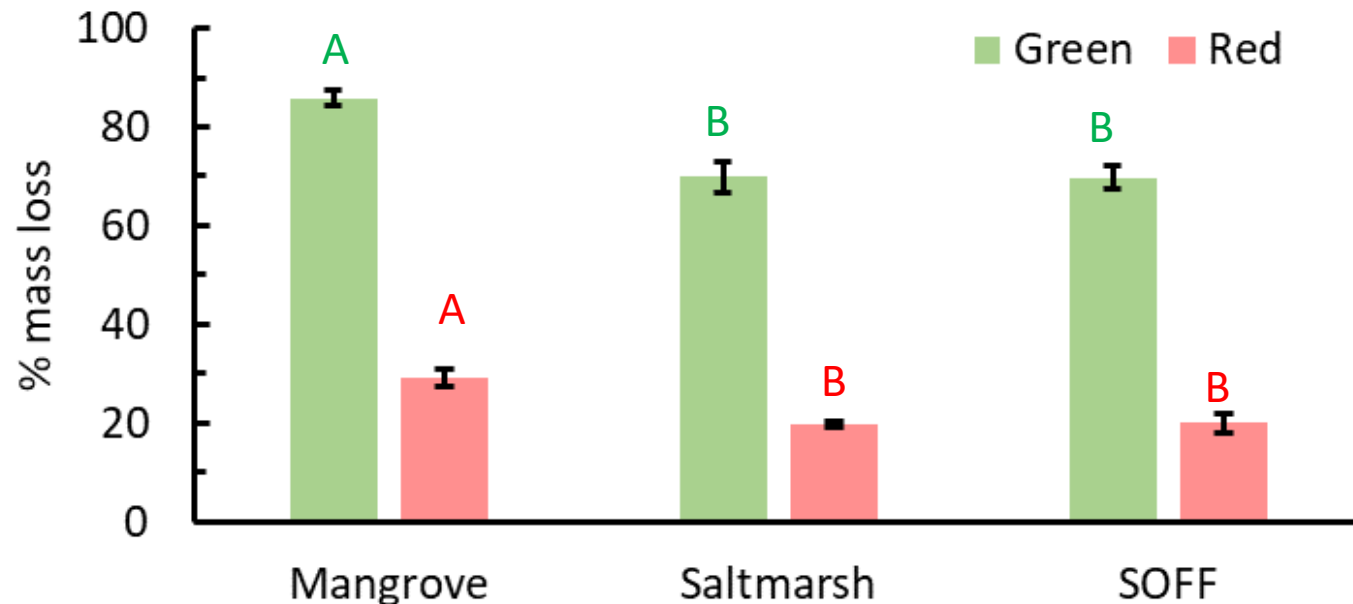
Towra Point (marine)

TeaComposition H₂O Global Aquatic Litter Decomposition Initiative

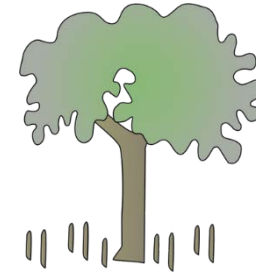
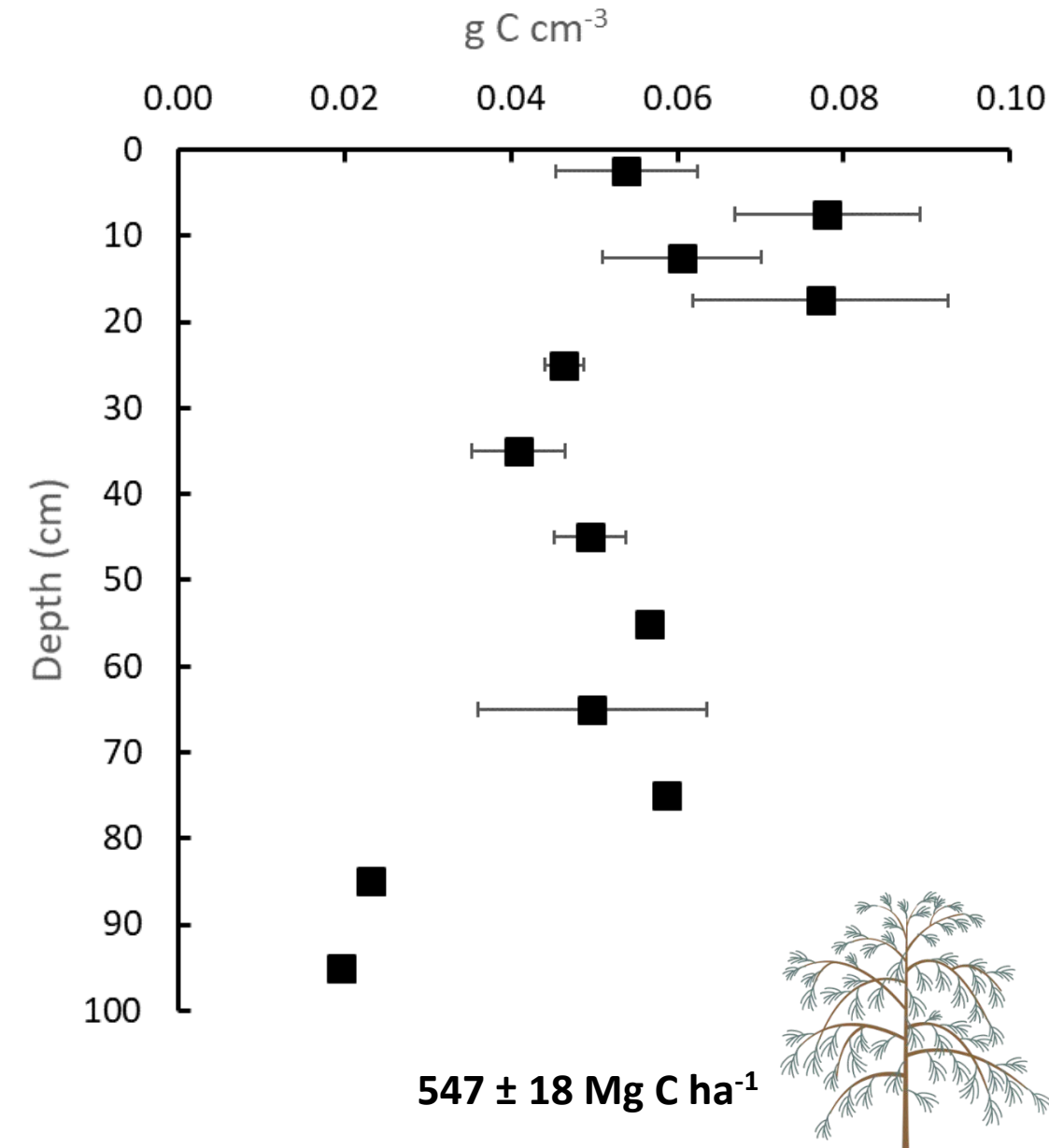


+ SOIL MICROBIOME
CHARACTERISATION

Decomposition - 3 months



Berowra Ck (brackish; fluvial delta)

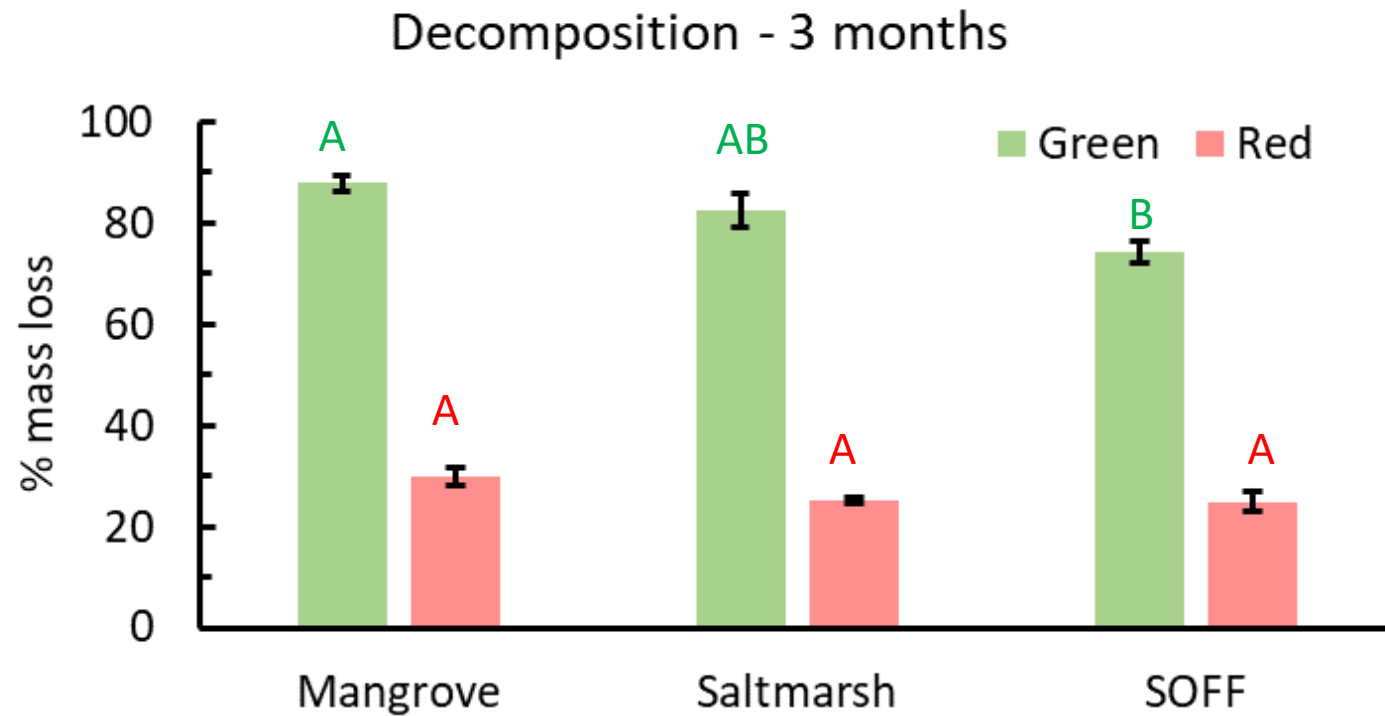


mangrove: 285 ± 74

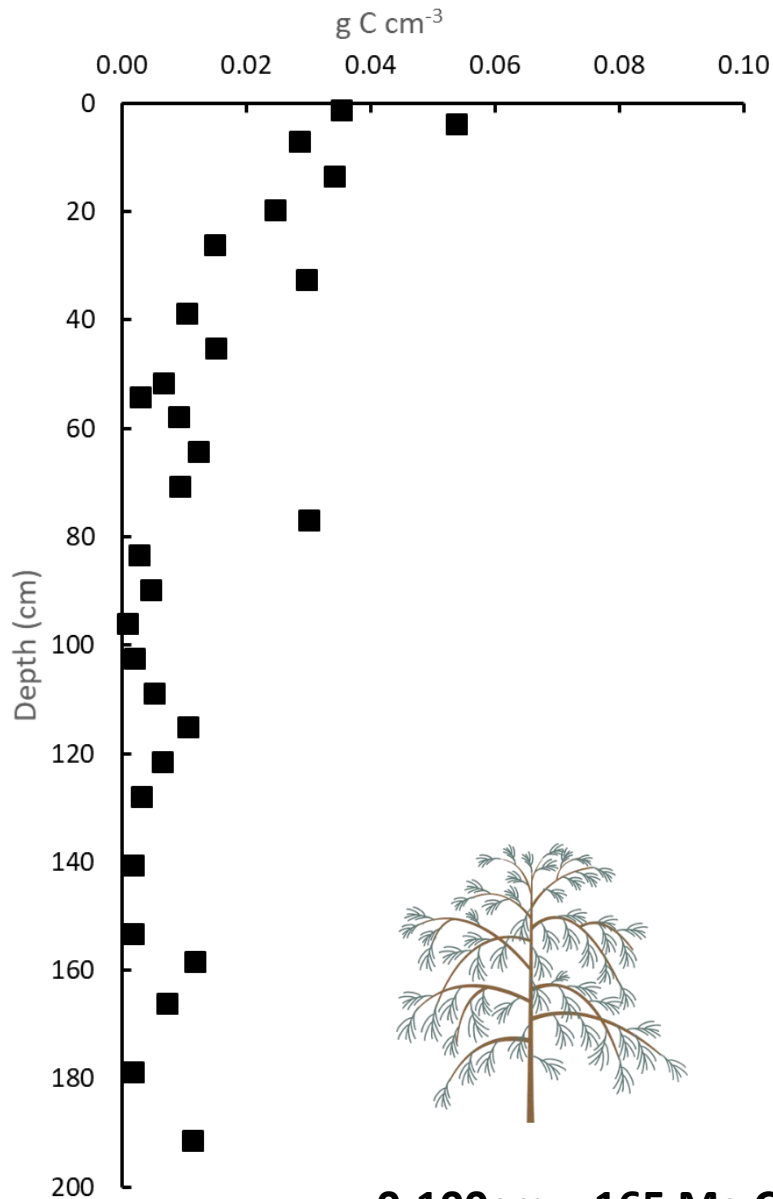


saltmarsh: 311 ± 31

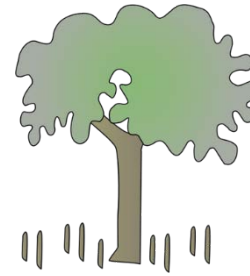
Berowra Ck (brackish; fluvial delta)



Currambene Ck (fluvial)



0-100cm = 165 Mg C ha⁻¹



mangrove: 25 ± 20



saltmarsh: 61 ± 51

Leschenault Inlet



Transects

Elev

- -0.490000 - -0.193000
- -0.192999 - 0.021000
- 0.021001 - 0.160000
- 0.160001 - 0.319000
- 0.319001 - 0.565000
- 0.565001 - 1.055000
- 1.055001 - 1.879000



0 1530 60 90 120
Metres

Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Leschenault Inlet



CASUARINA
 $181 \pm 17 \text{ Mg C ha}^{-1}$



SALTMARSH
 $151 \pm 8 \text{ Mg C ha}^{-1}$

< 60y MANGROVE
 $162 \pm 4 \text{ Mg C ha}^{-1}$

> 60y MANGROVE
 278 Mg C ha^{-1}

Tran
Elev

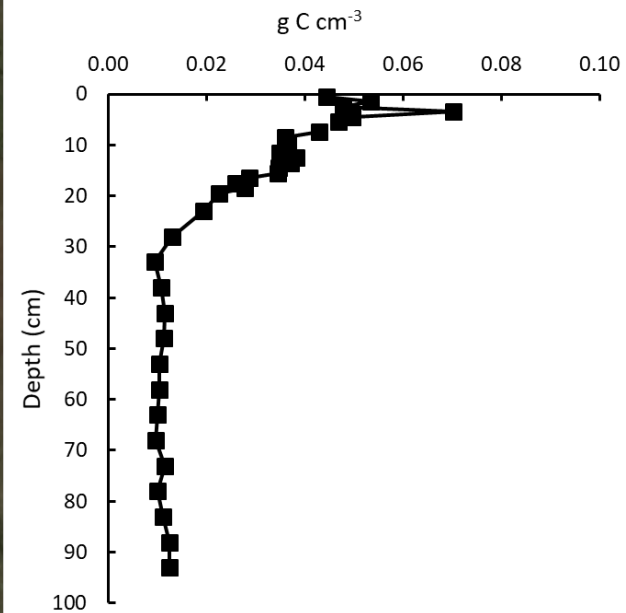
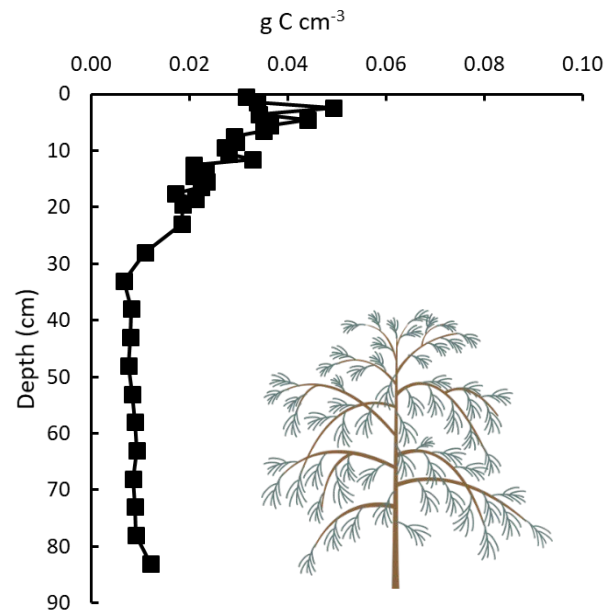
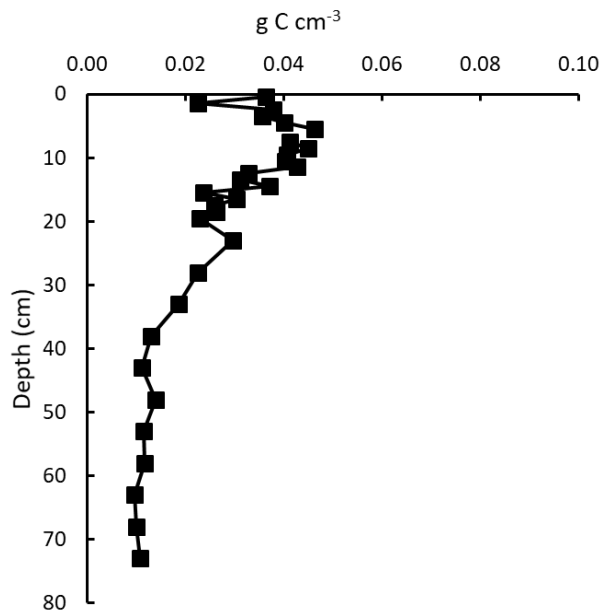
-
-
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Leschenault Inlet



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0 1530 60 90 120
Metres

Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Leschenault Inlet



$0.83 \pm 0.09 \text{ Mg C ha}^{-1} \text{ y}^{-1}$
 $0.86 \pm 0.09 \text{ mm y}^{-1}$

$0.48 \pm 0.05 \text{ Mg C ha}^{-1} \text{ y}^{-1}$
 $0.58 \pm 0.06 \text{ mm y}^{-1}$

$1.20 \pm 0.16 \text{ Mg C ha}^{-1} \text{ y}^{-1}$
 $0.42 \pm 0.06 \text{ mm y}^{-1}$

$0.78 \pm 0.10 \text{ Mg C ha}^{-1} \text{ y}^{-1}$
 $1.8 \pm 0.2 \text{ mm y}^{-1}$

Transects

Elev

- -0.490000 - -0.193000
- -0.192999 - 0.021000
- 0.021001 - 0.160000
- 0.160001 - 0.319000
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- 0.565001 - 1.055000
- 1.055001 - 1.879000



0 1530 60 90 120
Metres

Tropical *Melaleuca* floodplain forest



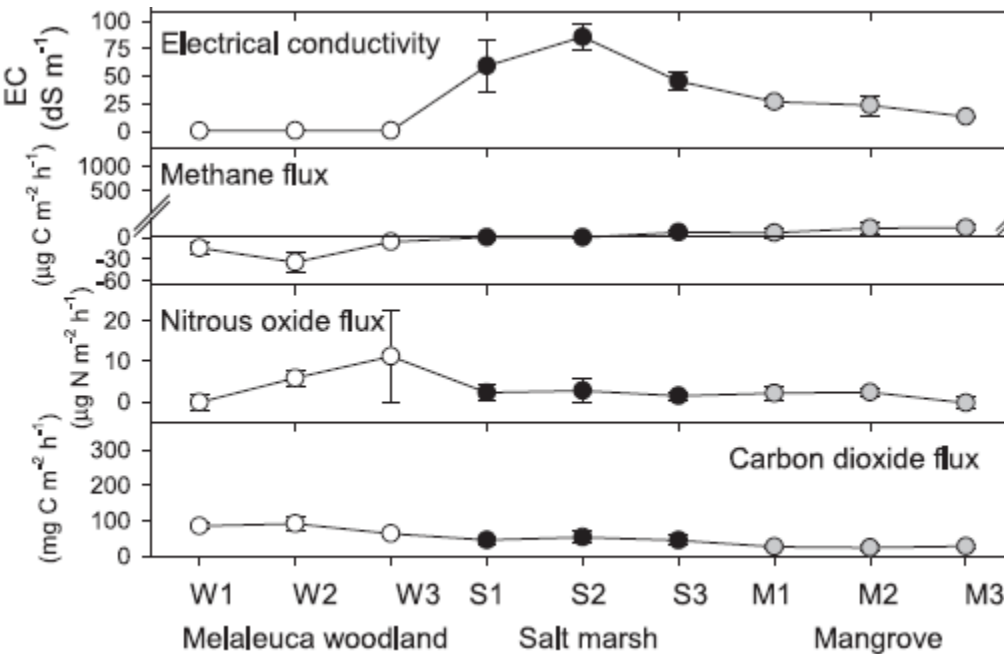
Location	Soil C stock (Mg C ha ⁻¹)	
	Coastal Floodplain Forest	Adjacent ecosystem(s)
Herbert catchment, QLD	Insulator Creek: 235 ± 44	mangrove: 173 ± 9 saltmarsh: 133 ± 9
	Mungalla: 481 ± 47	
Tully catchment, QLD	Site 1: 460 ± 65 Site 2: 622 ± 11	

Location	Soil C accumulation rate (Mg C ha ⁻¹ y ⁻¹)	
	Coastal Floodplain Forest	National estimates
Herbert catchment, QLD	Insulator Creek: 0.67 ± 0.05	mangrove: 1.3 ± 0.89
	Mungalla: 0.66 ± 0.07	saltmarsh: 0.39 ± 0.29

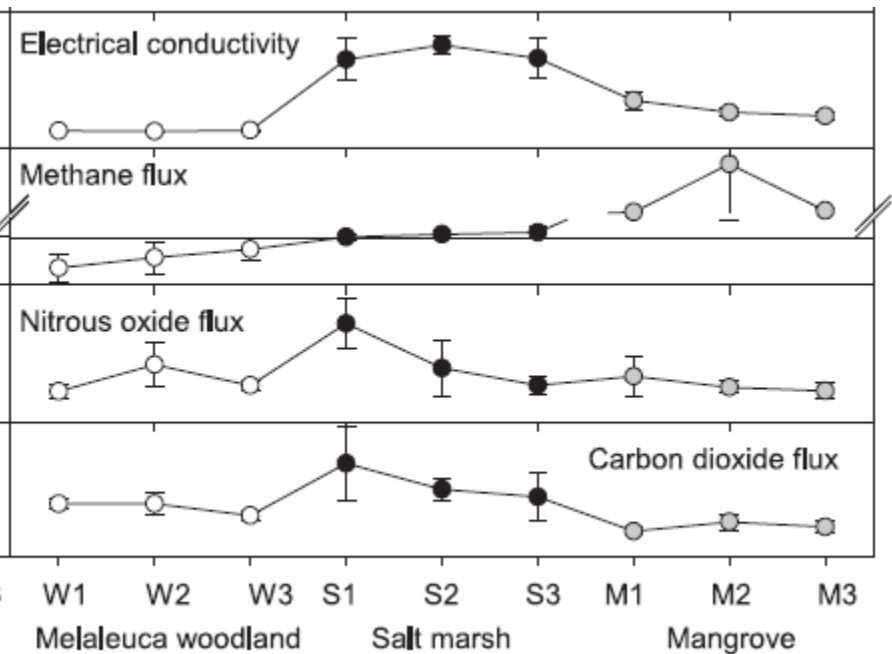
Atmospheric flux



WINTER



SUMMER



Summary

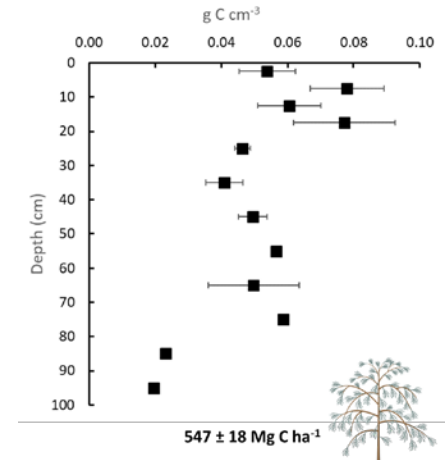
Coastal Floodplain Forests can have substantial belowground C storage

- Perhaps linked to Holocene SL

C stocks may be vulnerable to anthropogenic pressures and SLR

There is much to learn:

- biomass; atmospheric and lateral fluxes → C budgets
- other ecosystem values
- SLR vulnerability



Questions?

Special thanks to:

Daniel Sloane

Emilie Ens

Kerrylee Rogers

Jennifer Bratchell

Liam Clerke

Connor Campbell

Henry Beeson

Nicholas Jones

Christian Salinas

Karen Lamont

Freya Wadlow

Stacey Trevathan-Tackett

Karita Negandhi

Michael Rupic

Laura Guppy

Trinity Grammar School

NSW NPWS

NSW DPI Fisheries