BIOGRIP soil and water node

ENVIRONMENTAL BIOGEOCHEMISTRY FIELD SAMPLING COURSE :

SEAGRASS BLUE CARBON

SAMPLING PROTOCOL

Andrew Ndhlovu

School for Climate Studies
Department of Botany and Zoology
Stellenbosch University

PROJECT SEASTORE

PLANNING ELEMENTS

1) Conception
2) Carbon and biomass field sampling
3) Sample prep and lab analysis
4) Carbon stocks calculations

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1) CONCEPTION

Step 1
Define project boundaries

Step 2
Stratify project area

Step 3
Decide which carbon pools to measure

Step 4
Determine type, number, and location of measurement plots

Step 5
Determine measurement frequency

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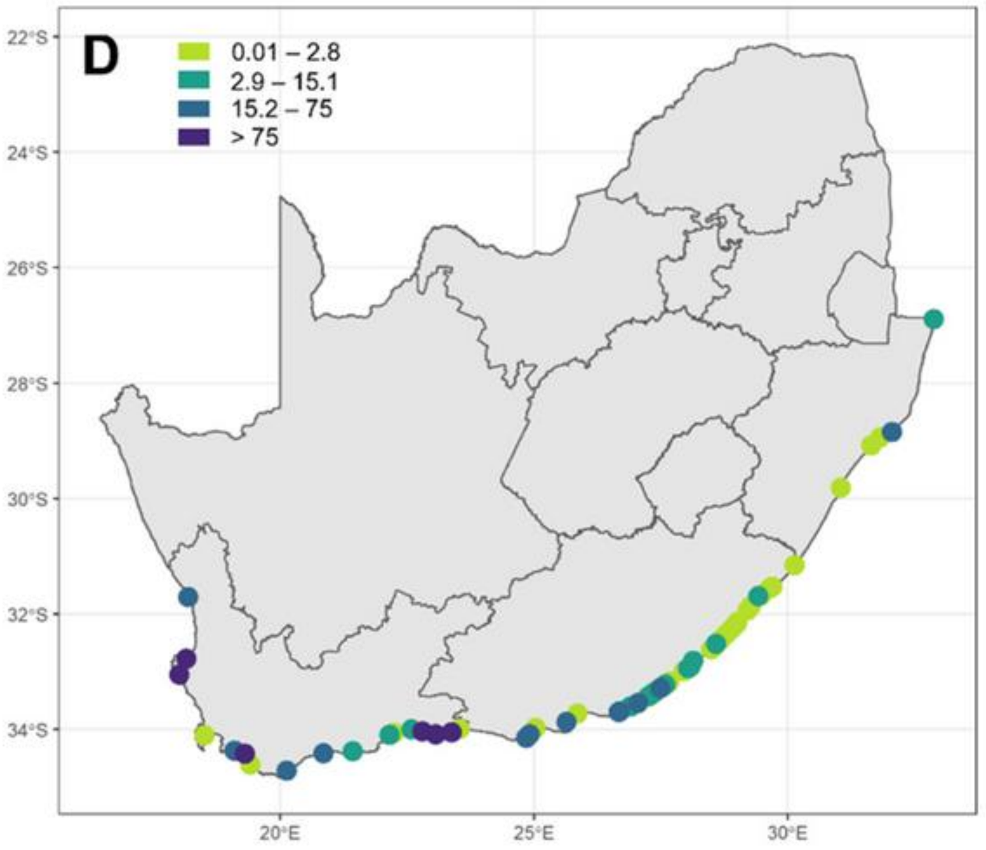
1) CONCEPTION

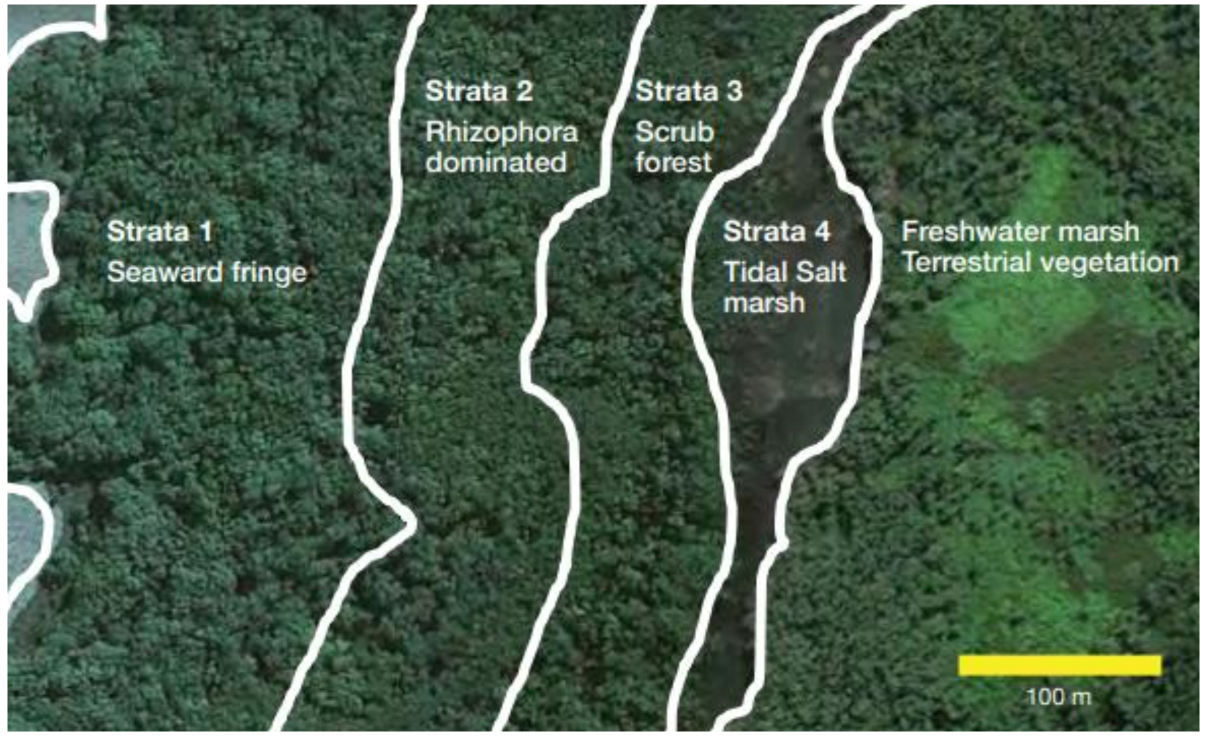
1.1 Determining the project's spatial boundaries

Areas may range from a single site (tens of hectares) to national-scale assessments (hundreds of thousands of hectares)



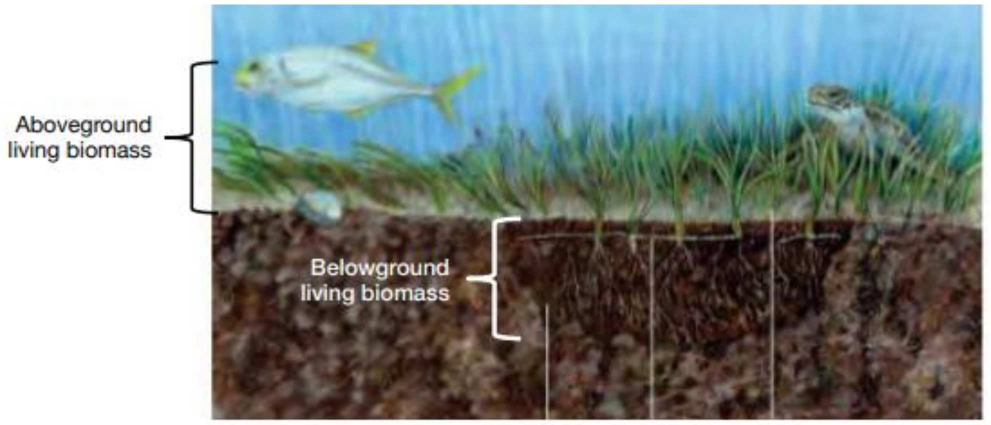
1.2 Stratifying the project area

Stratification divides large heterogeneous sites (requiring many samples to account for variation) into smaller homogeneous areas (where fewer samples are needed)



1.3 Determine carbon pools to sample

- **Aboveground living biomass**
- **Belowground living biomass**
- **Soil carbon**



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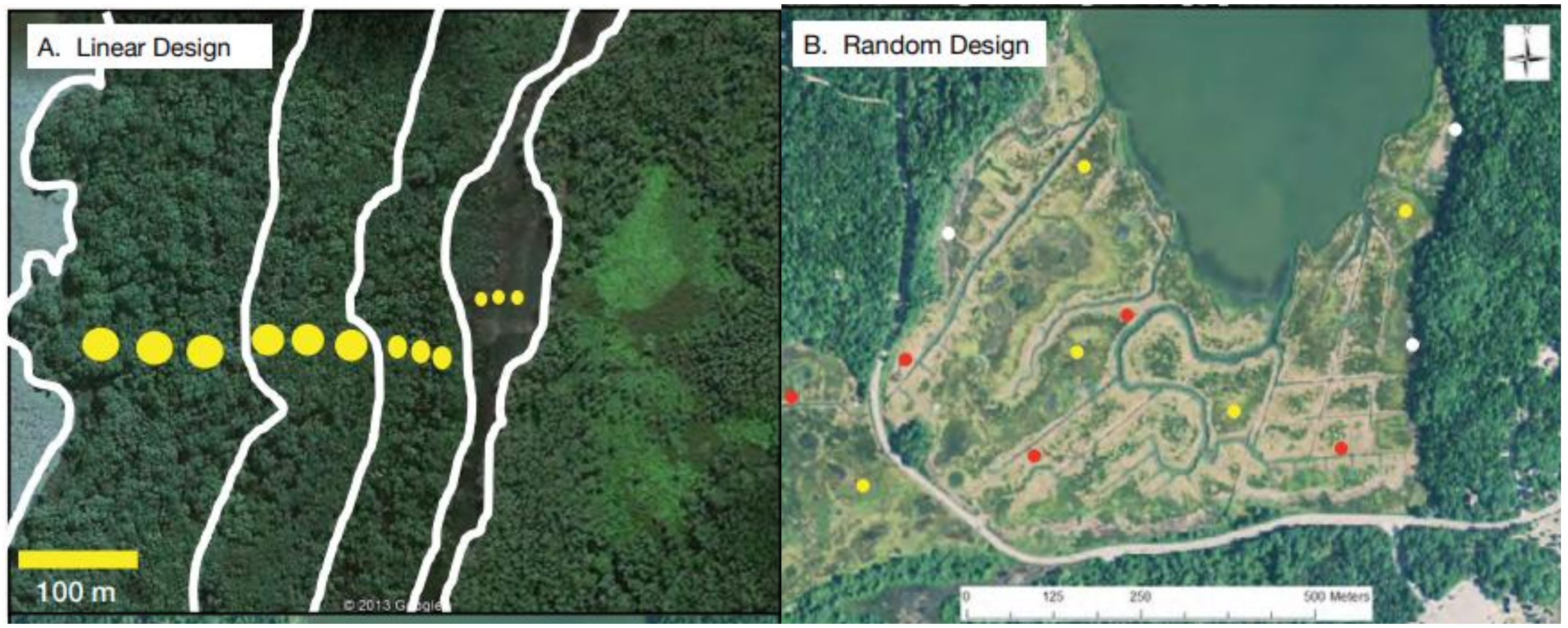
1) CONCEPTION

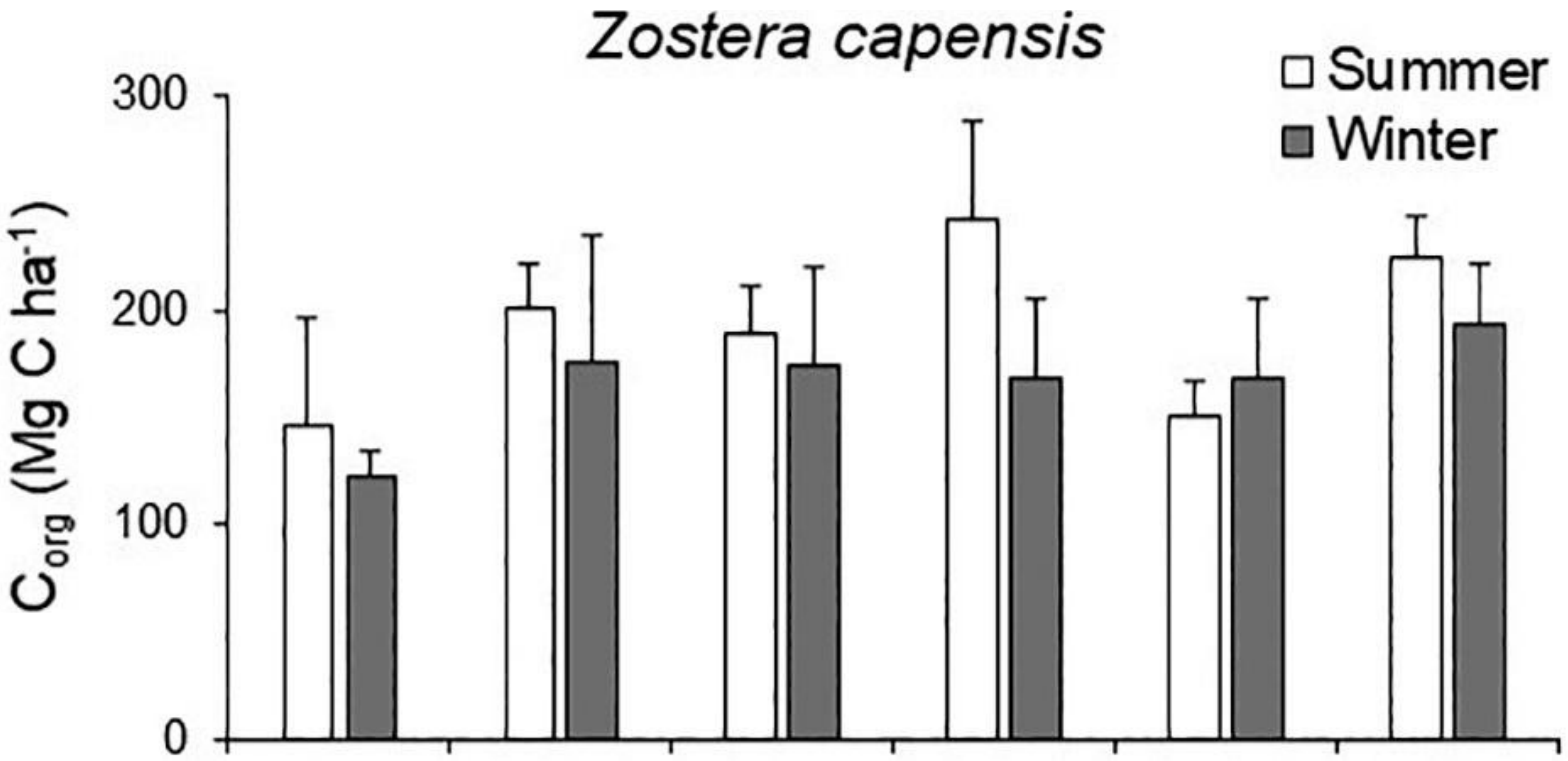
1.4 Determine plot number, type and location

- Permanent or temporary plots
- Minimum number of plots to ensure accuracy
- Plot location should minimize disturbance
- Number of replicates



1.5 Determine measurement frequency

The frequency required to conduct (and repeat) carbon stock assessments depends on the assessment objectives and the rate of expected change in the ecosystem being studied



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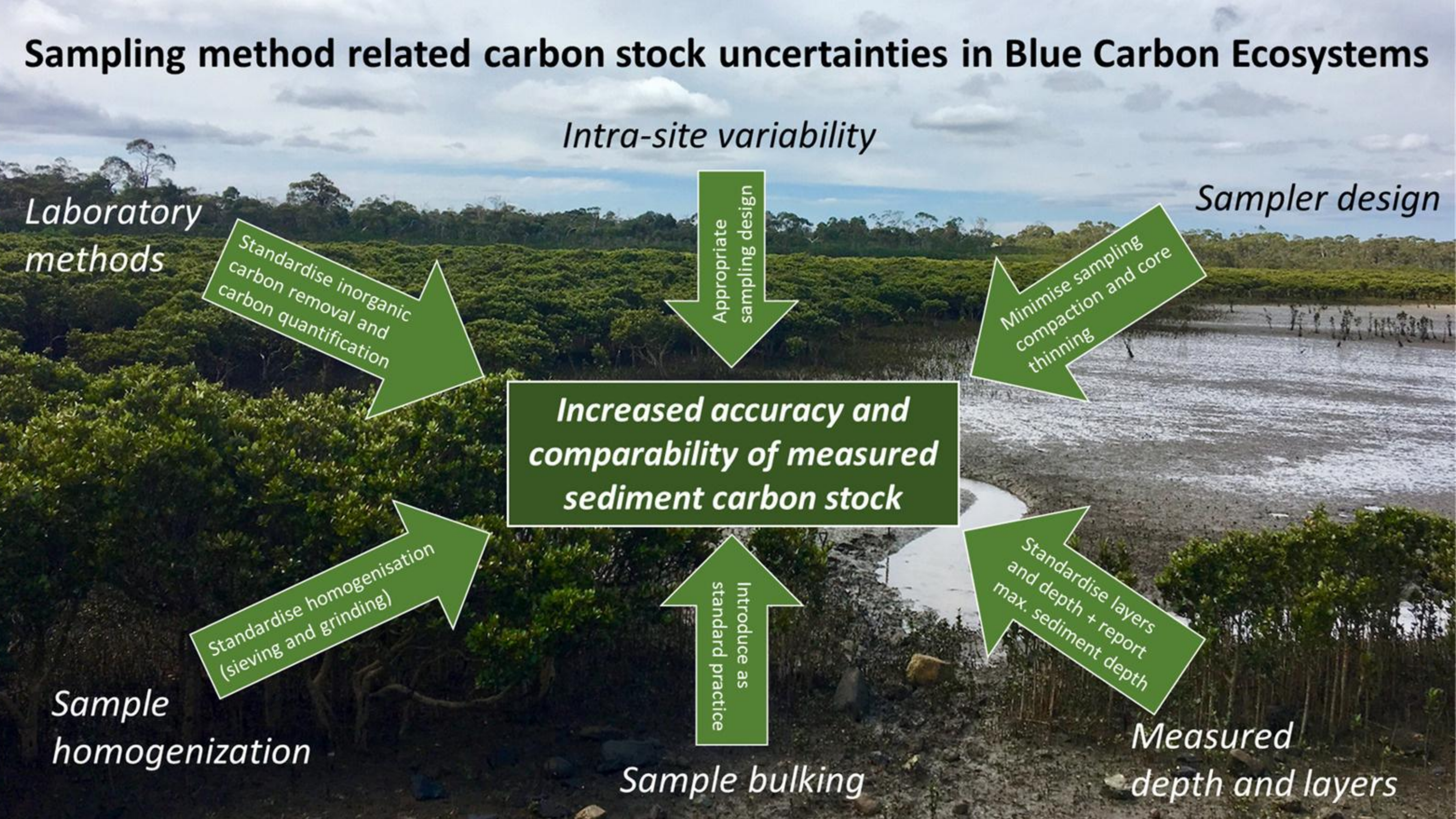
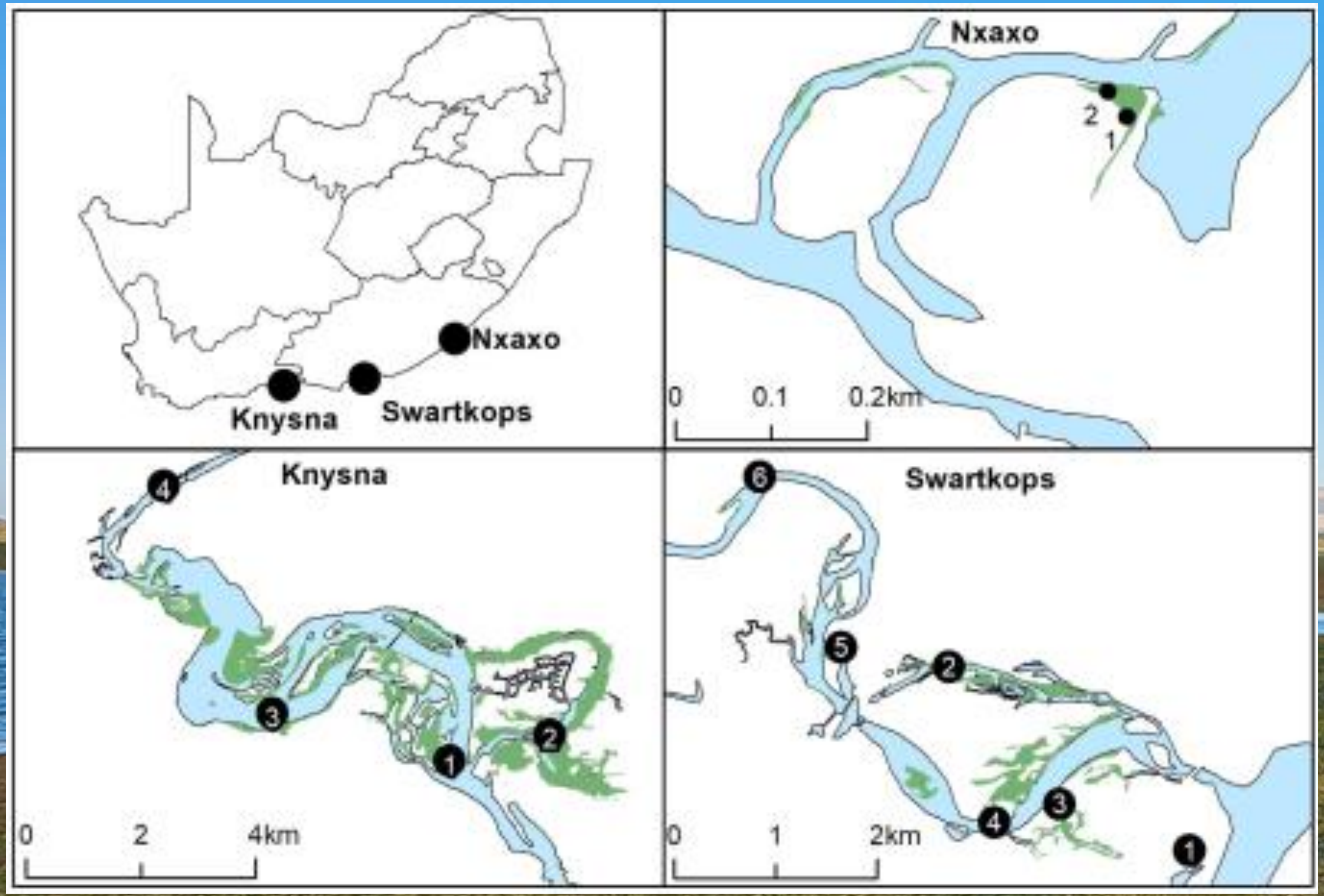
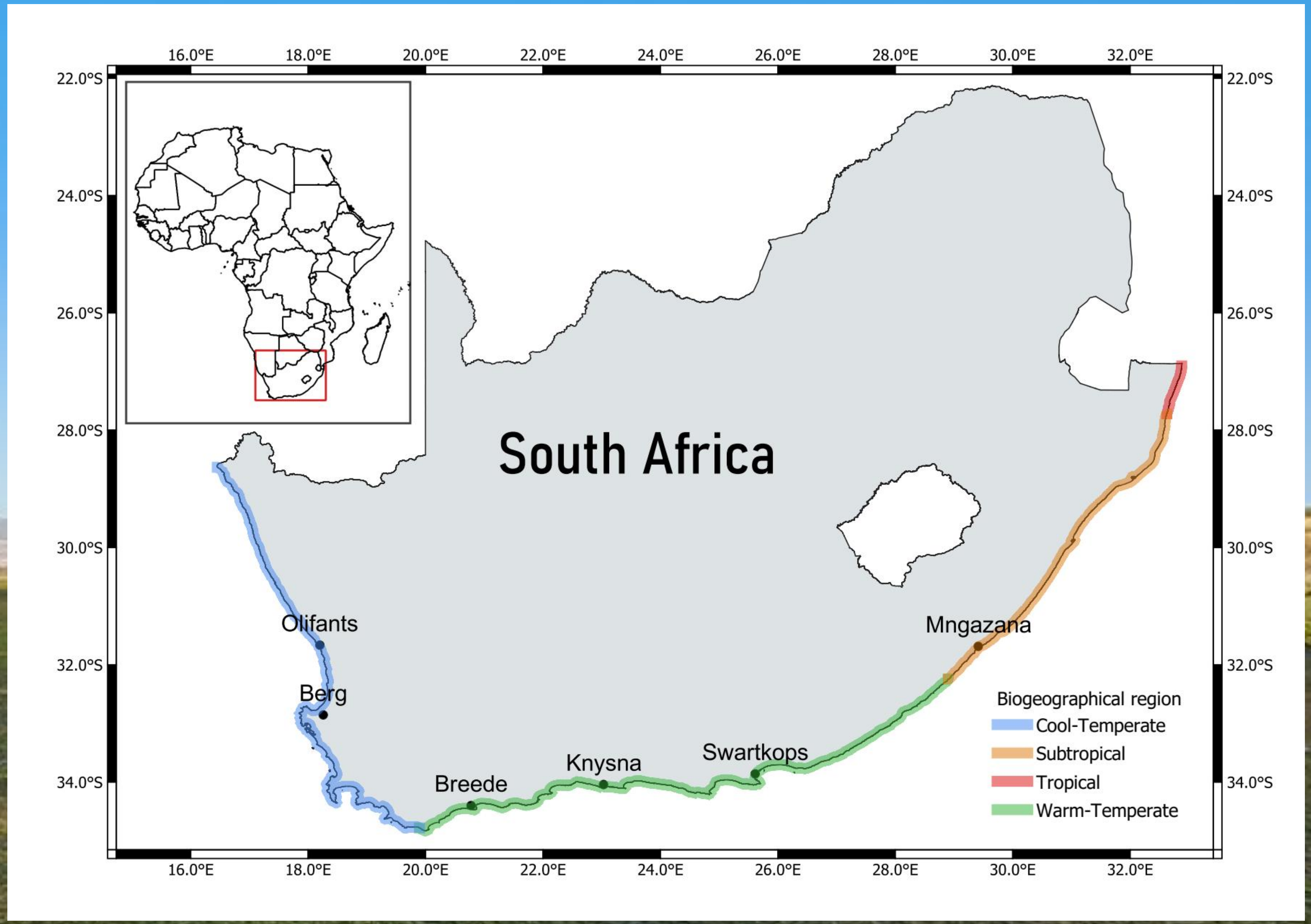


Sampling method related carbon stock uncertainties in Blue Carbon Ecosystems
Intra-site variability
Appropriate sampling design
Laboratory methods
Standardise inorganic carbon removal and carbon quantification
Sampler design
Minimise sampling compaction and core thinning
Increased accuracy and comparability of measured sediment carbon stock
Standardise homogenisation (sieving and grinding)
Sample homogenization
Introduce as standard practice
Sample bulking
Standardise layers and depth + report max. sediment depth
Measured depth and layers

(Ndhlovu et al., 2024, *Science of The Total Environment*)

Field sampling considerations: sampling sites





(Wasserman et al., 2023, *Estuarine, Coastal and Shelf Science;* Ndhlovu et al., 2024, *Science of The Total Environment*

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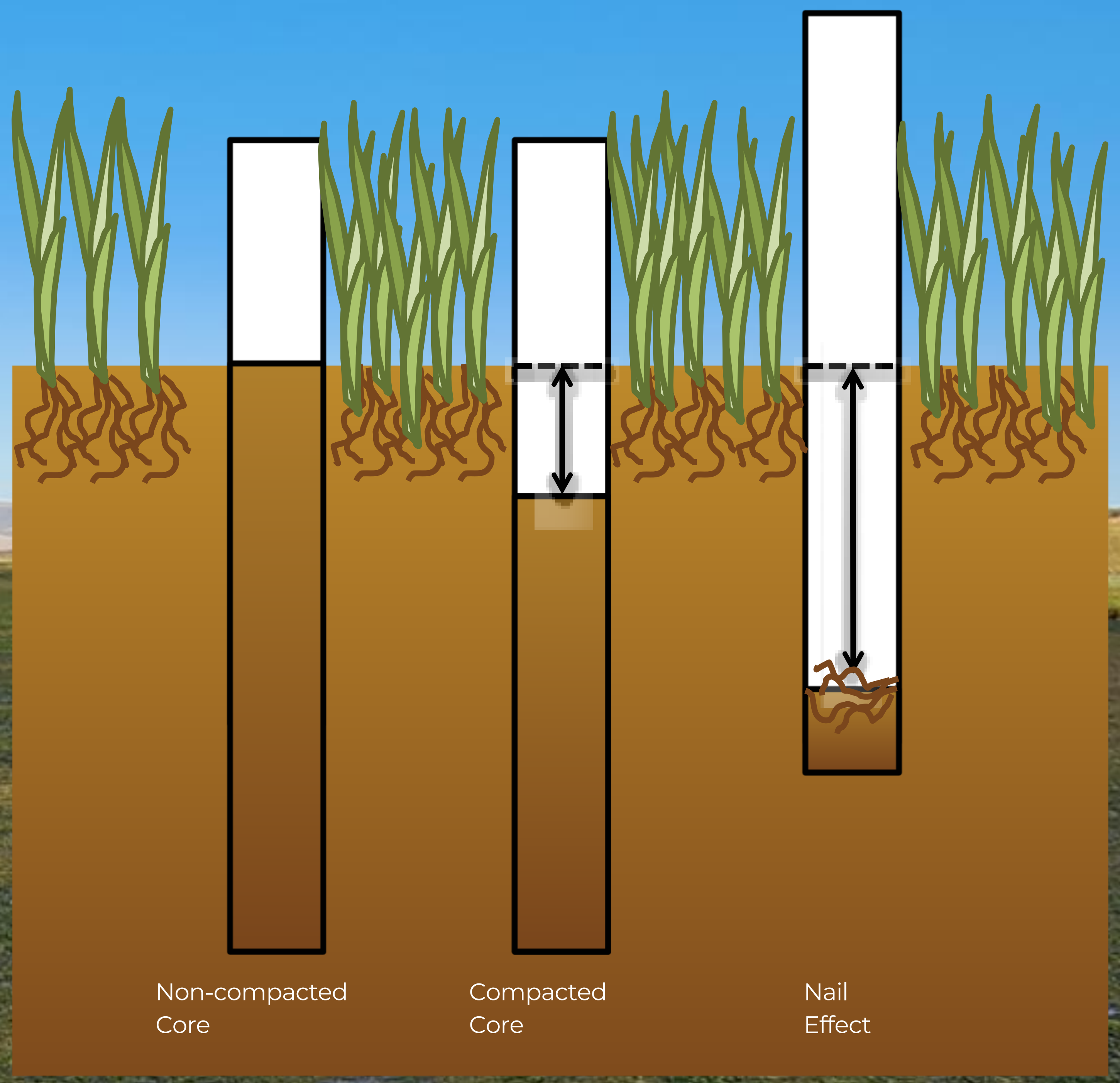
Field sampling considerations: Nature of the soil

General factors to account for:

- Soils are saturated with water
- sand or mud
- Do not hold their shape well
- More susceptible to compaction
- Can be underwater



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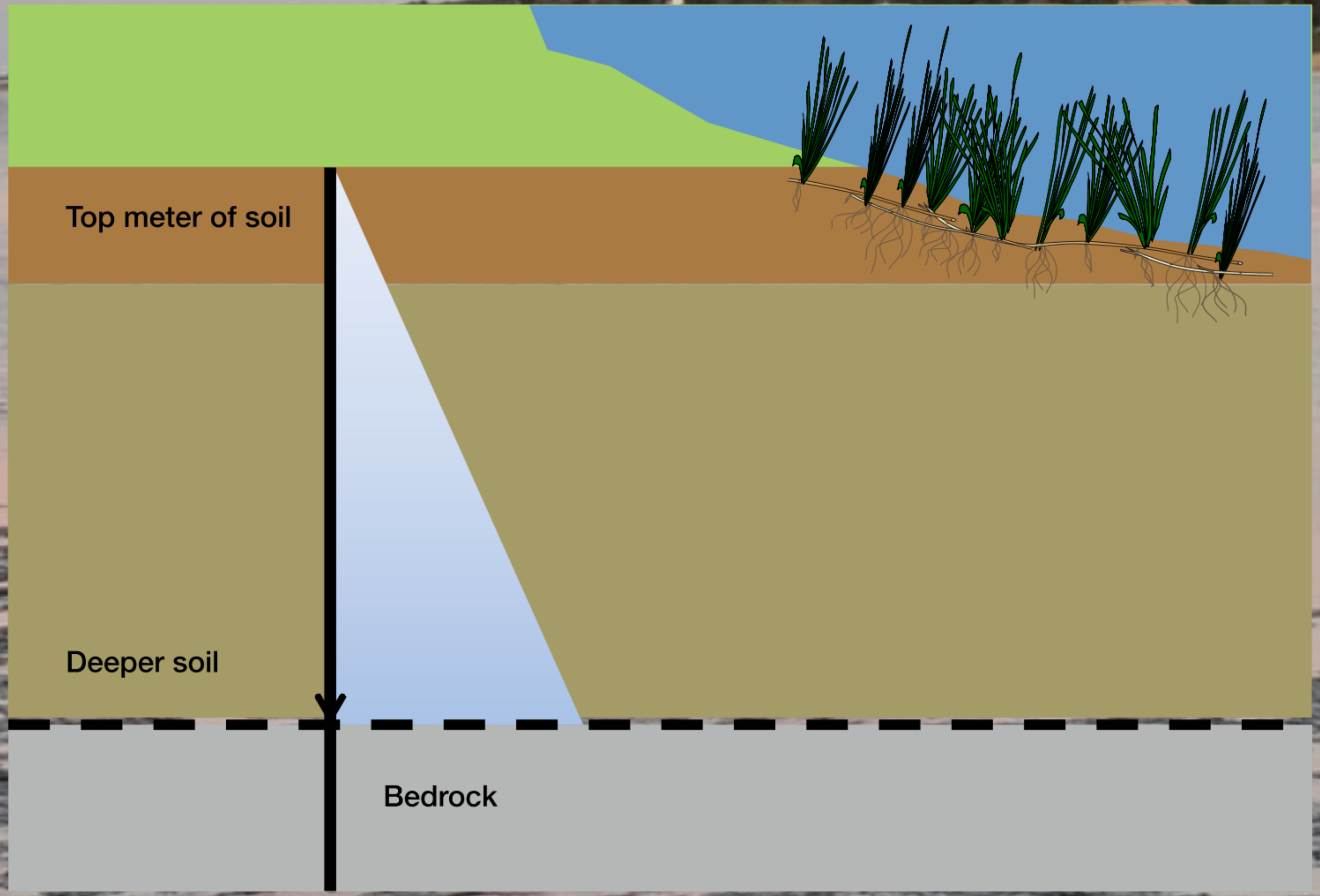
Field sampling considerations: sampling depth

Factors to consider when determining sampling depth

- Sampling device
- Physical conditions: wet vs dry soils
- Depth to refusal: depth at which the pole can no longer be inserted
- Resources and scope of the project



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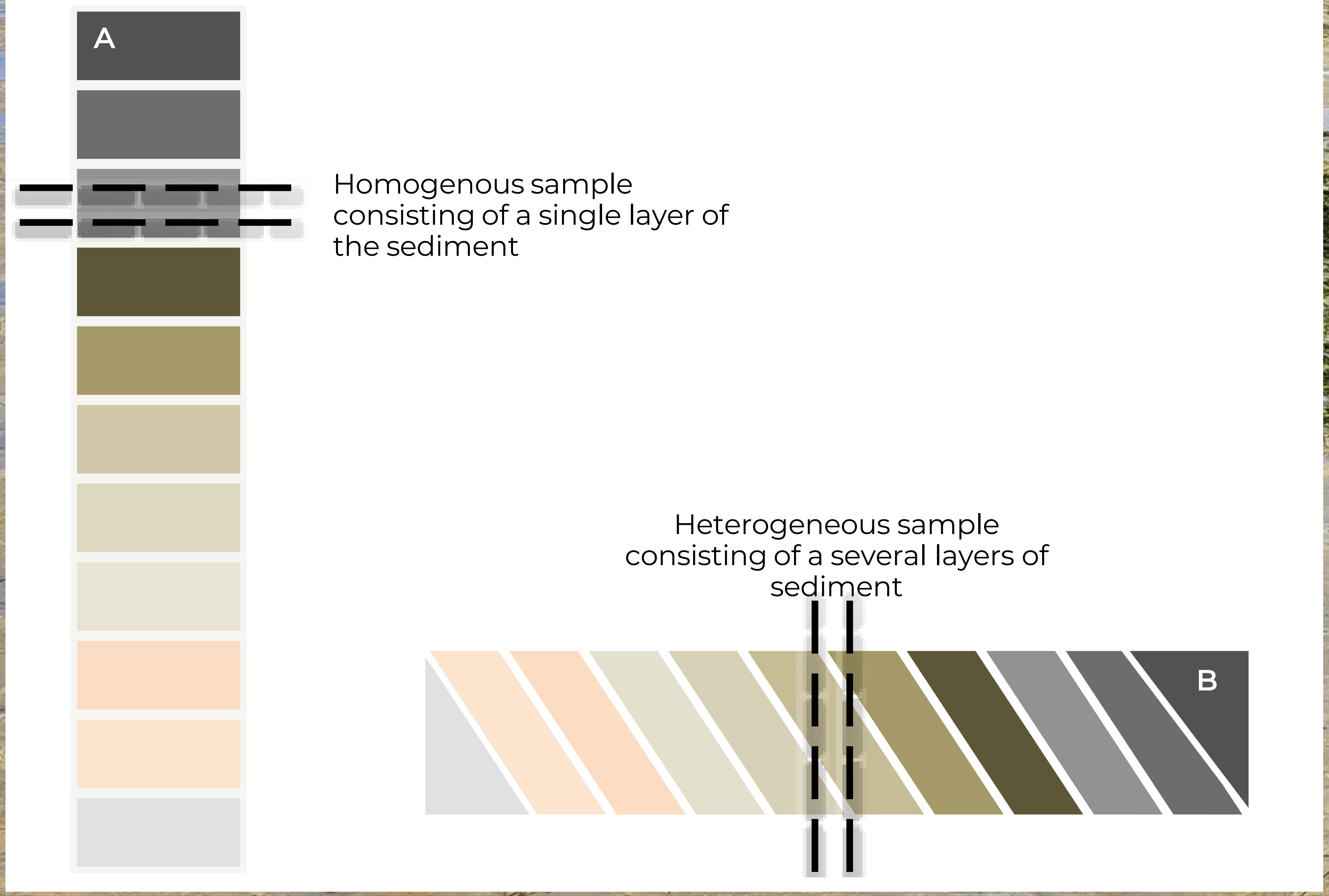
Field sampling considerations: transpontation

What to consider when transporting cores

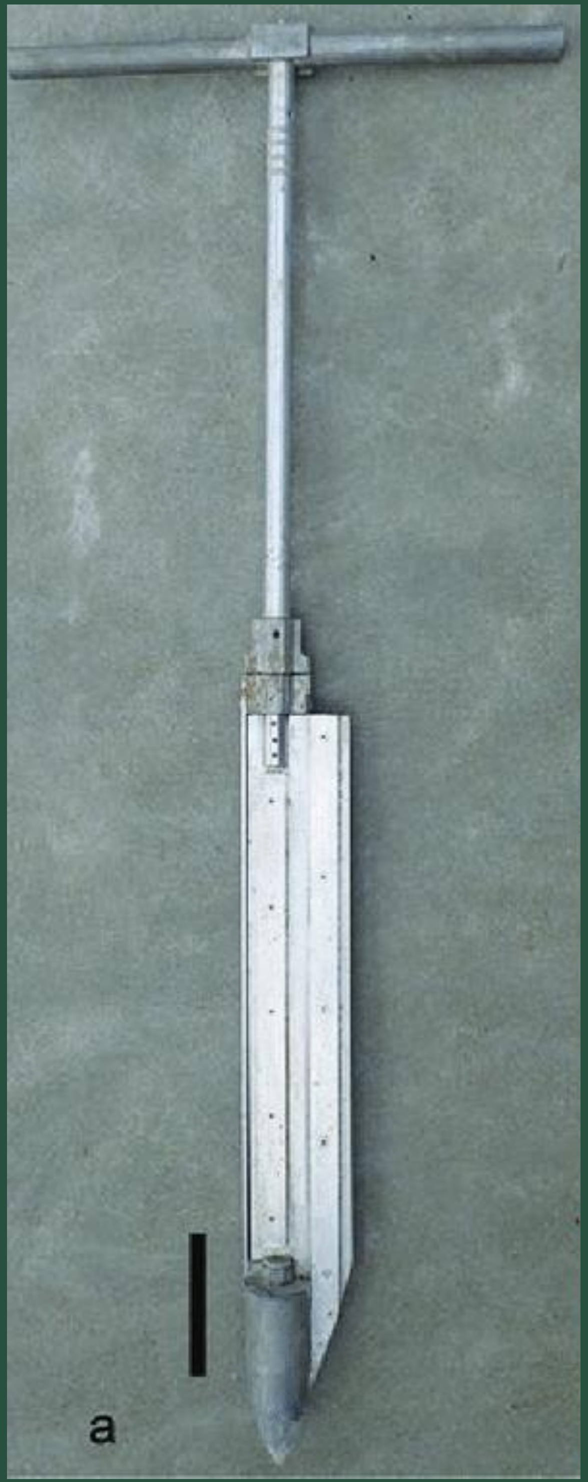
- Keep cores upright to prevent soil layers from mixing to ensure a consistent subsample



2) Field sampling

Equipment

Tools	PURPOSE
Soil depth probe (optional)	For measuring soil depth
Measuring tape	For measuring thickness of soil sampled and depth along the soil core
Sharp knife or 25 ml syringe	To subsample core
Soil coring device	To sample the soil core; (can also be used to determine soil depth)
GPS	To record the coring position
Plastic sample bags	To store samples
Waterproof writing utensils and tape	To label samples
Camera	To archive sample appearance and sample number



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FIELD SITE TRANSPORT

Kayaking across small distances

Boat required for large distances

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TYPES OF SAMPLING

SOIL CORER TYPE 1

SOIL CORER TYPE 2

INTERTIDAL

SUBTIDAL

MORPHOMETRICS

DEPTH SECTIONING OF SEDIMENT

SOIL CORER TYPE 1

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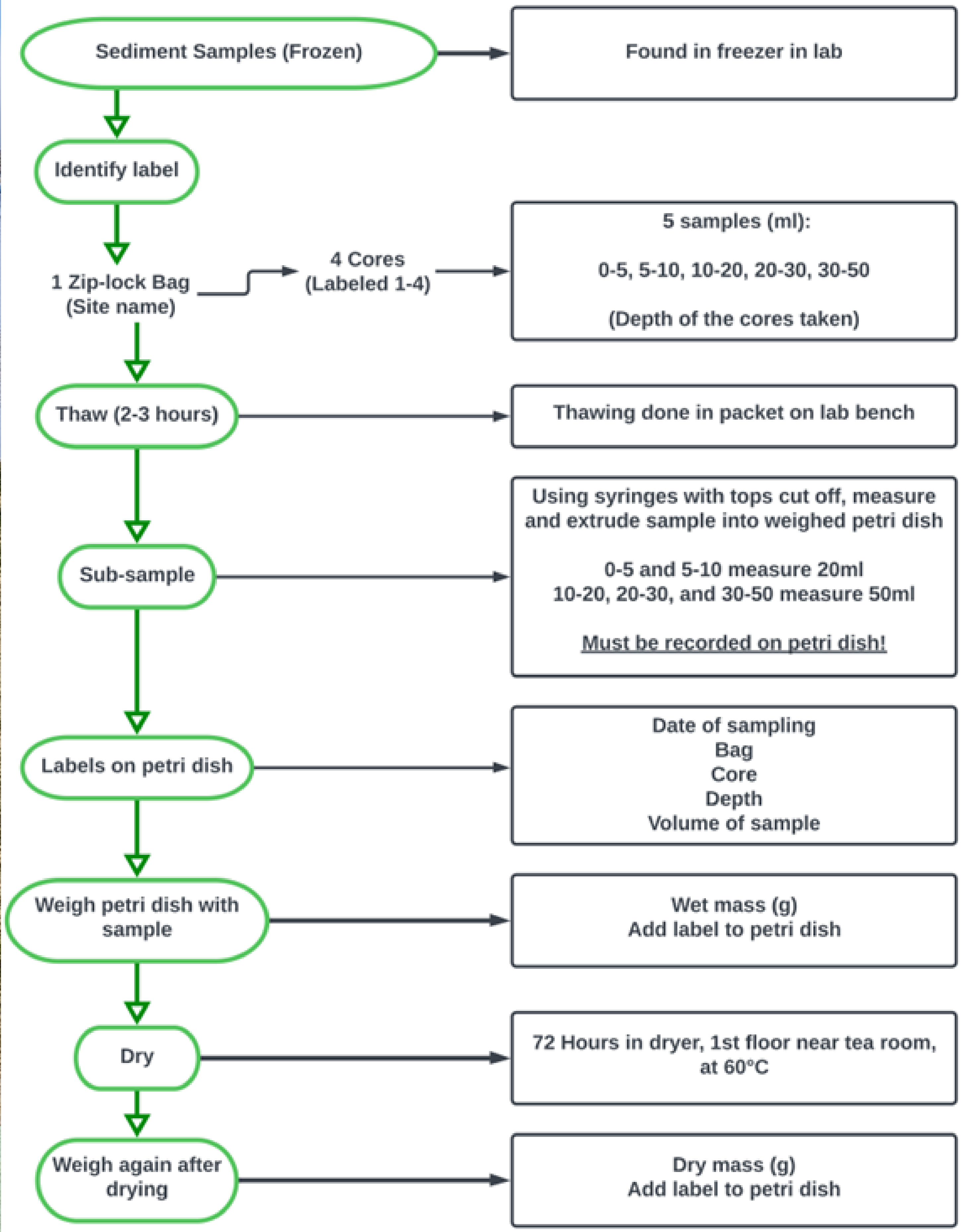
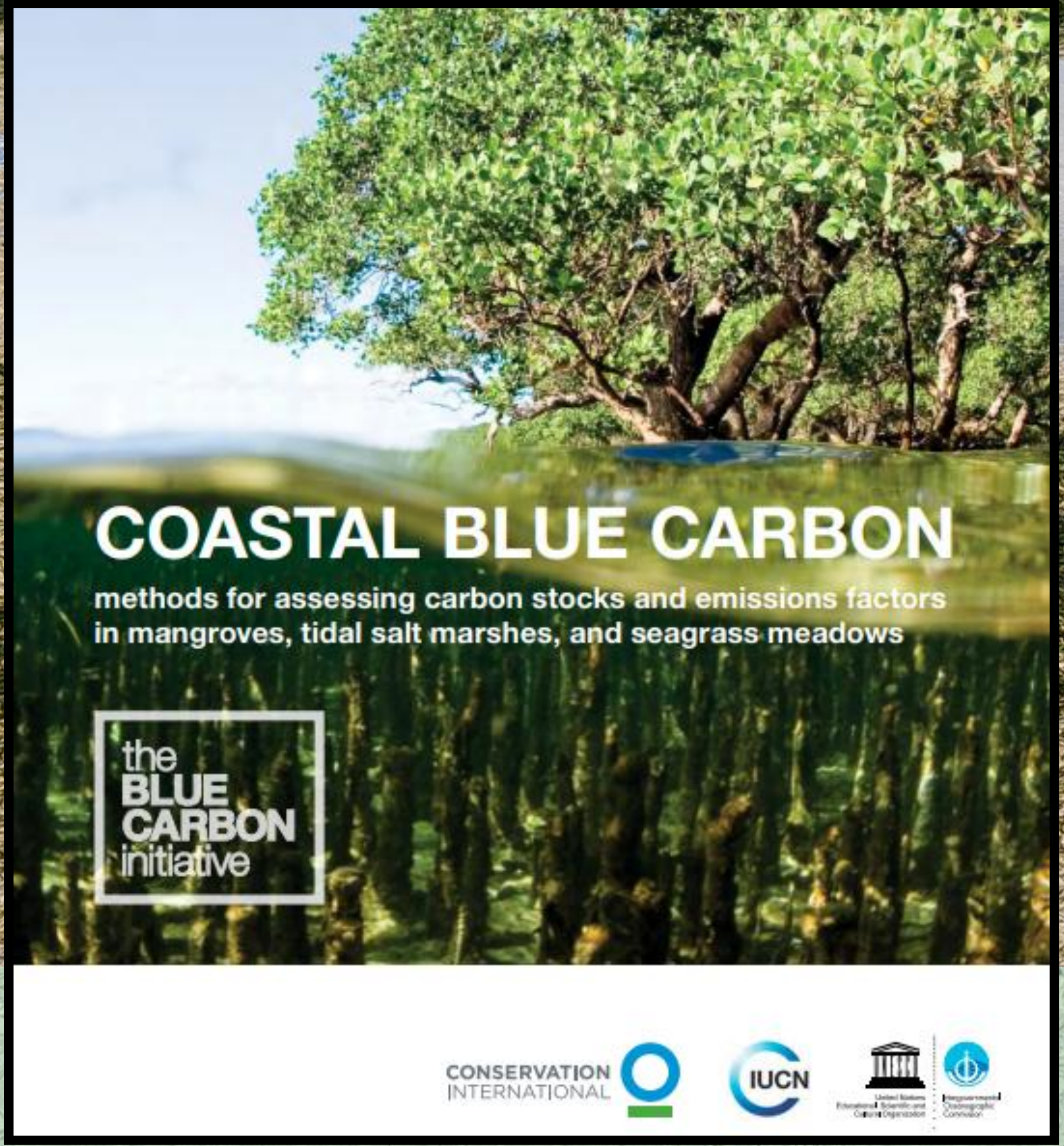
3) LAB ANALYSIS

Operating procedure for sampling of sediment cores



Blue carbon Lab SOP by:
Grant Evans
Phindulo Precious Mashavhele
Bianca Pretorius



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3) LAB ANALYSIS

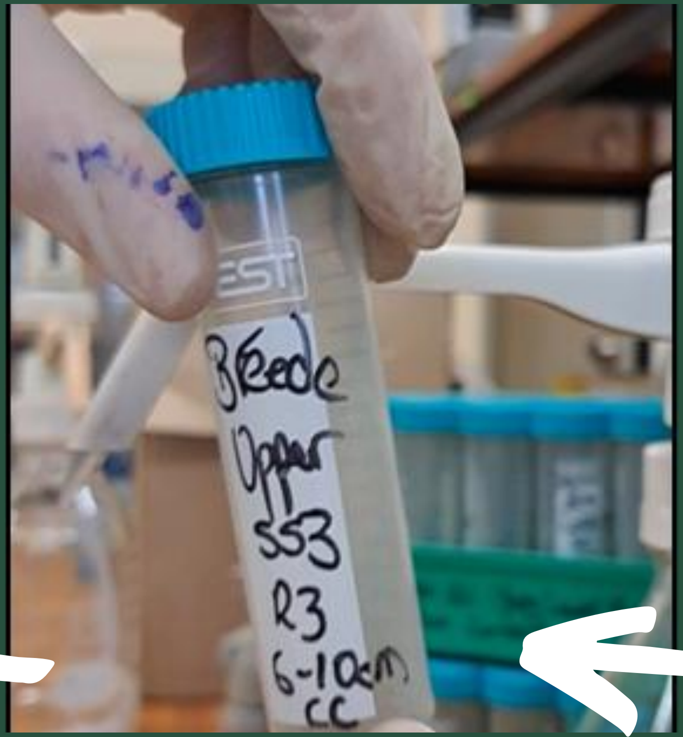
CARBON ANALYSIS

EXTRACT SEDIMENT

WEIGH SEDIMENT

DRY SEDIMENT

WEIGH SEDIMENT



TREAT SEDIMENT

ANALYSE SEDIMENT

MORPHOMETRICS ANALYSIS

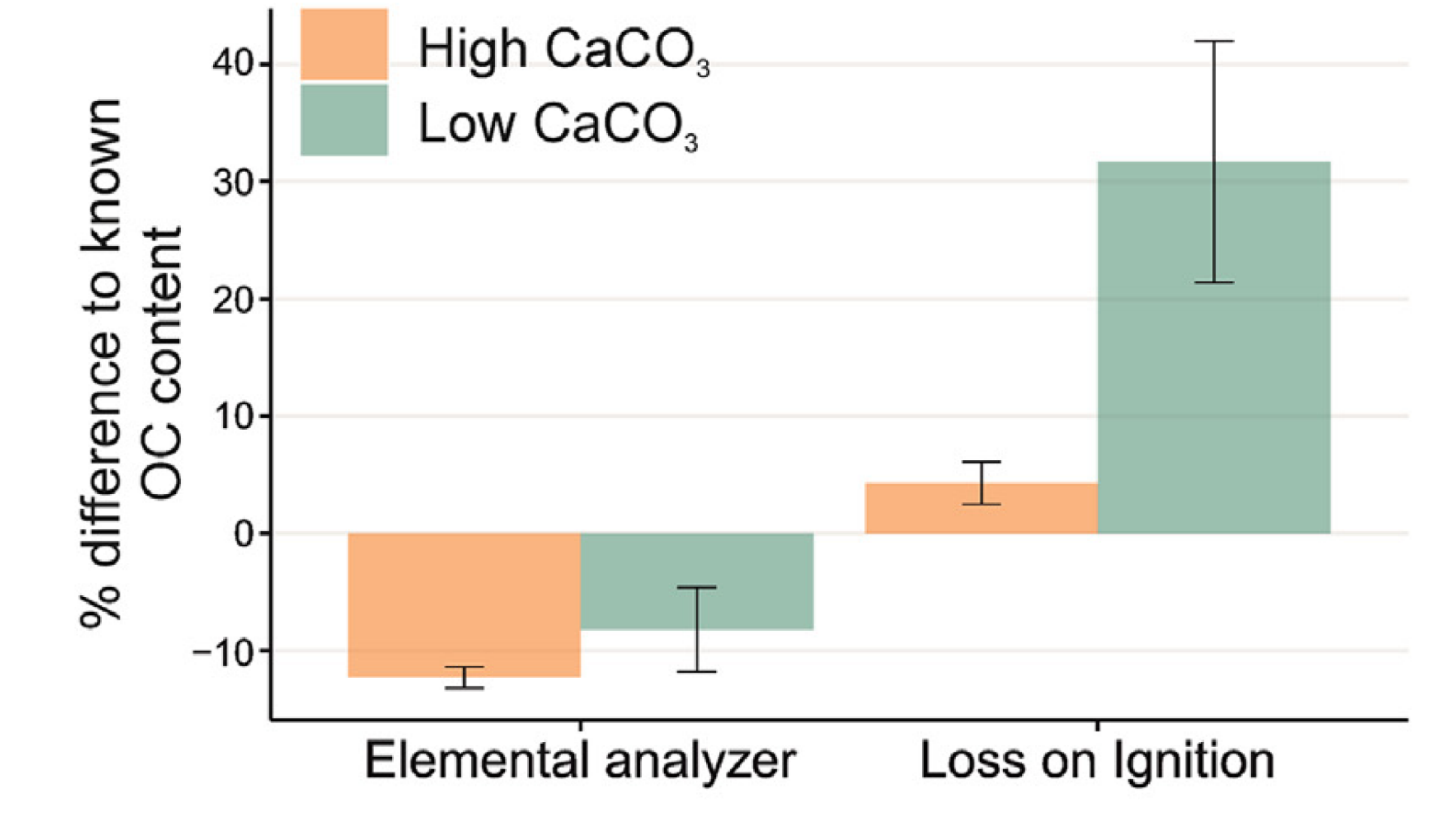
3) LAB ANALYSIS

CARBON ANALYSIS

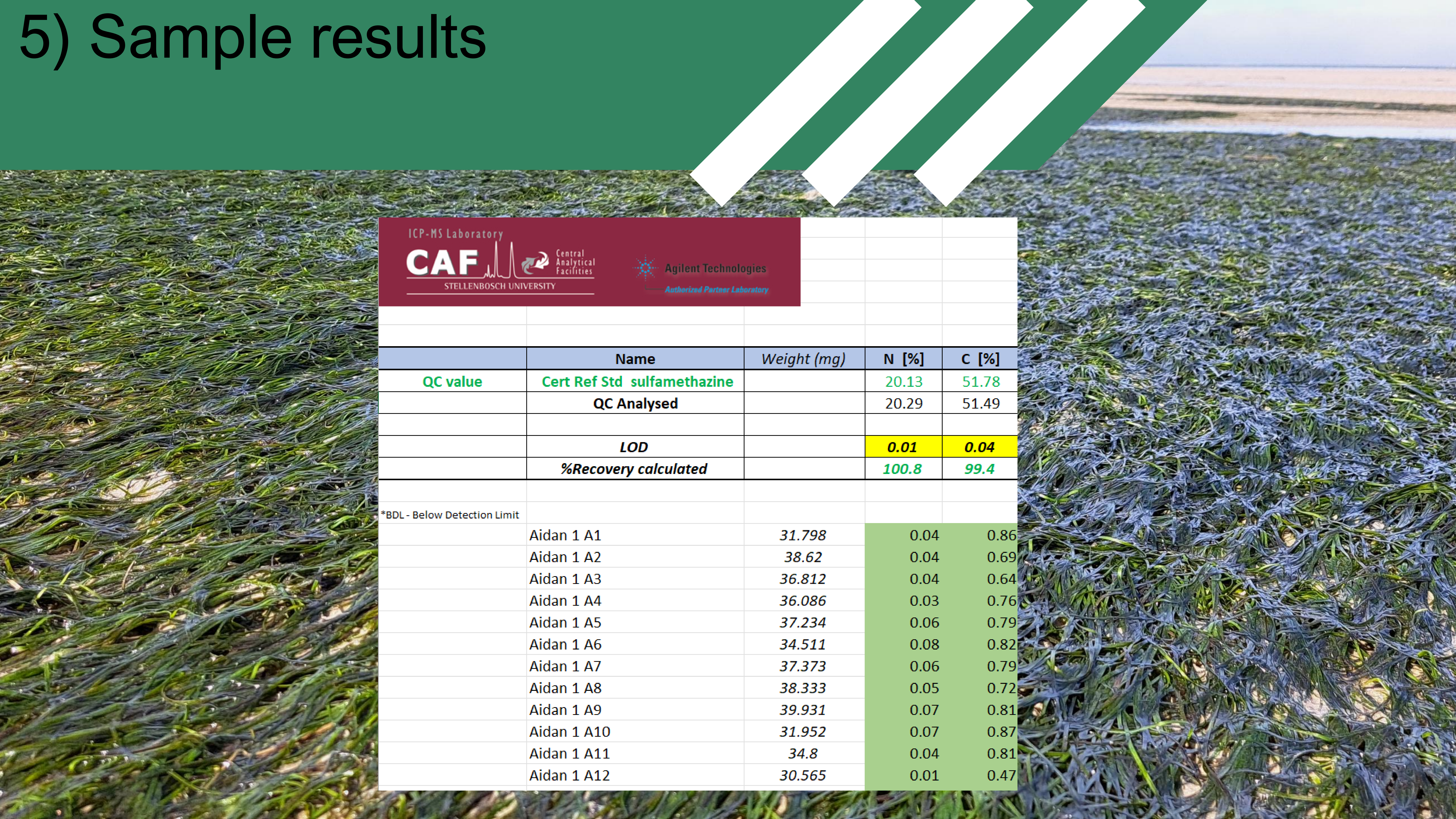
One Earth

Review

Recommendations for strengthening blue carbon science



5) Sample results



ICP-MS Laboratory
CAF Central Analytical Facilities
STELLENBOSCH UNIVERSITY
Agilent Technologies
Authorized Partner Laboratory

	Name	*Weight (mg)*	N [%]	C [%]
QC value	Cert Ref Std sulfamethazine		20.13	51.78
	QC Analysed		20.29	51.49
	LOD		***0.01***	***0.04***
	%Recovery calculated		***100.8***	***99.4***
*BDL - Below Detection Limit				
	Aidan 1 A1	*31.798*	0.04	0.86
	Aidan 1 A2	*38.62*	0.04	0.69
	Aidan 1 A3	*36.812*	0.04	0.64
	Aidan 1 A4	*36.086*	0.03	0.76
	Aidan 1 A5	*37.234*	0.06	0.79
	Aidan 1 A6	*34.511*	0.08	0.82
	Aidan 1 A7	*37.373*	0.06	0.79
	Aidan 1 A8	*38.333*	0.05	0.72
	Aidan 1 A9	*39.931*	0.07	0.81
	Aidan 1 A10	*31.952*	0.07	0.87
	Aidan 1 A11	*34.8*	0.04	0.81
	Aidan 1 A12	*30.565*	0.01	0.47

4) Carbon Calculations/Demo

- **Step 1:** Calculate carbon in each sections of core sampled
- **Step 2:** Sum carbon content across all depth sections
- **Step 3:** Convert total core carbon into appropriate units (MgC/hectare-cm)
- **Step 4:** Determine average carbon in sediment cores and calculate standard deviation
- **Step 5:** Total ecosystem carbon = average carbon per core x area of seagrass (± SD)

RStudio

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