ELSEVIER

Ecological Indicators

Volume 171, February 2025, 113205

Carbonate sediment production in coastal wetlands: Periphyton contributions and diatom indicators

Samantha Hormiga [a], Evelyn E. Gaiser [a], Michael S. Ross [b], James W. Fourqurean [a], Rosario Vidales [b]

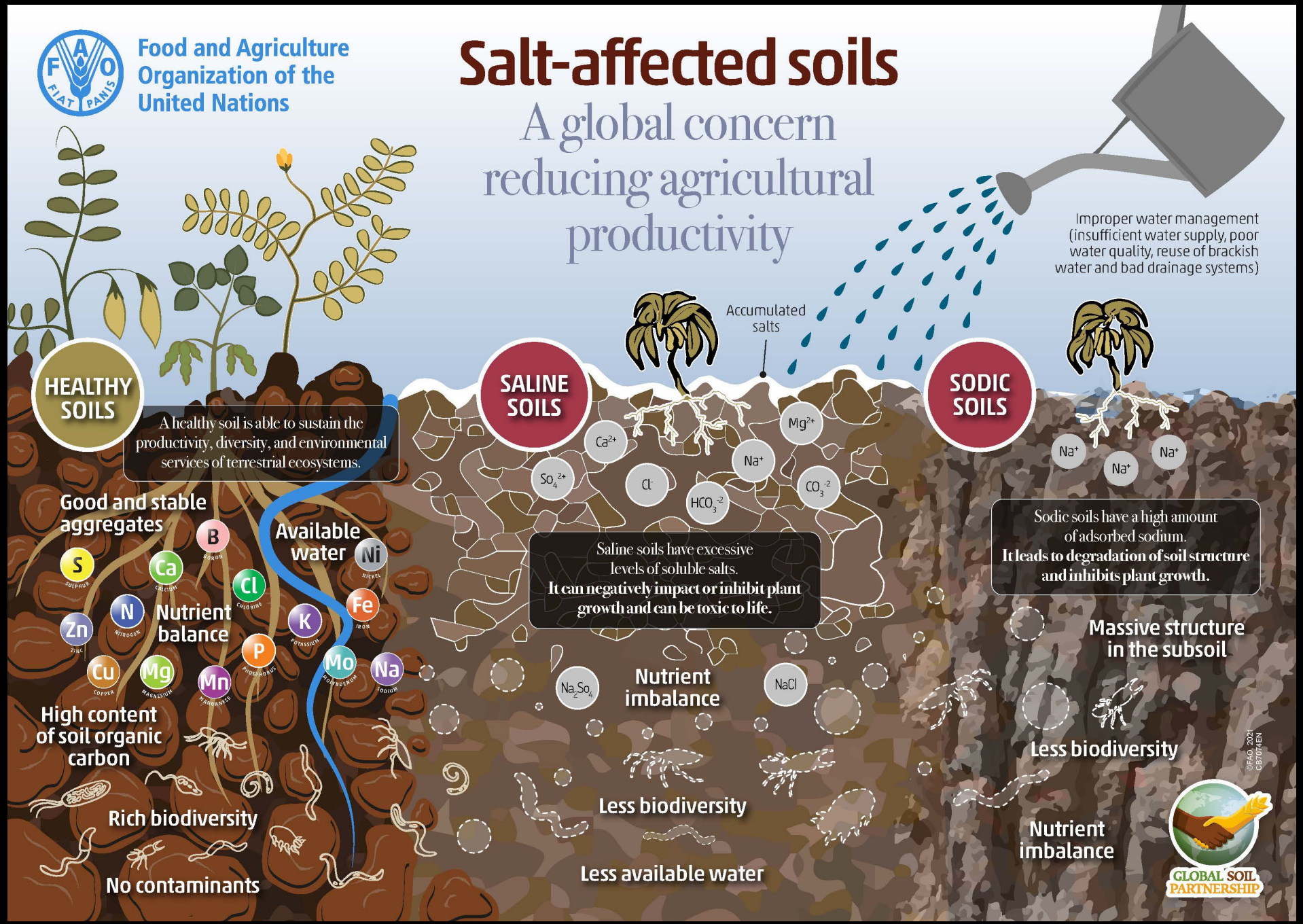
Show more

+ Add to Mendeley Share Cite

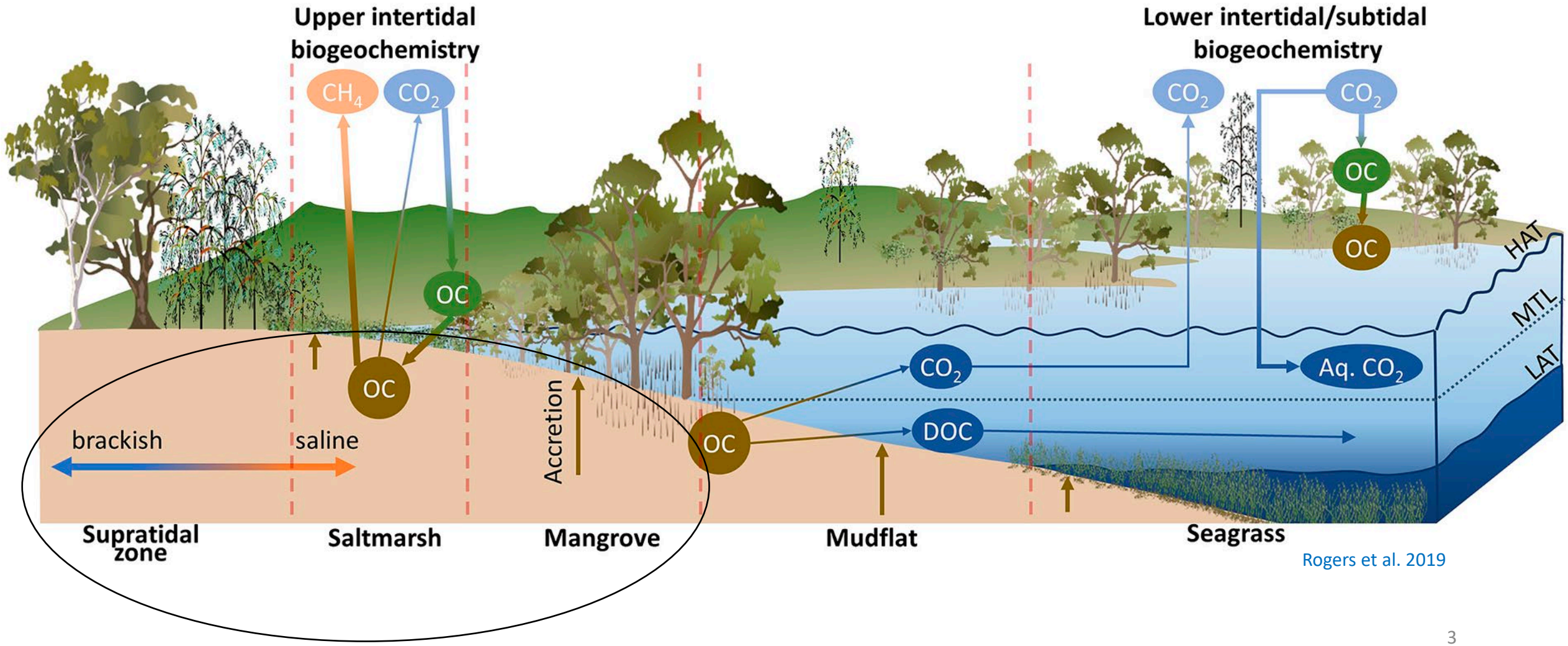
https://doi.org/10.1016/j.ecolind.2025.113205

Get rights and content

Presented by: Samantha Hormiga

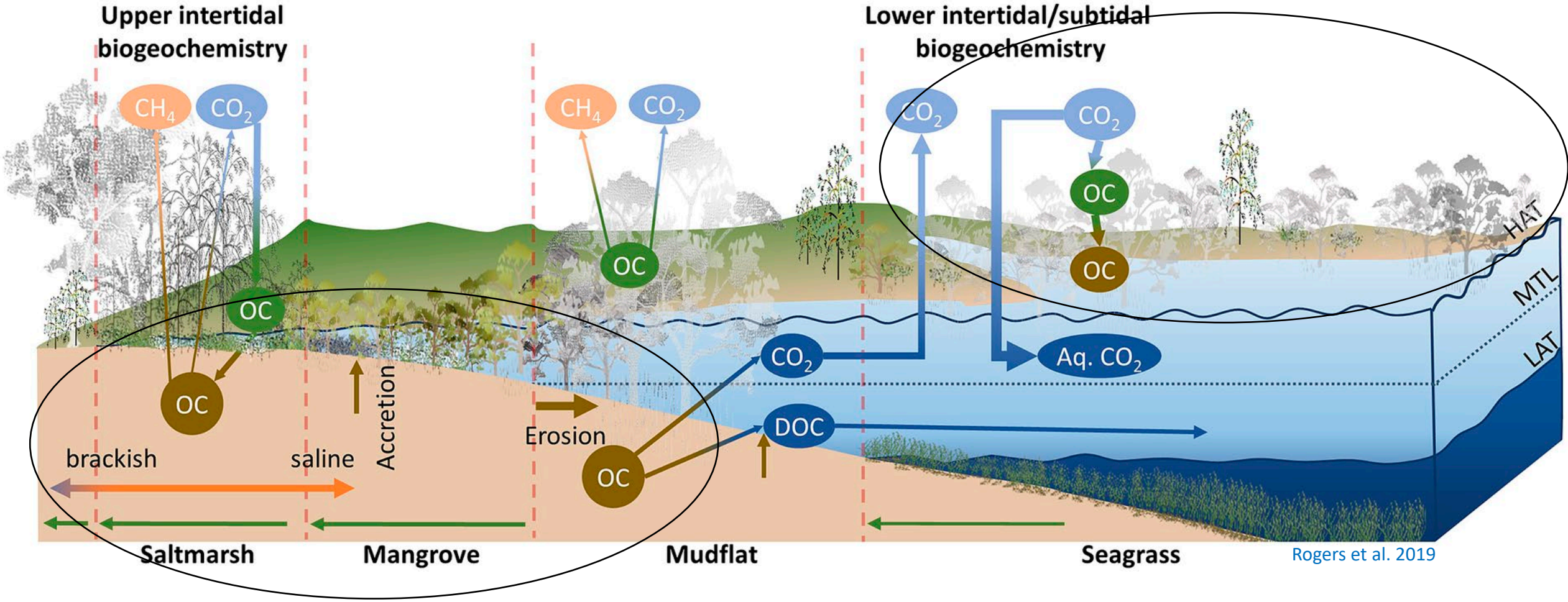

Food and Agriculture Organization of the United Nations
Salt-affected soils
A global concern reducing agricultural productivity
Improper water management (insufficient water supply, poor water quality, reuse of brackish water and bad drainage systems)
HEALTHY SOILS
A healthy soil is able to sustain the productivity, diversity, and environmental services of terrestrial ecosystems.
Good and stable aggregates
Available water
Nutrient balance
High content of soil organic carbon
Rich biodiversity
No contaminants
SALINE SOILS
Accumulated salts
Saline soils have excessive levels of soluble salts. It can negatively impact or inhibit plant growth and can be toxic to life.
Nutrient imbalance
Less biodiversity
Less available water
SODIC SOILS
Sodic soils have a high amount of adsorbed sodium. It leads to degradation of soil structure and inhibits plant growth.
Massive structure in the subsoil
Less biodiversity
Nutrient imbalance
©FAO, 2021
CB7074EN
GLOBAL SOIL PARTNERSHIP

A Baseline scenario: CO_2 = 300 p.p.m.; Temp = 0°C; RSLR = 2 mm yr^{-1}

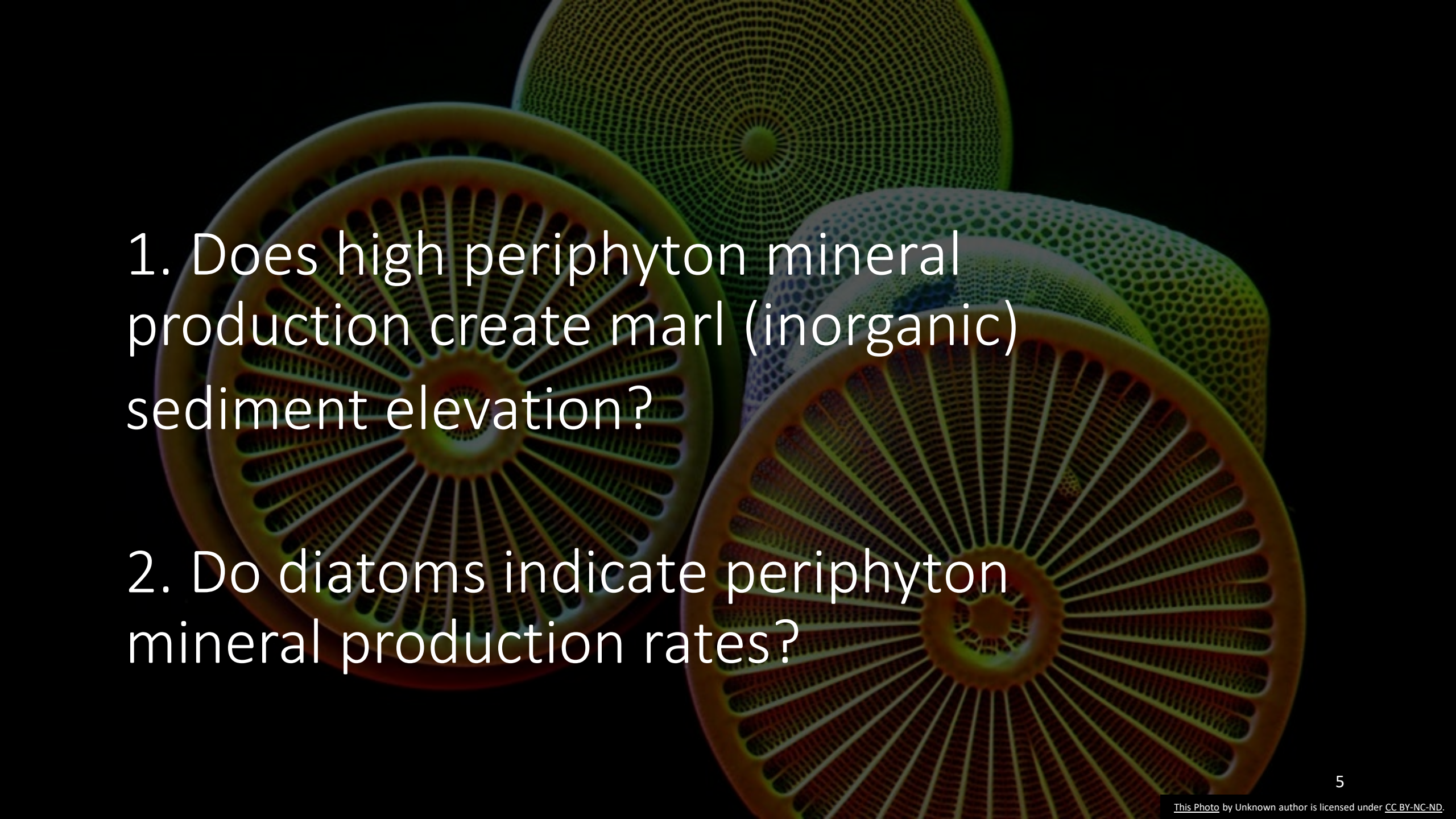


Rogers et al. 2019

B: High range emissions scenario CO_2 = 900 p.p.m.; Temp = +3°C; RSLR = 8 mm yr^{-1}



Rogers et al. 2019

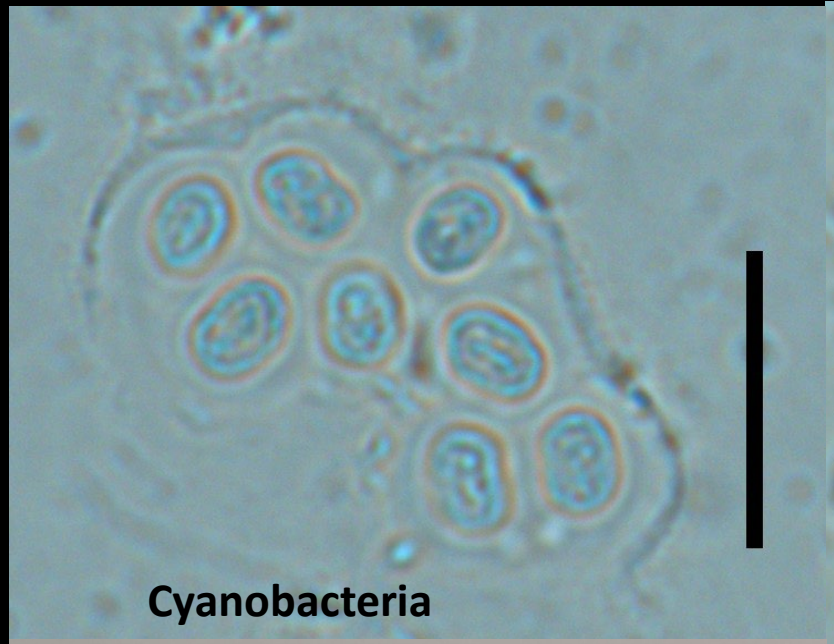


1. Does high periphyton mineral production create marl (inorganic) sediment elevation?

2. Do diatoms indicate periphyton mineral production rates?

Periphyton – a microscopic village

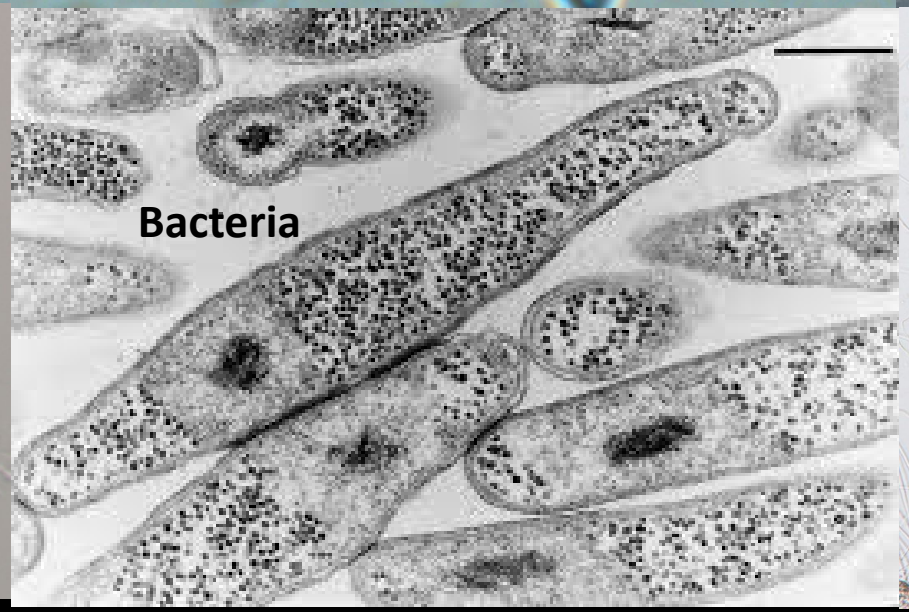
Wikimedia commons

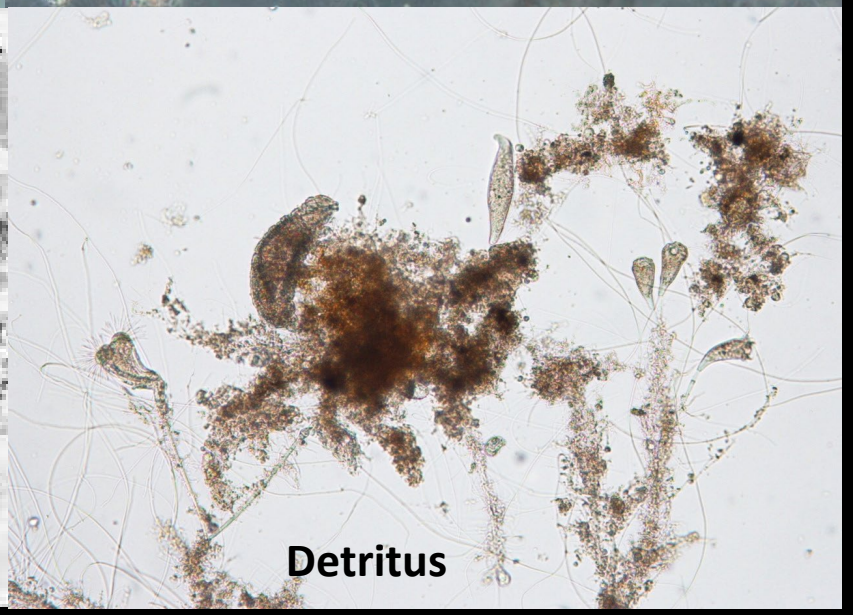

Cyanobacteria


Green algae


Fungi

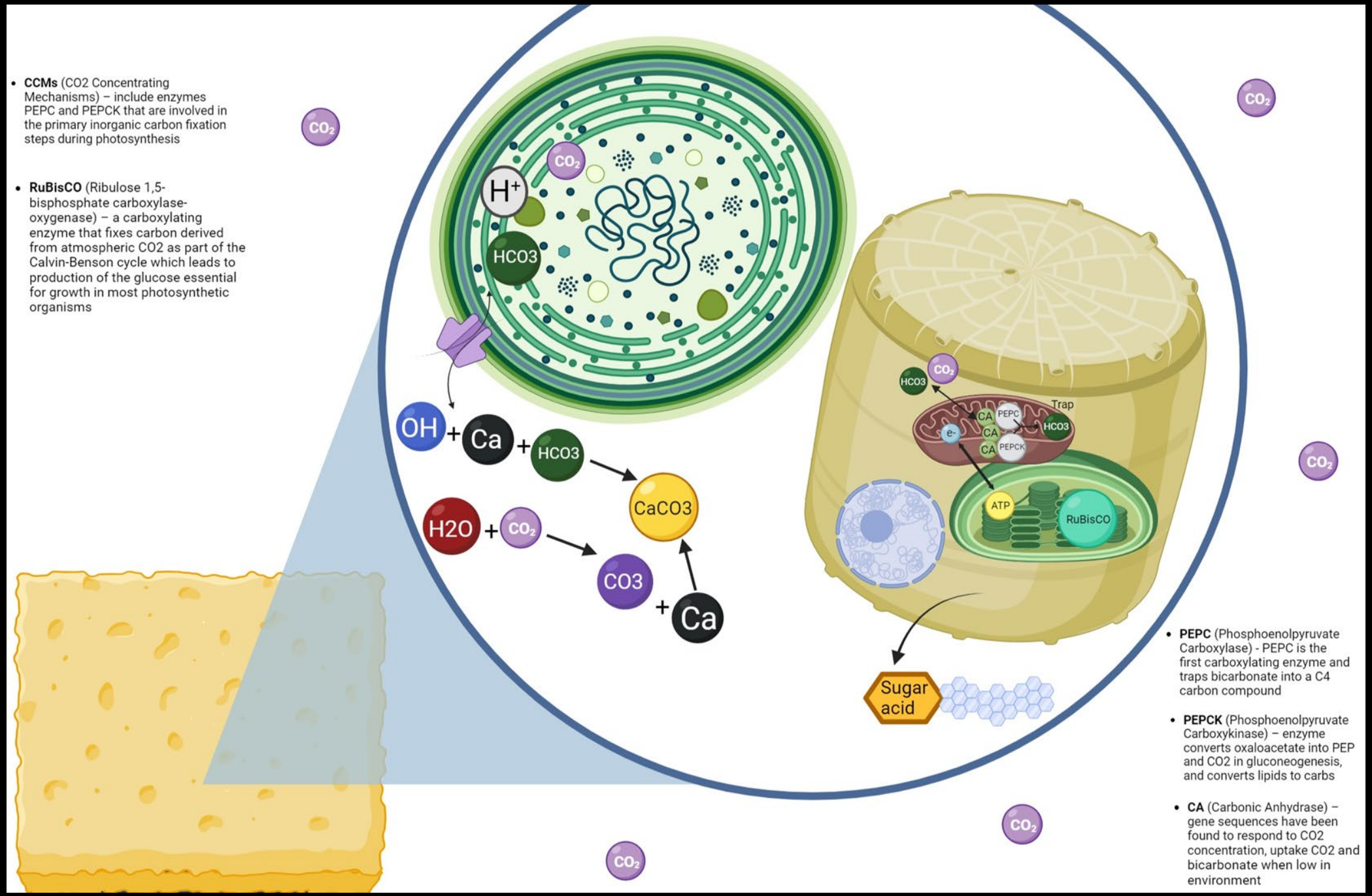

Protozoa


Bacteria


Detritus

- **CCMs** (CO2 Concentrating Mechanisms) – include enzymes PEPC and PEPCK that are involved in the primary inorganic carbon fixation steps during photosynthesis

- **RuBisCO** (Ribulose 1,5-bisphosphate carboxylase-oxygenase) – a carboxylating enzyme that fixes carbon derived from atmospheric CO2 as part of the Calvin-Benson cycle which leads to production of the glucose essential for growth in most photosynthetic organisms

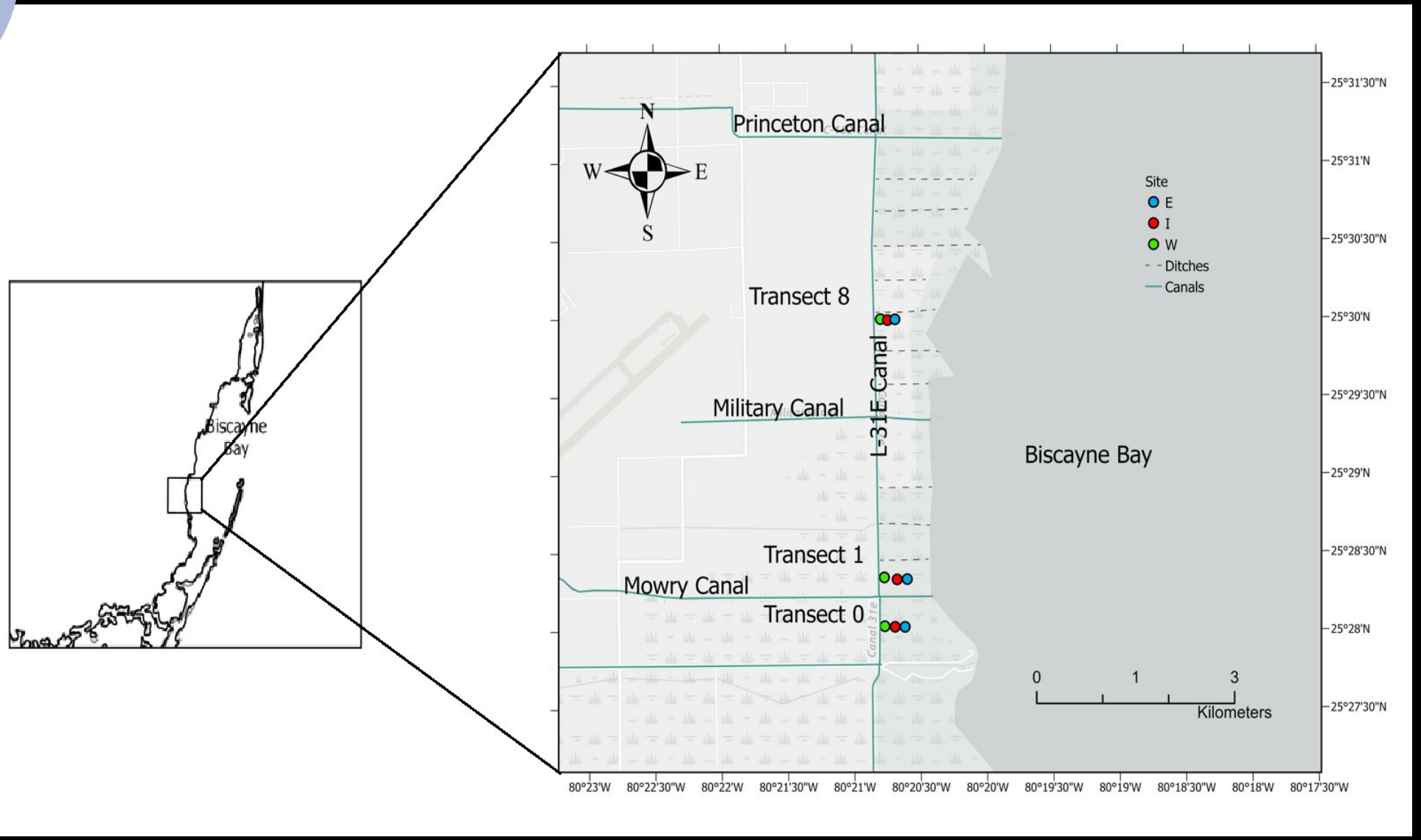


- **PEPC** (Phosphoenolpyruvate Carboxylase) - PEPC is the first carboxylating enzyme and traps bicarbonate into a C4 carbon compound

- **PEPCK** (Phosphoenolpyruvate Carboxykinase) – enzyme converts oxaloacetate into PEP and CO2 in gluconeogenesis, and converts lipids to carbs

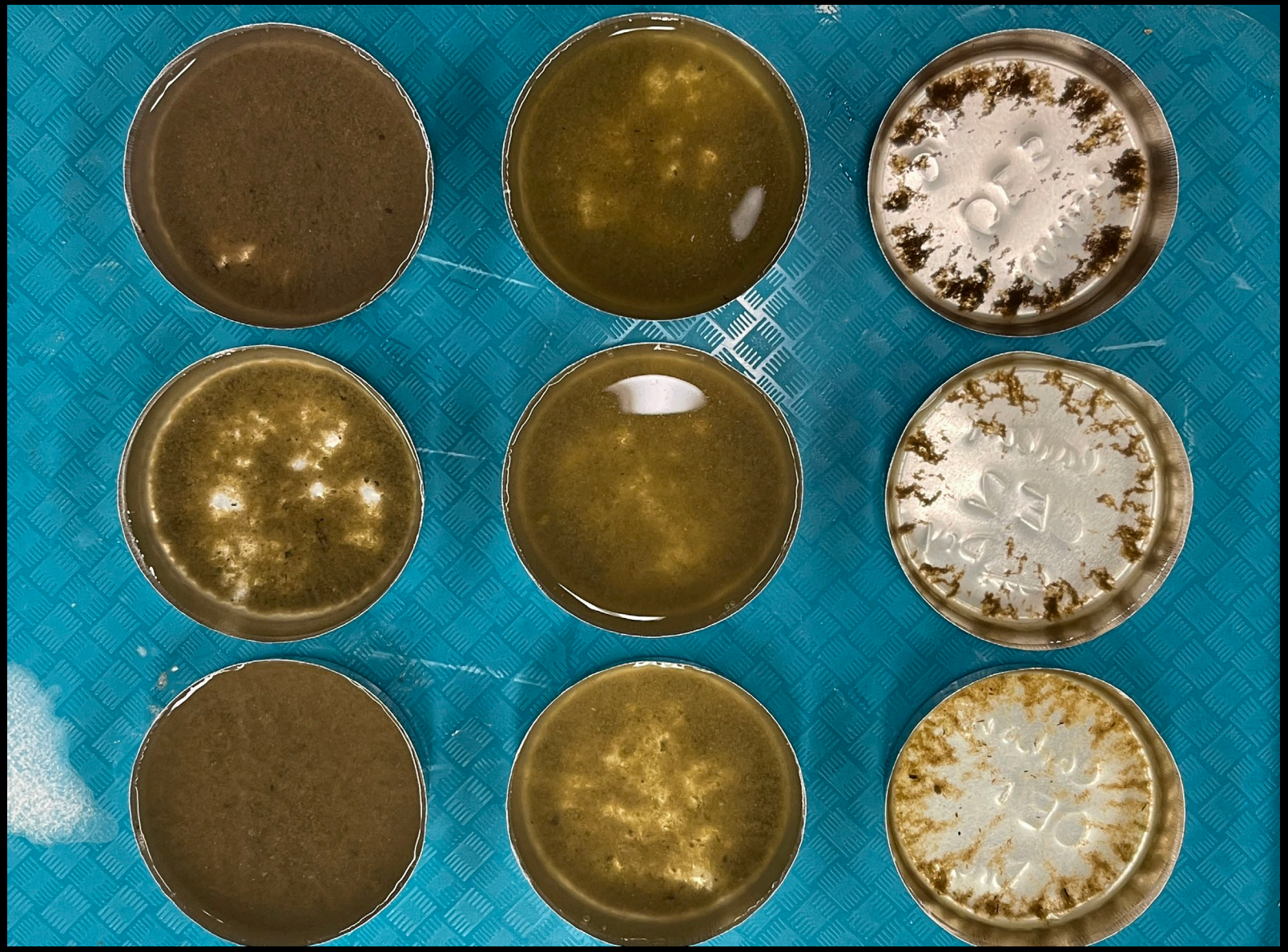
- **CA** (Carbonic Anhydrase) – gene sequences have been found to respond to CO2 concentration, uptake CO2 and bicarbonate when low in environment

Biscayne Bay Coastal Wetlands: Long-term Rehydration Project


Biscayne Bay
N
W
E
S
Princeton Canal
Transect 8
L-31E Canal
Military Canal
Biscayne Bay
Transect 1
Mowry Canal
Transect 0
Site
E
I
W
Ditches
Canals
0
1
3
Kilometers
25°31'30"N
25°31'N
25°30'30"N
25°30'N
25°29'30"N
25°29'N
25°28'30"N
25°28'N
25°27'30"N
80°23'W
80°22'30"W
80°22'W
80°21'30"W
80°21'W
80°20'30"W
80°20'W
80°19'30"W
80°19'W
80°18'30"W
80°18'W
80°17'30"W

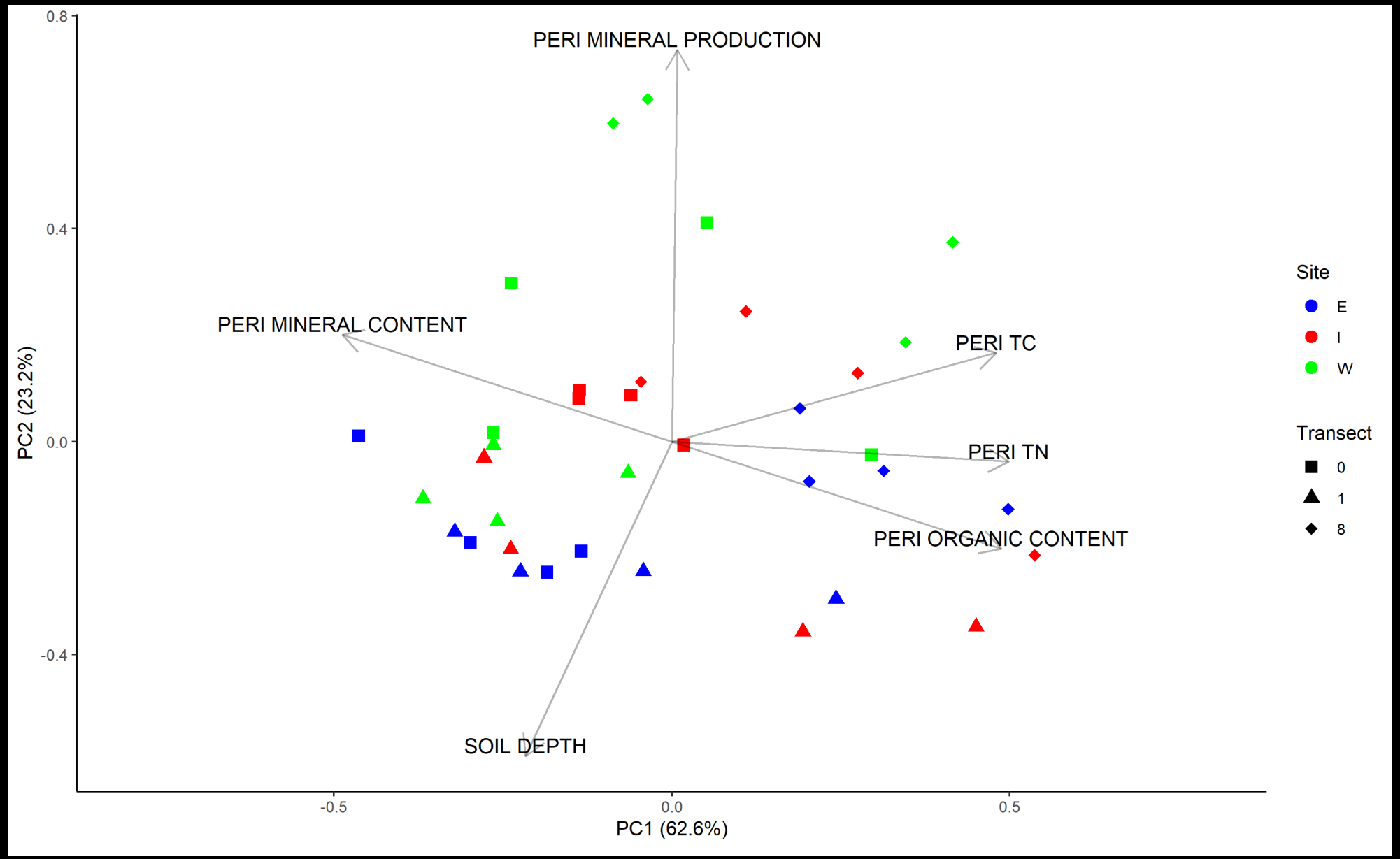
W → E

W → E

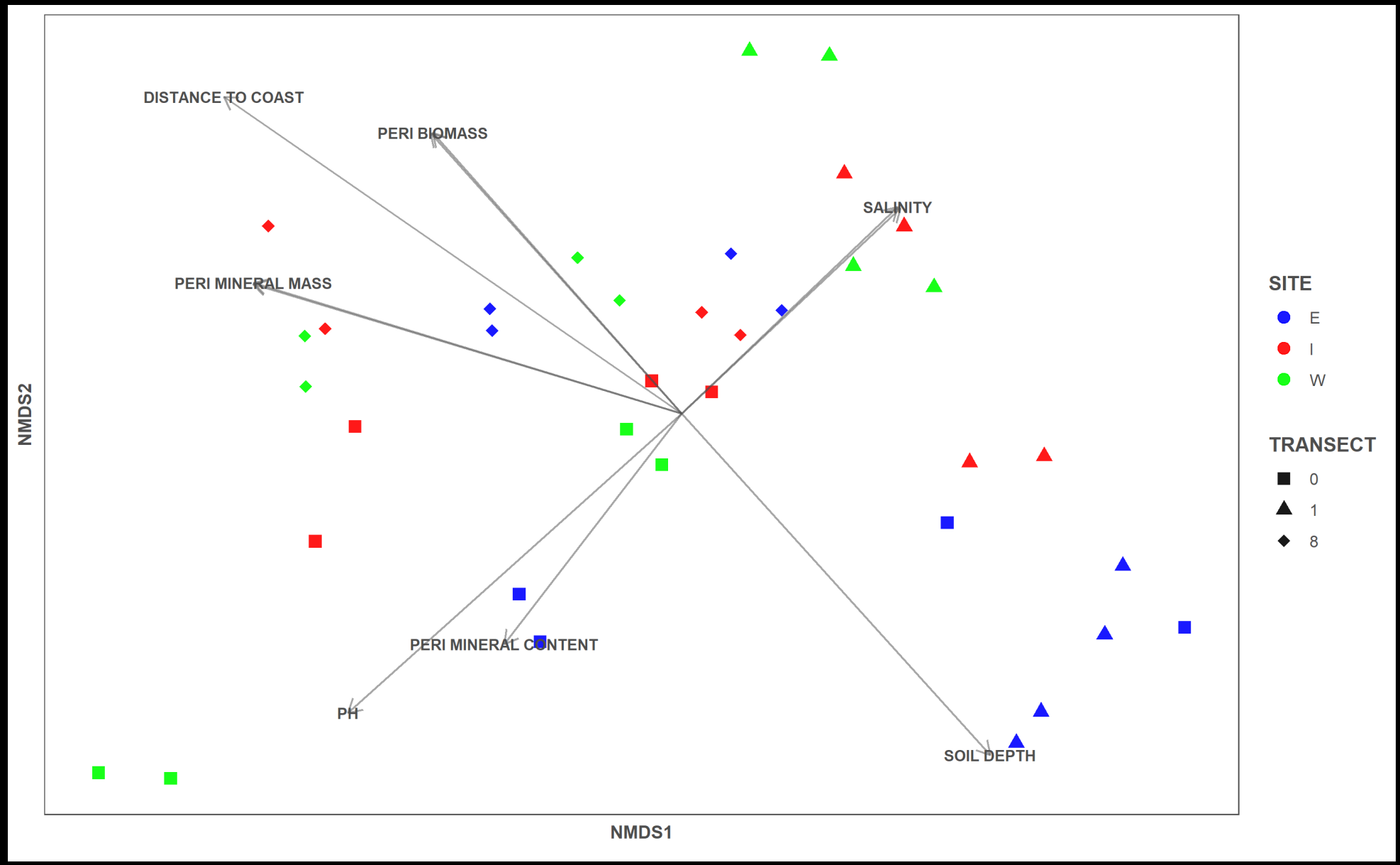


W → E

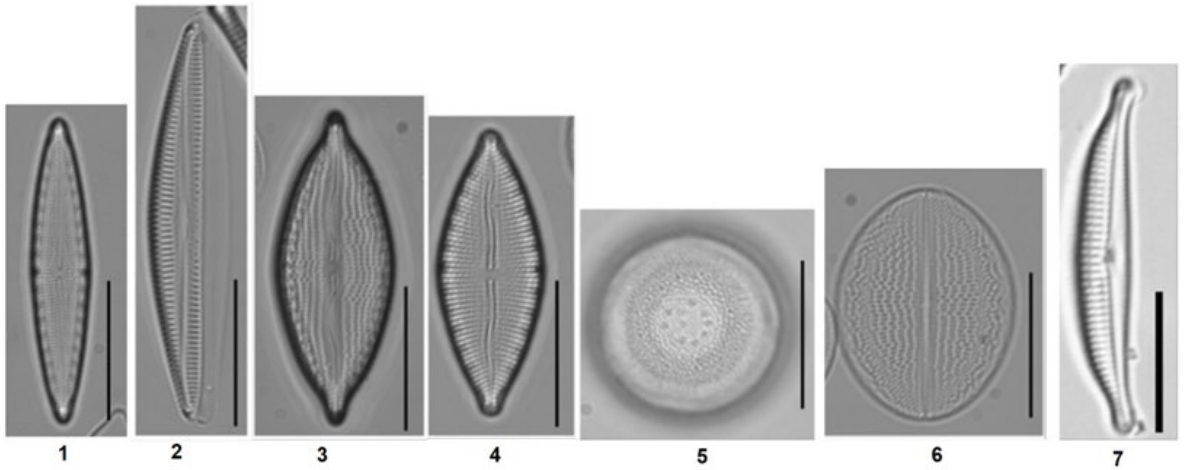
PCA: Principal component analysis



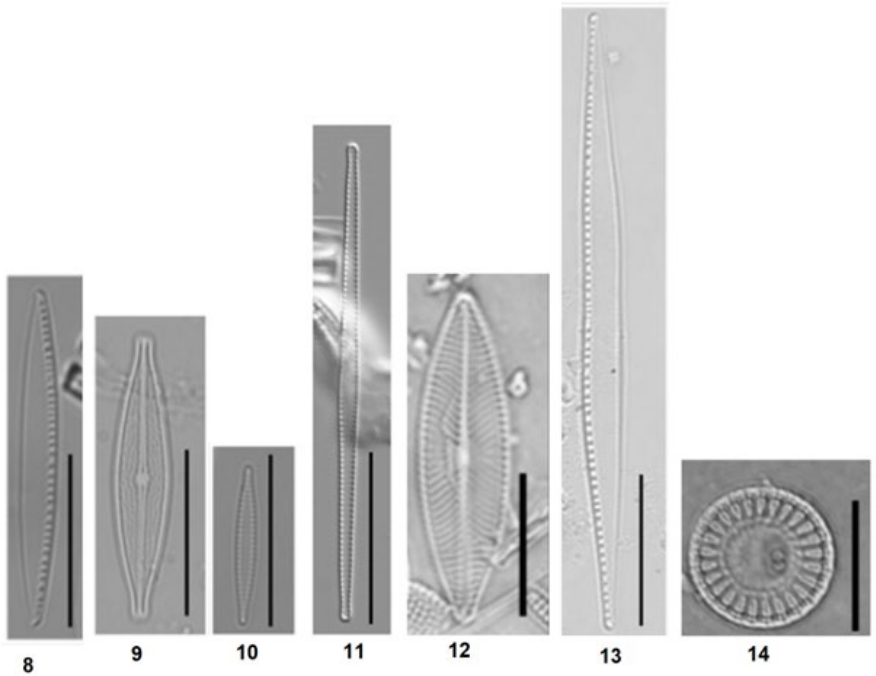
NMDS: Non-metric multidimensional scaling



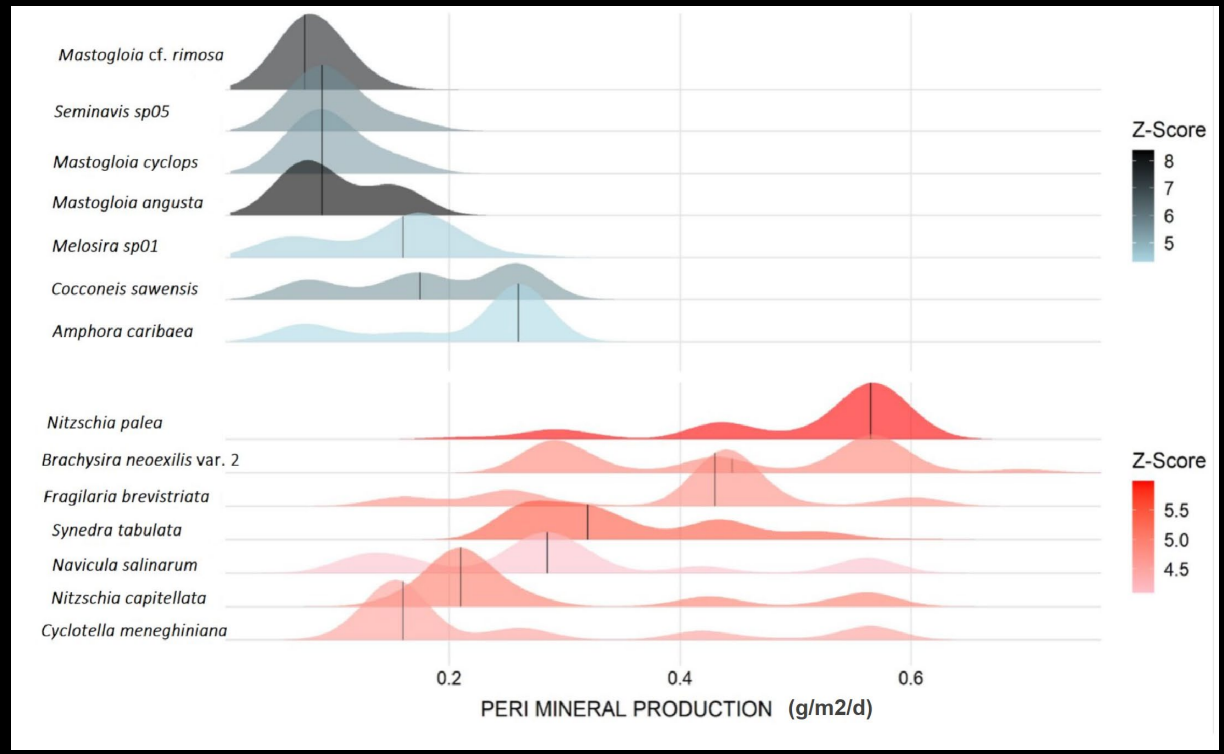
TITAN: Threshold indicator taxa analysis



INDICATOR: LOW MINERAL PRODUCTION



INDICATOR: HIGH MINERAL PRODUCTION



Future Research:

1. Can periphytic mineral production help stabilize coastal sediments in the face of rising sea levels?

2. Can diatoms be used to assess sediment elevation risks?

3. Is freshwater restoration creating more stable and resilient ecosystems with the increase in periphyton production?

Questions?