SESSION 1:

THE LIFE CYCLE & ADAPTATIONS OF MANGROVES: SUPERHEROES OF THE SEASHORE

30 YEARS THE EVERGLADES FOUNDATION

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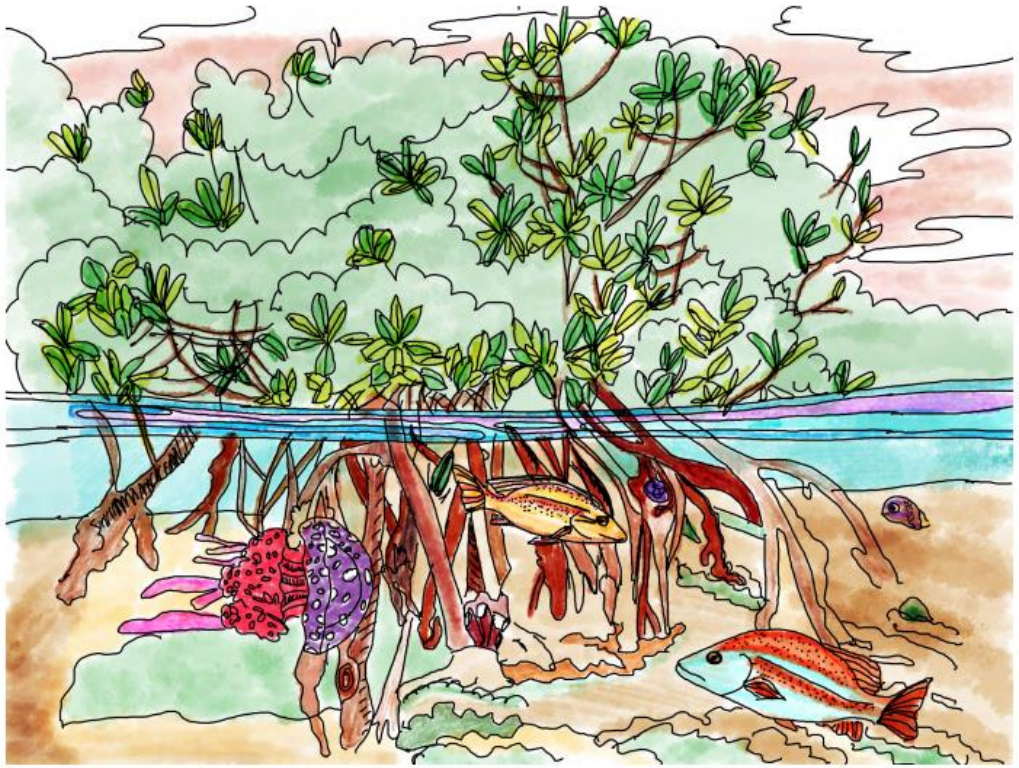
1. Answer the True/False questions on a sticky note.

1. South Florida is home to two species of mangrove tree. ____
2. Red and black mangroves have pore-like structures which are used to absorb oxygen into their roots. ____
3. Mangroves are responsible for contributing to beach erosion in coastal areas. ____
4. Mangrove trees are more tolerant of salty environments than other trees. ____



2. Select a mangrove card and discuss what you know and what you wonder.

K-W-L CHART

WHAT I KNOW	WHAT I WONDER	WHAT I LEARNED

What is a mangrove?

Definition

Mangroves are tropical plants that are adapted to loose, wet soils, salt water and being periodically submerged by tides.

Mangroves in the Everglades

The Everglades supports over 550 square miles of mangroves – the largest mangrove forest in the continental U.S.

Ecosystem Services

Mangroves provide ecosystem services, natural benefits to humans from nature.

Undercover Groves

- Found worldwide, they are adapted to live in brackish waters along tropical and subtropical coastlines.
- Their “kryptonite” is cold weather.
- Mangroves in the Everglades provide critical habitat for a variety of wildlife.

Wildlife in the Mangroves


Florida Manatee


Snook


Green Sea Turtle


Roseate Spoonbill


Raccoon

Types of Mangroves in the Everglades


Red Mangroves


Black Mangroves


White Mangroves

Florida Mangrove Zonation

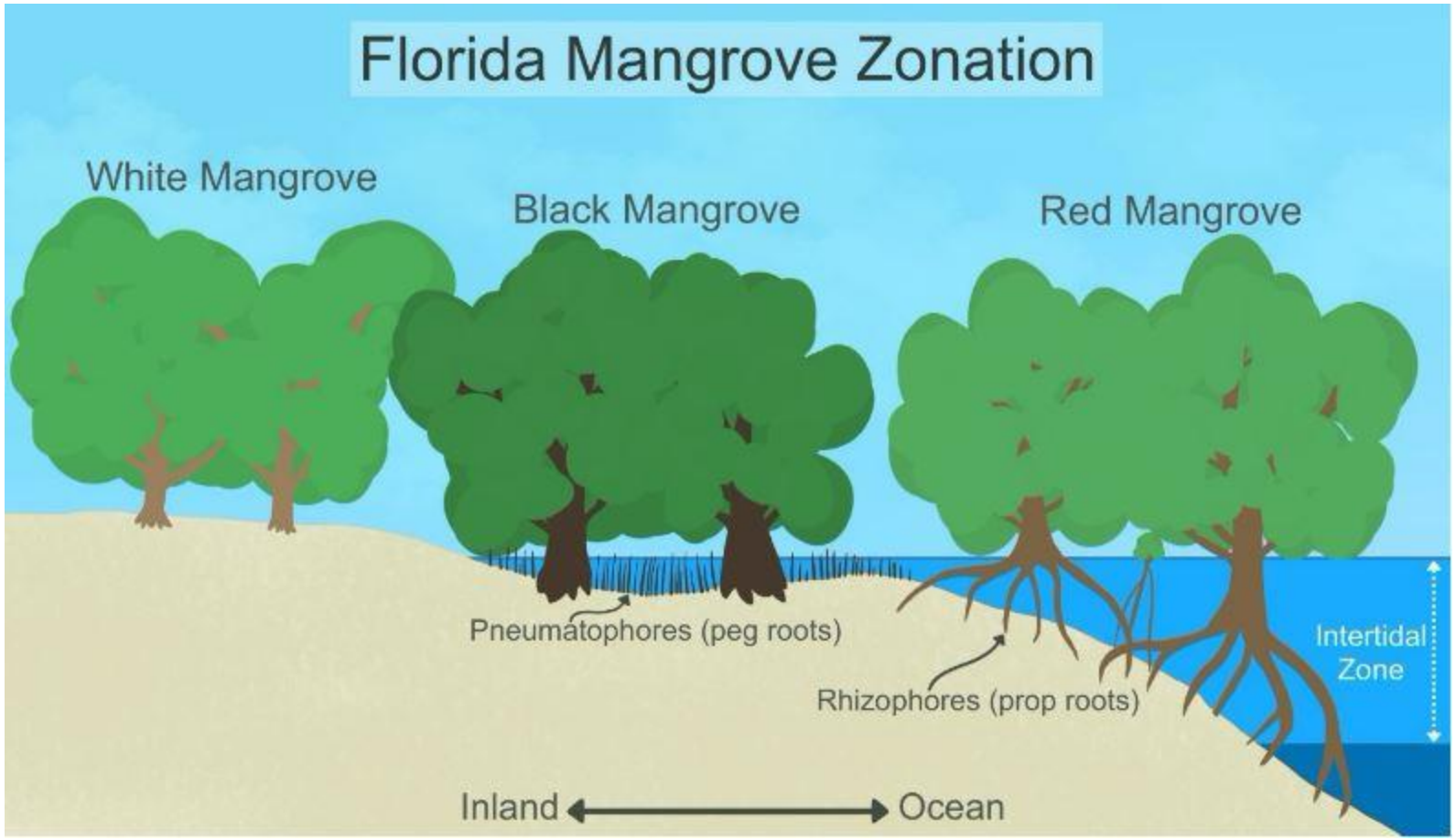


Photo Credit: Natalia Medina-Irizarry, UF/IFAS

Red Mangroves

- "Walking trees" with aerial prop roots that provide stabilization.

Black Mangroves

- Pencil-like root projections called pneumatophores, which help their roots breathe like a snorkel.

White Mangroves

- The most inland species.

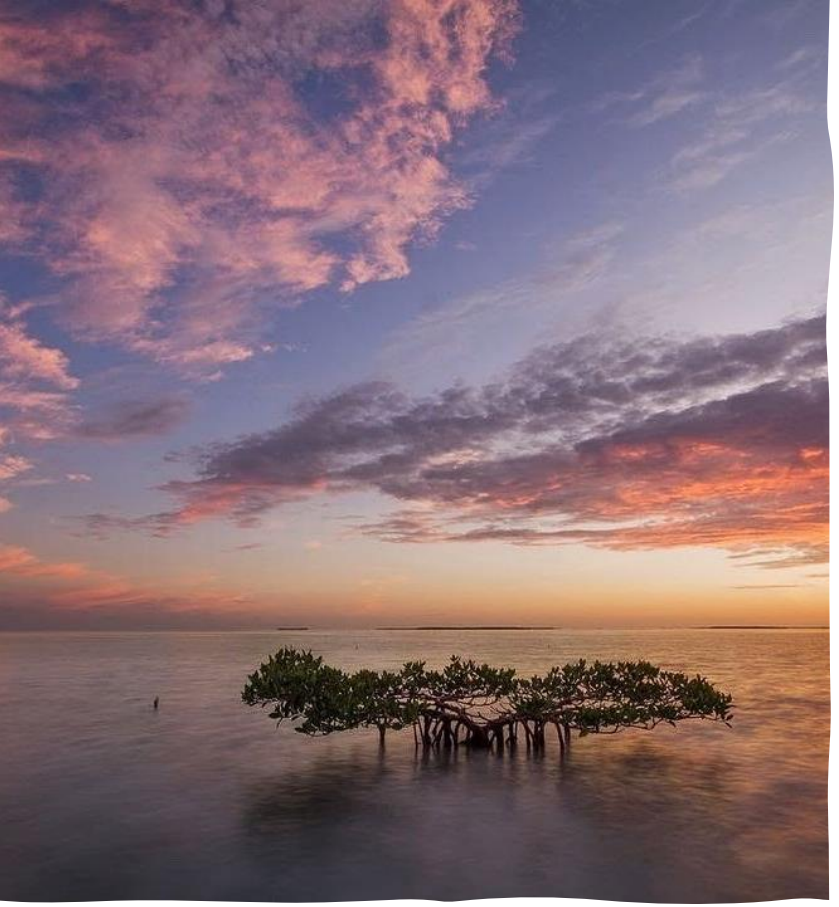
“Special Powers” Mangrove Adaptations

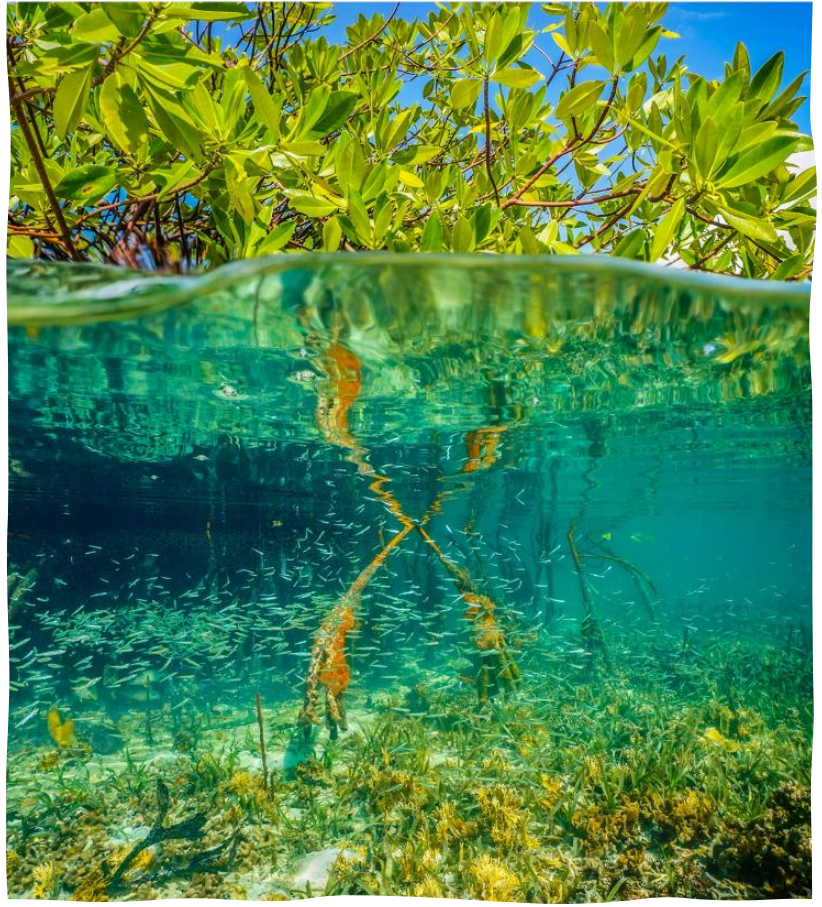
- Prop roots and pneumatophores help aerate the soil, creating a force-field that protects their roots.
- Red mangroves perform reverse osmosis to prevent salt from entering.
- White and black mangroves excrete salt from their leaves.
- Like desert plants, mangroves can minimize water loss through their leaves during the hottest parts of the day.

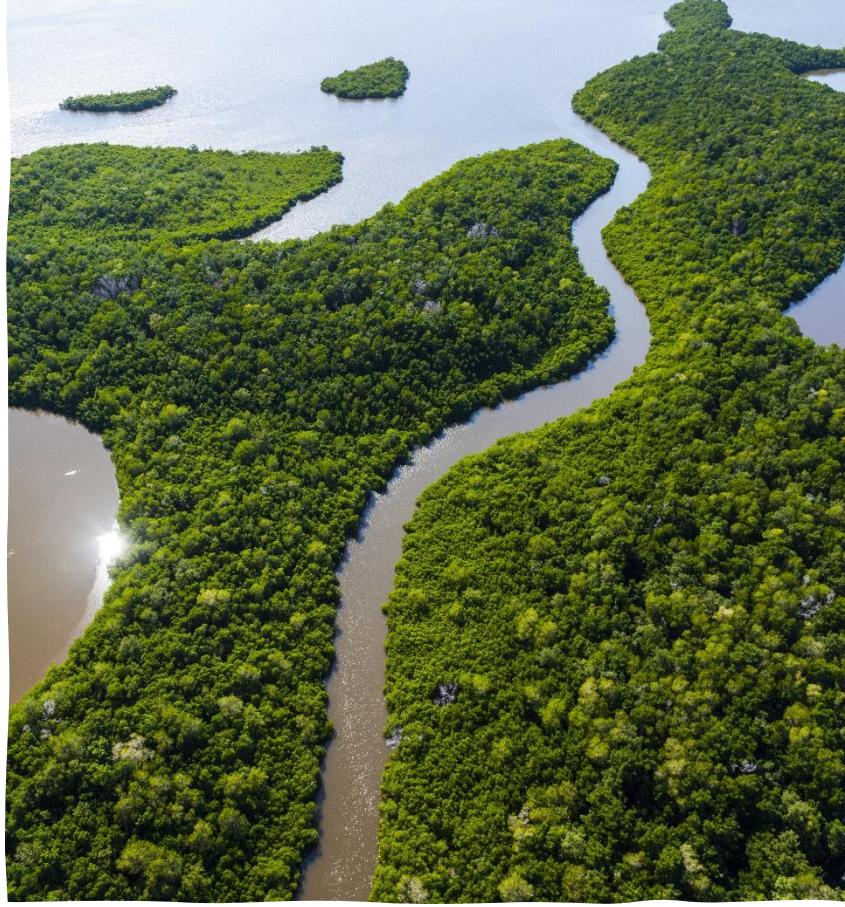
Pneumatophores

Ecosystem Services

- Storm Buffer
- Stabilization
- Critical Habitat
- Water Filtration
- Carbon Sequestration







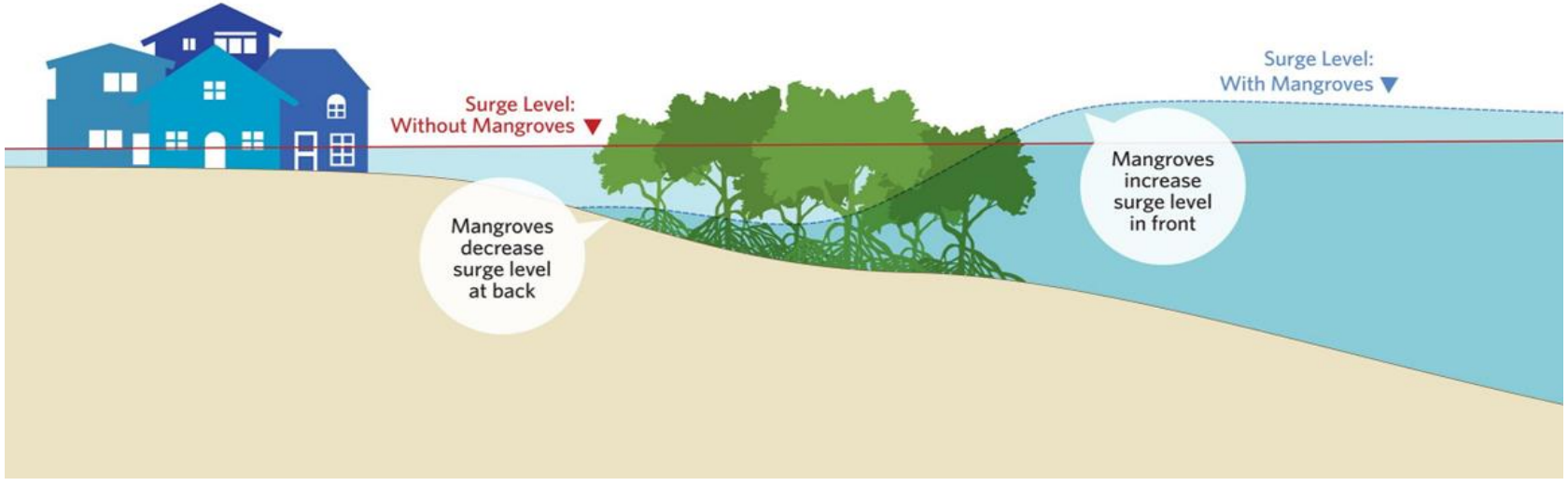
Water Filtration

As freshwater moves down through the Everglades ecosystem it empties out into our coastal estuaries with mangrove forests.

Guardians of the Coastline

- First line of defense in the face of tropical storms and hurricanes.

- During storm season, the Everglades provides a “buffer” that slows storms’ intensity, providing protection throughout South Florida.




Brian Call Photo


Luca Martinez Photo

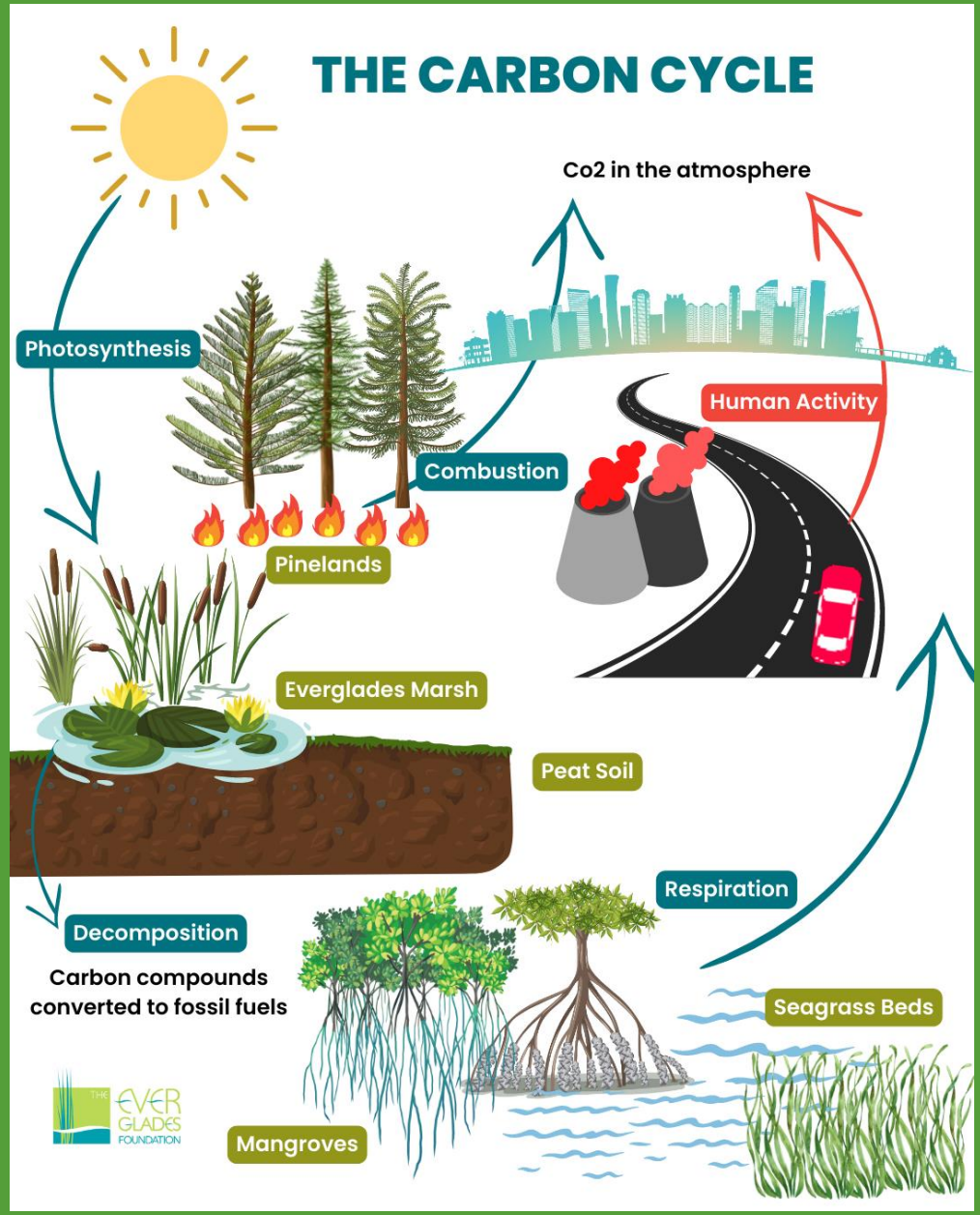
Captain Climate

- Mangroves are a carbon sink.
- The mangroves in Everglades National Park store a lot of carbon in their soils and vegetations.
- Disturbing this forest could lead to carbon emissions equivalent to burning ~190 to 230 billion pounds of coal.
- By increasing freshwater flows to the coast, Everglades restoration will improve the health of the forests and increase their carbon capturing capacity.

Carbon Dioxide CO_2

Constantly moving in and out of our atmosphere through 4 major processes:

- Photosynthesis
- Organic decomposition
- Respiration
- Burning of organic materials



Mangrove Adversaries

- Mangroves are threatened by habitat loss and changes in freshwater flow.
- Everglades mangroves have shifted inland since the 1960s from both sea level rise and reduced freshwater flow.

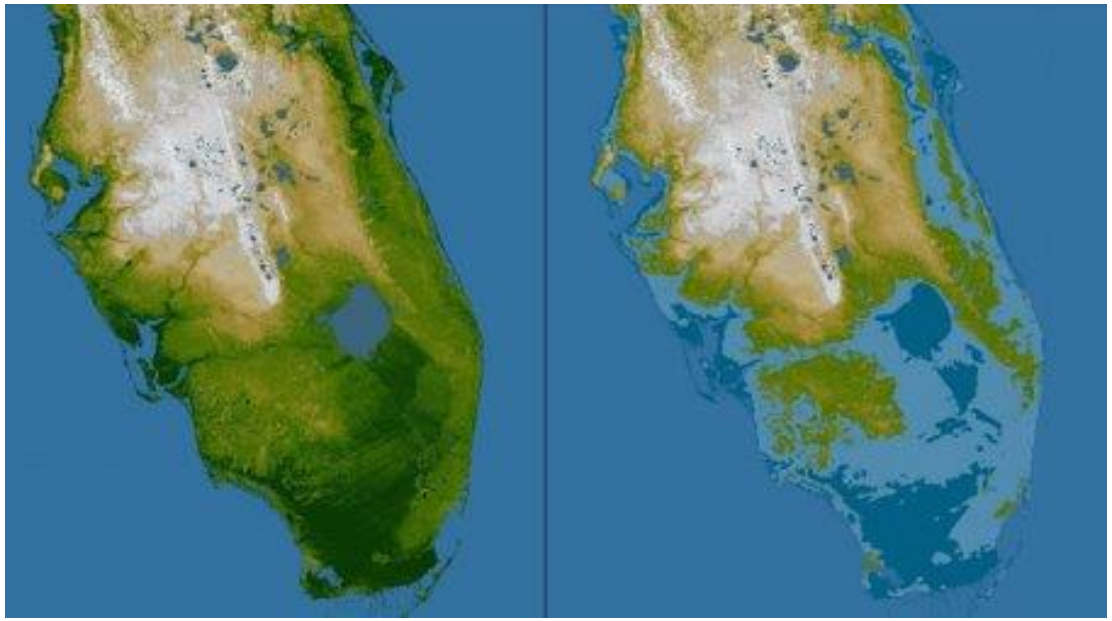

Luca Martinez Photo

Threats to Mangroves in the Everglades Ecosystem

- Under the combination of sea level rise, low freshwater flow, and saltwater intrusion, peat soil can break down and disappear faster than it can accumulate.

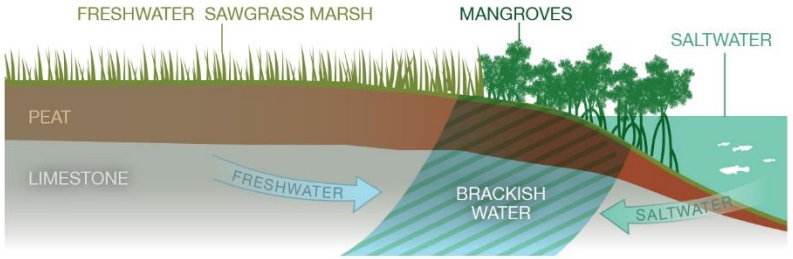
- If peat soil collapse occurs before mangroves are established, the affected area will transform to open water, not to mangrove forest.

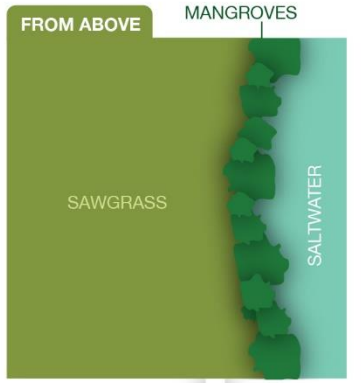
Saltwater Intrusion in the Everglades



1 Current

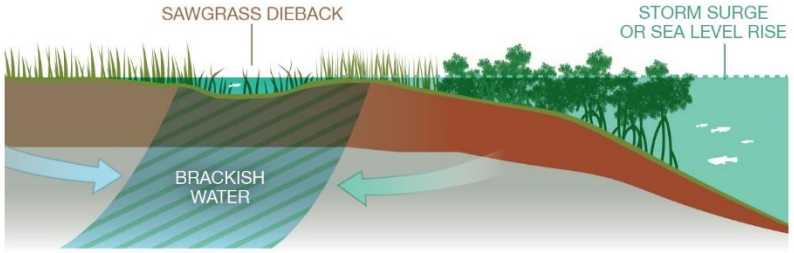
Sawgrass marsh builds peat soil on top of the limestone only in freshwater areas. Mangroves develop peat soil in saline and brackish conditions.

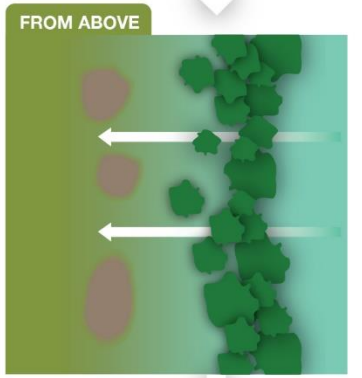




2 Saltwater Intrusion

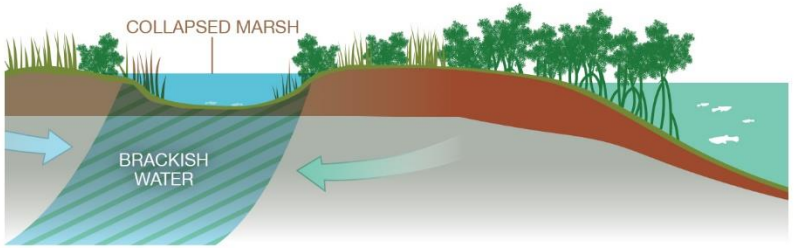
Intrusion of saltwater causes sawgrass dieback and mangrove expansion. Freshwater peat soil begins to degrade with exposure to saltwater.

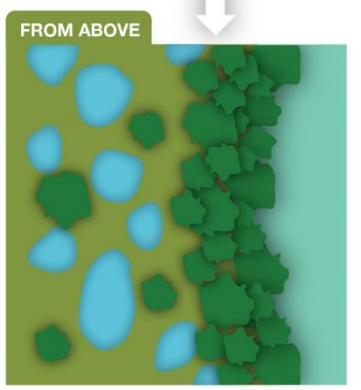




3 Peat Collapse

Freshwater peat collapses and the water is too deep for plants to become established. Mangroves established elsewhere help to re-stabilize soil.





A Closer Look at One of our Superheroes: Red Mangrove Trees

Red mangrove tree growing in shallow water near Cape Sable area of Everglades National Park

Red Mangrove Life Cycle

Red Mangrove Propagule

- Red mangroves are flowering trees and reproduce when pollen from the flowers is spread by wind and insects to other flowers.
- The result of this fertilization is the fruit, which contains the seeds, called propagules.
- Propagules are large green cigar-shaped pods that stay attached to the parent tree and begin to germinate. They are viviparous, meaning they grow from the seed.
- After falling in the water, they float or collect along the shore.
- They continue to develop as they are dispersed by the tides and currents. They can survive a whole year before taking root in a suitable location.
- Once they take root, they grow into a new tree. The cycle continues.

Vocabulary and Standards

SC.1.L.14.2	Identify the major parts of plants, including stem, roots, leaves, and flowers.
SC.2.L.16.1	Observe and describe major stages in the life cycles of plants and animals, including beans and butterflies.
SC.3.L.14.1	Describe structures in plants and their roles in food production, support, water and nutrient transport, and reproduction.
SC.4.L.16.1	Identify processes of sexual reproduction in flowering plants, including pollination, fertilization (seed production), seed dispersal, and germination.
SC.5.L.17.1	Compare and contrast adaptations displayed by animals and plants that enable them to survive in different environments such as life cycles variations, animal behaviors and physical characteristics.
SC.6.L.14.4	Compare and contrast the structure and function of major organelles of plant and animal cells, including cell wall, cell membrane, nucleus, cytoplasm, chloroplasts, mitochondria, and vacuoles.
SC.912.L.14.2	Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).


Mature red mangrove tree


Red mangrove propagule


Red mangrove fruit


Settled propagule growing

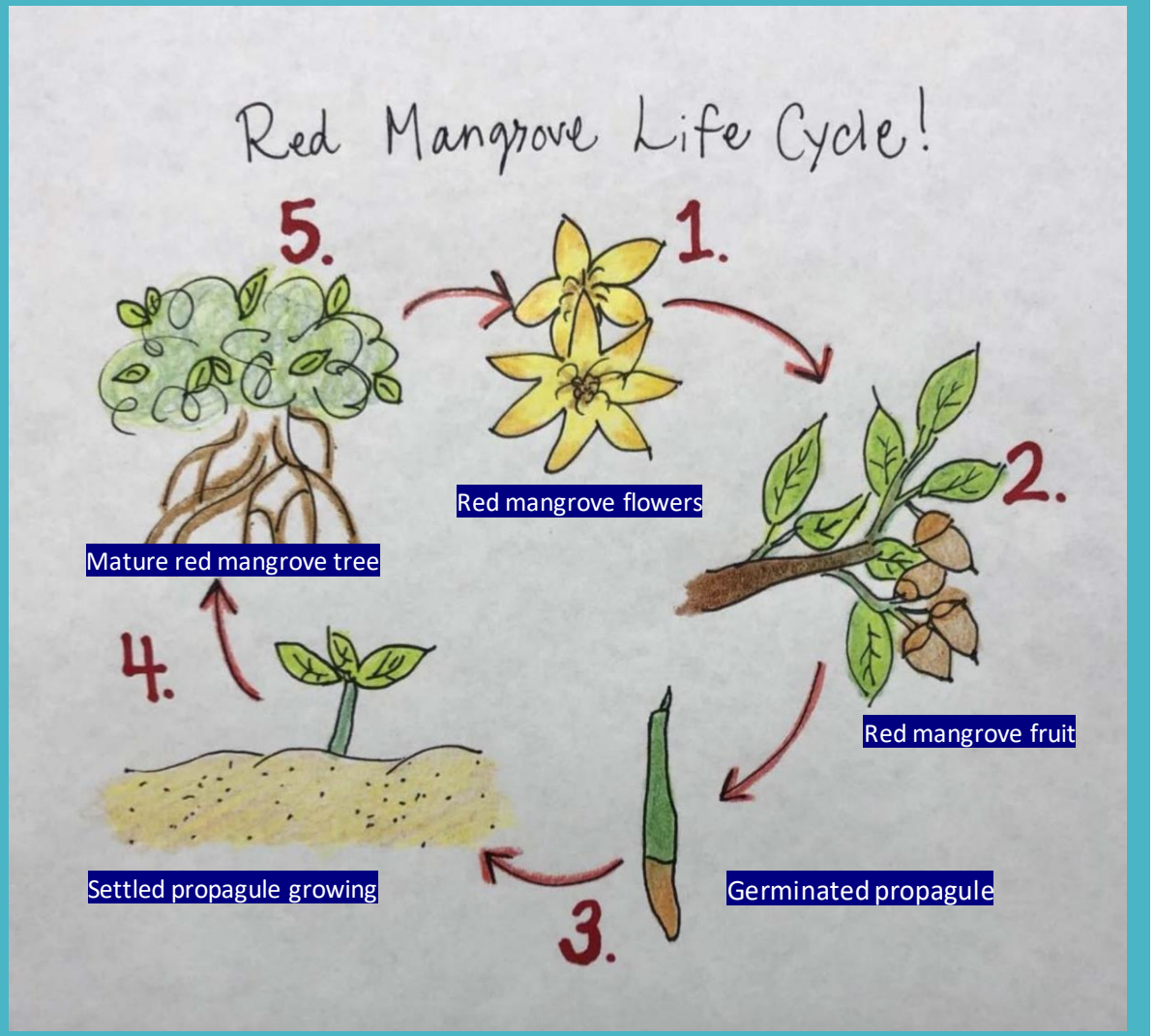

Red mangrove flowers

Activity

1. Draw and label the red mangrove life cycle.

2. In addition to the concept of life cycle, discuss at your table what other concepts you can introduce during instruction and illustrate them on your drawing. Consider your standards.

3. Fill out the "What I Learned" section of your K-W-L chart.



Activity

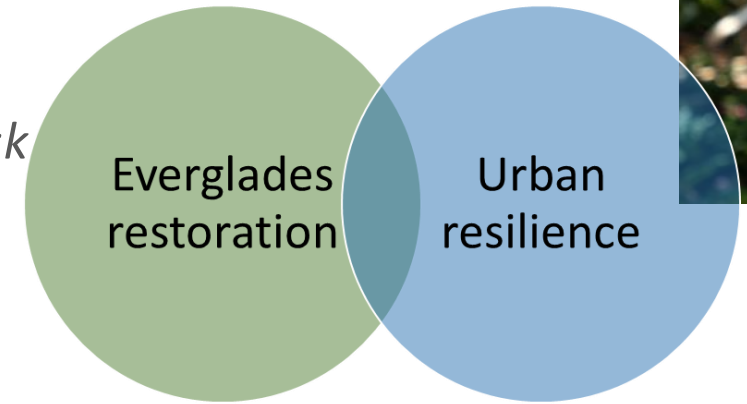
1. Draw and label the red mangrove life cycle.

2. In addition to the concept of life cycle, discuss at your table what other concepts you can introduce.
   - Adaptations
   - Anatomy (xylem)
   - Photosynthesis
   - Cellular Respiration
   - Water Cycle
   - Carbon Cycle
   - And more!

Questions with a Scientist

Meenakshi Chabba, Ph.D.

- **Social-ecological systems scientist**
  - Ecosystems Science, Sustainability Science, Ecological Economics, and Urban Resilience
- **Ph.D. in Earth System Science**
  - Dissertation: "*Urban transitions toward risk resilience: Sustainable solutions for social and ecological wellbeing*"



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The role of economic, policy, and ecological factors in estimating the value of carbon stocks in Everglades mangrove forests, South Florida, USA

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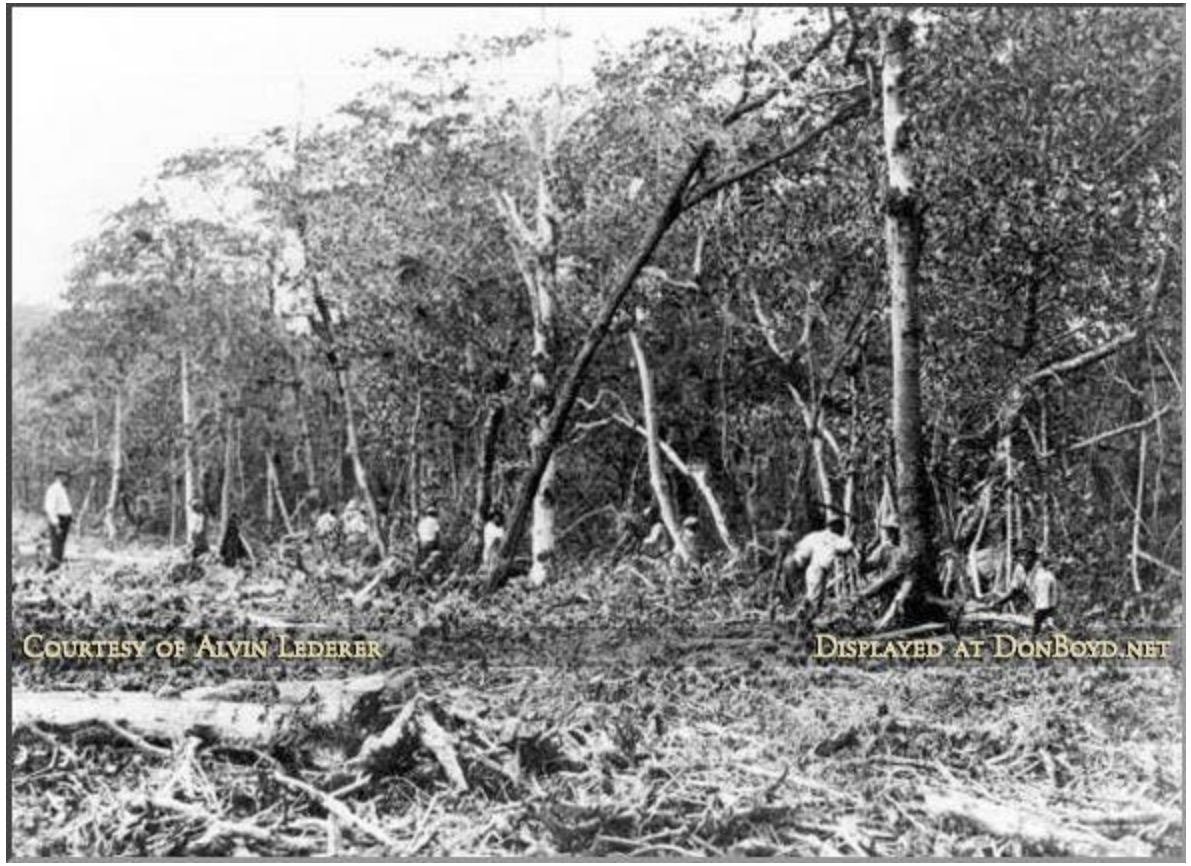
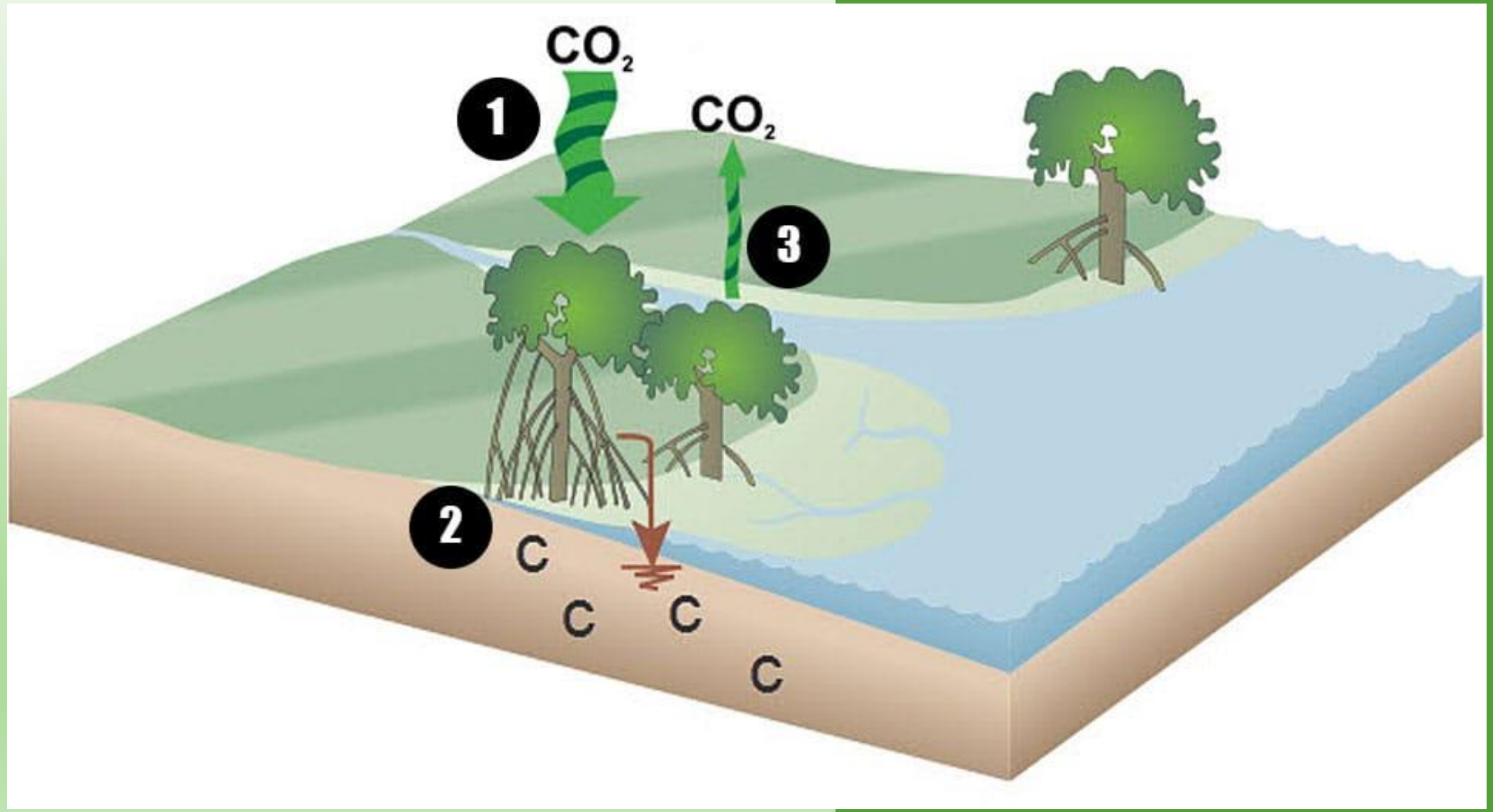
What did South Florida look like before clearing the mangroves?



1910s – Workers clearing every mangrove from Miami Beach. Photo by Don Boyd

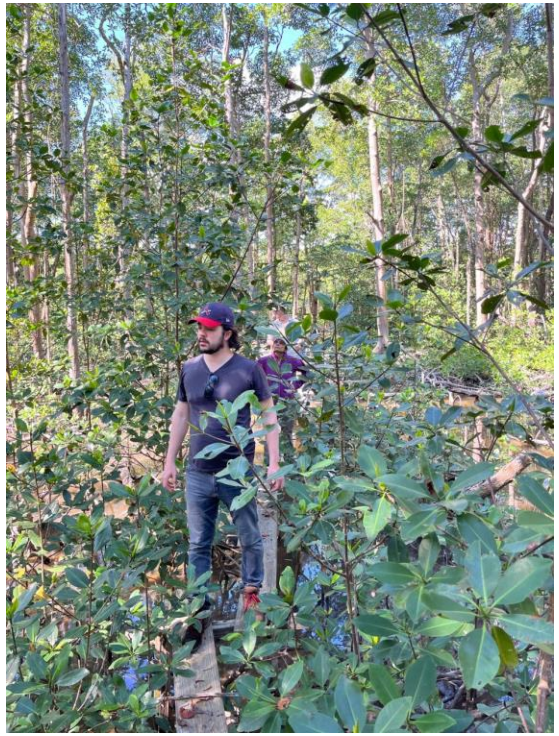
1916 – Miami Beach looking south from 18th Street. Photo by @edofcourse

Coastal Carbon Sequestration



This diagram is adapted from a figure in Sutton-Grier et al. 2014 Marine Policy

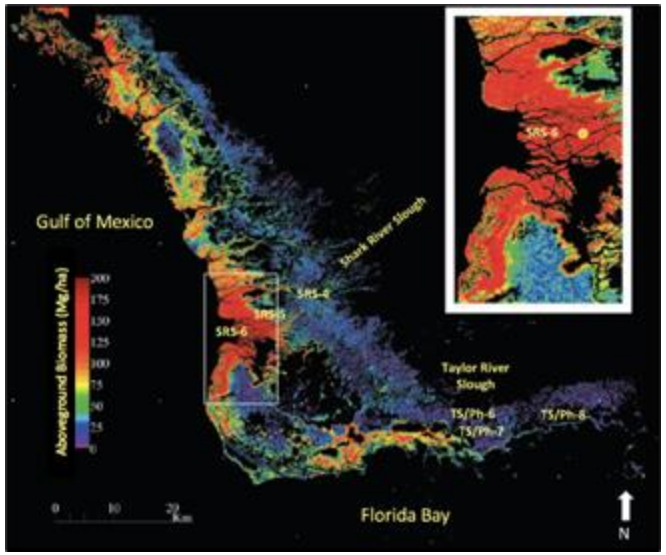
Everglades Mangroves Blue Carbon Assessment



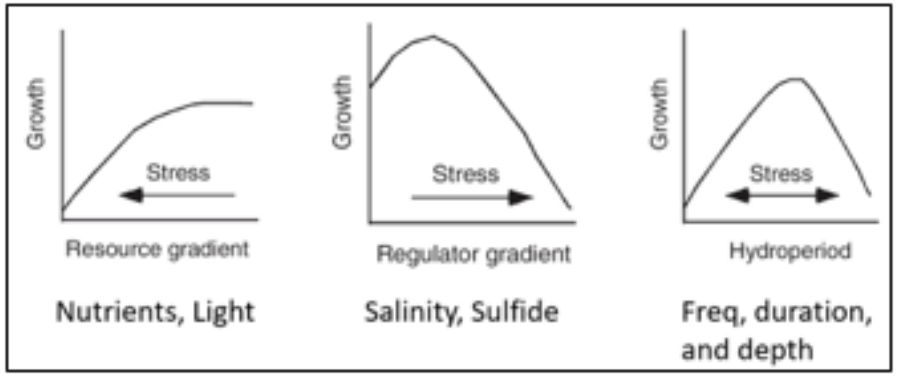
The mangrove blue carbon research team visiting the Everglades mangrove forest in February this year.

Learning from leading scientific experts in the field about latest research and techniques.

Everglades Mangroves Blue Carbon Assessment



Remote sensing data



Environmental gradients

Disturbances

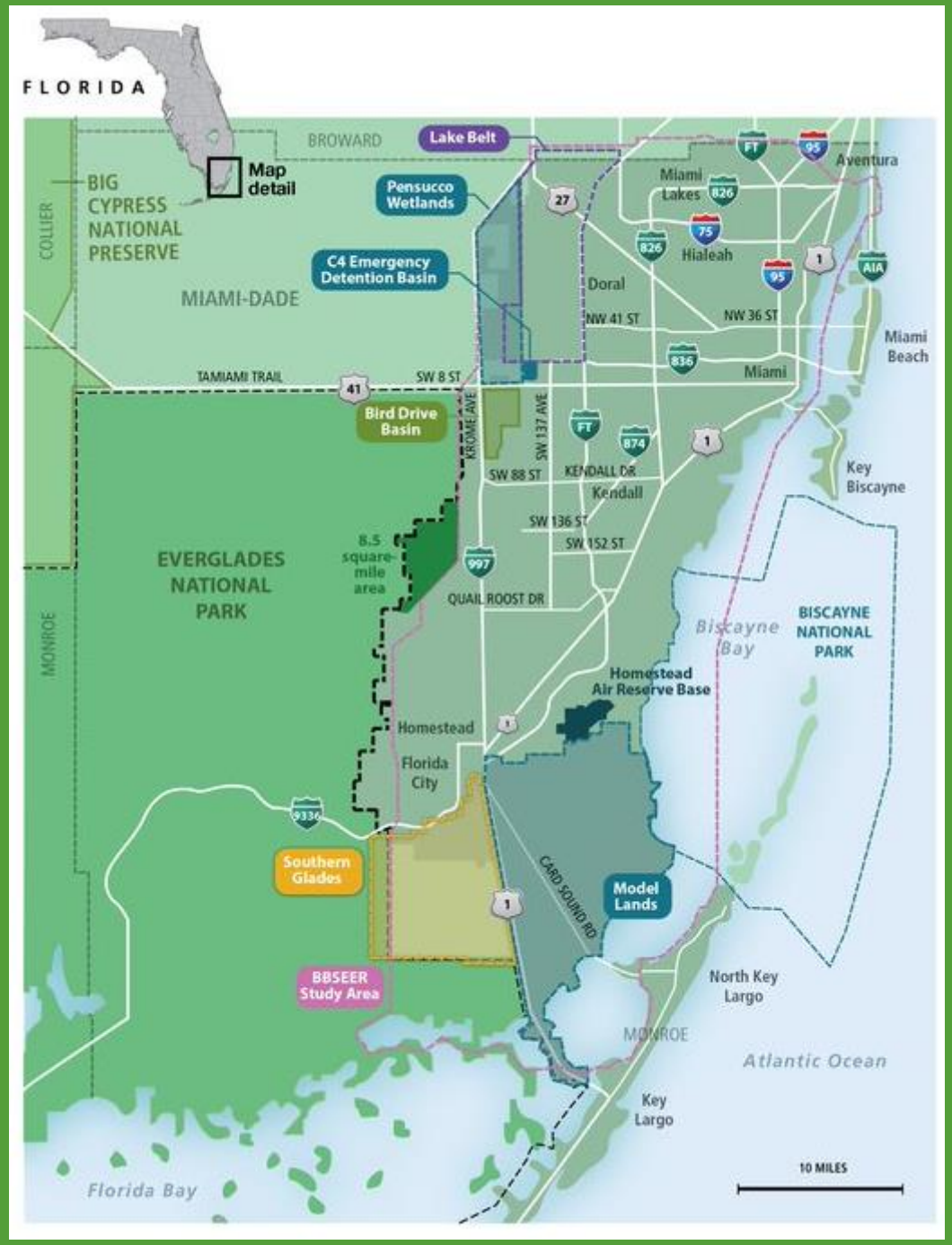
Sea level rise
(ArcGIS Pro 2.7)

Value mangrove blue carbon

Everglades restoration

Mangroves are nature-based solutions

Biscayne Bay Southeastern Everglades Ecosystem Restoration



Restoration

How does improving freshwater flow through Everglades restoration help with mangroves and coastal estuaries?

Tamiami Trail Bridges

Biscayne Bay Coastal Wetlands

Teaching others about the Everglades

Use less plastic
Use reusable water bottles and shopping bags.

Hang dry clothes
This uses less energy than running the dryer.

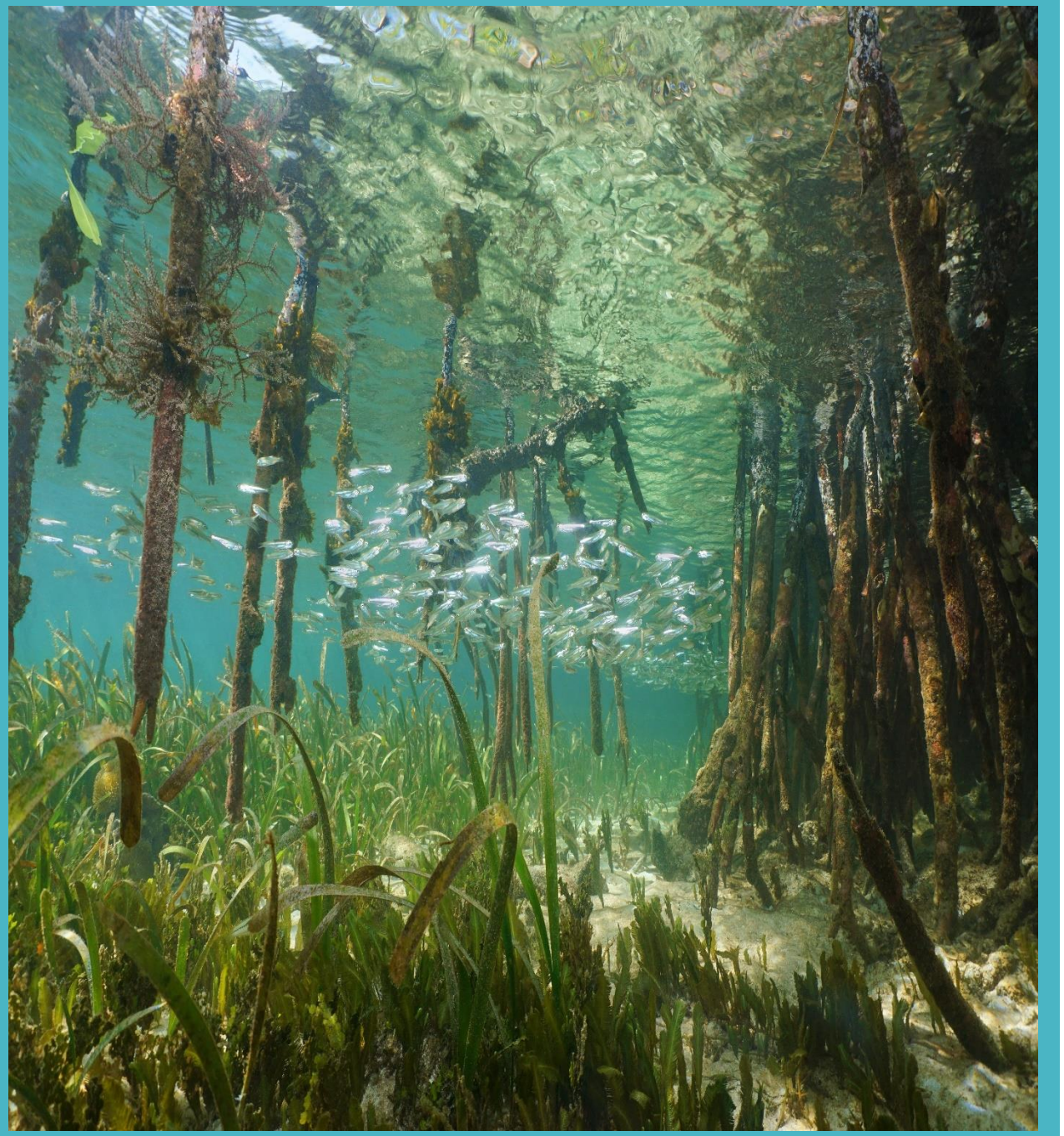
Recycle
Reduce, reuse, replace, and recycle.

Wash clothes in cold water
This uses less energy than washing in hot water.

Eat more plants
This helps to reduce our carbon footprint.

Walk/bike instead of drive
Less cars on the road equals less greenhouse gases in the air.

Buy local
Less carbon emissions from shipping trucks and planes.



THANK YOU

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