New Jersey Carbon Flux in Non-tidal, Freshwater Wetlands Pilot Project

Funded by:
NJDEP Division of Science & Research
(SR24-029)

Funding Source:
USEPA
Performance Partnership Grant
(FY20-21, BG99248819)

PI: Charles Schutte, Rowan University
Support: Partnership for the Delaware Estuary & USDA-NCRS

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

- Background, Goals, & Team
- Sites
- Sampling Methods
- Timeline

Background, Goals, & Team

Background

- Reduction of greenhouse gas is a priority for NJ
- Wetlands comprise some of the highest stores of carbon on Earth.
- 19-21% of NJ land area are wetlands, with 80% fresh, nontidal.
- Little research on their carbon sequestration capacity relative to tidal wetlands.
- One differences is that lower salinities can result in higher CH_4 and CO_2 flux

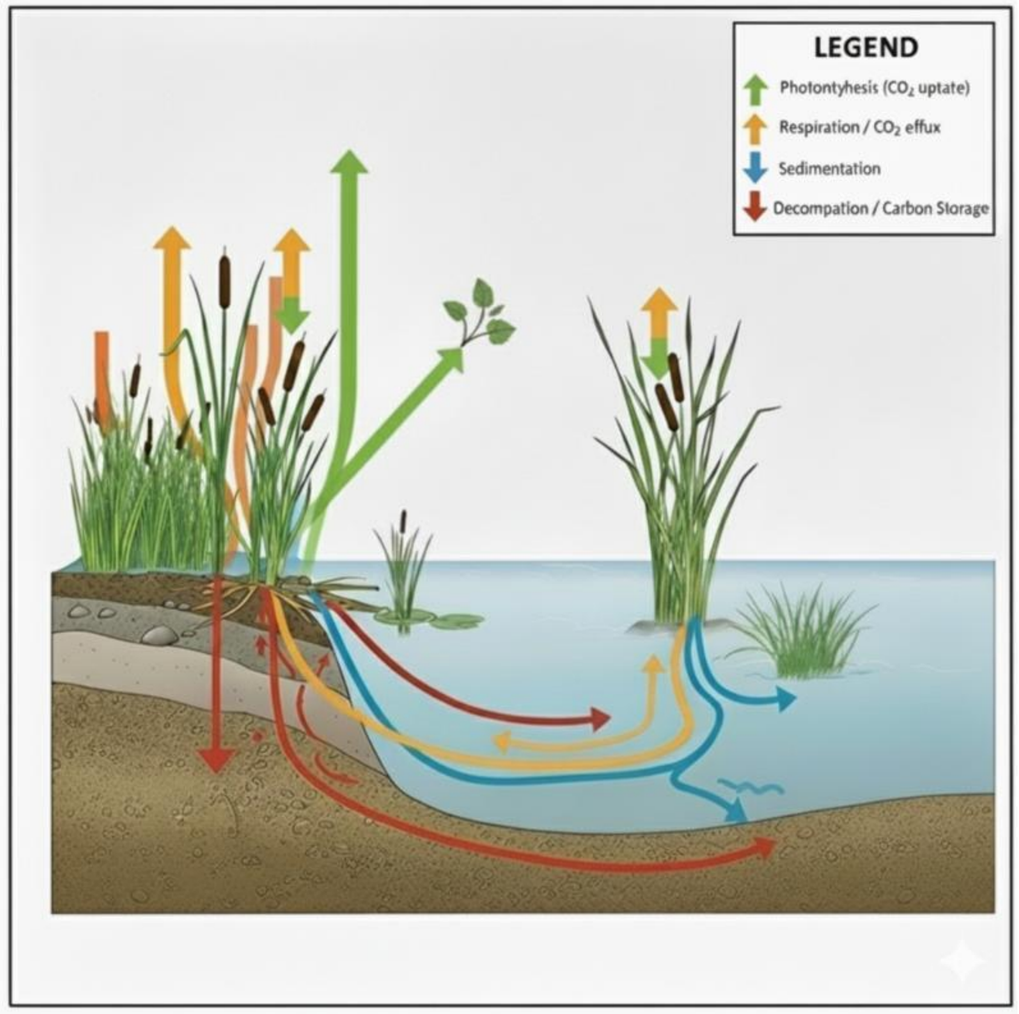
Overall Goals

1. Develop singular method to calculate carbon flux/climate cooling potential of NJ non-tidal wetlands through measurement of carbon pools and movement.
2. Identify the significant factors of a carbon flux model to inform future data collection needs.
3. Begin to develop NJ specific carbon flux values for different types of wetlands. This data will be used to improve the state Greenhouse Gas Inventory, update the Climate Science Report, and state workplans that are related to carbon sequestration.

Team

- Rowan: PIs- Drs. Charles Schutte & Lauren Kipp
- USDA Natural Resources Conservation Service: David Steinmann
- Partnership for the Delaware Estuary: LeeAnn Haaf
- NJDEP DSR: Dr. Joshua Moody (PM) & Metthea Yepsen

Quantitative Goal



<u>Goal is to calculate the radiative balance (CO_2-eq)</u>

Net cooling = negative, sequestration

Net warming = positive, emissive

Salt marshes = cooling, high Cseq, low CH_4 emission

-Not all pathways equally explored

-specifically, surface and ground water

-Schutte et al. (2020) ~mean groundwater-derived CH_4 flux of 125 g CO_2-eq m^{-2} $year^{-1}$ (GA, USA) USA,

-counteracted ~14% of the global average salt marsh soil carbon burial rate of 897 g CO_2-eq m^{-2} $year^{-1}$ (Ouyang and Lee 2014).

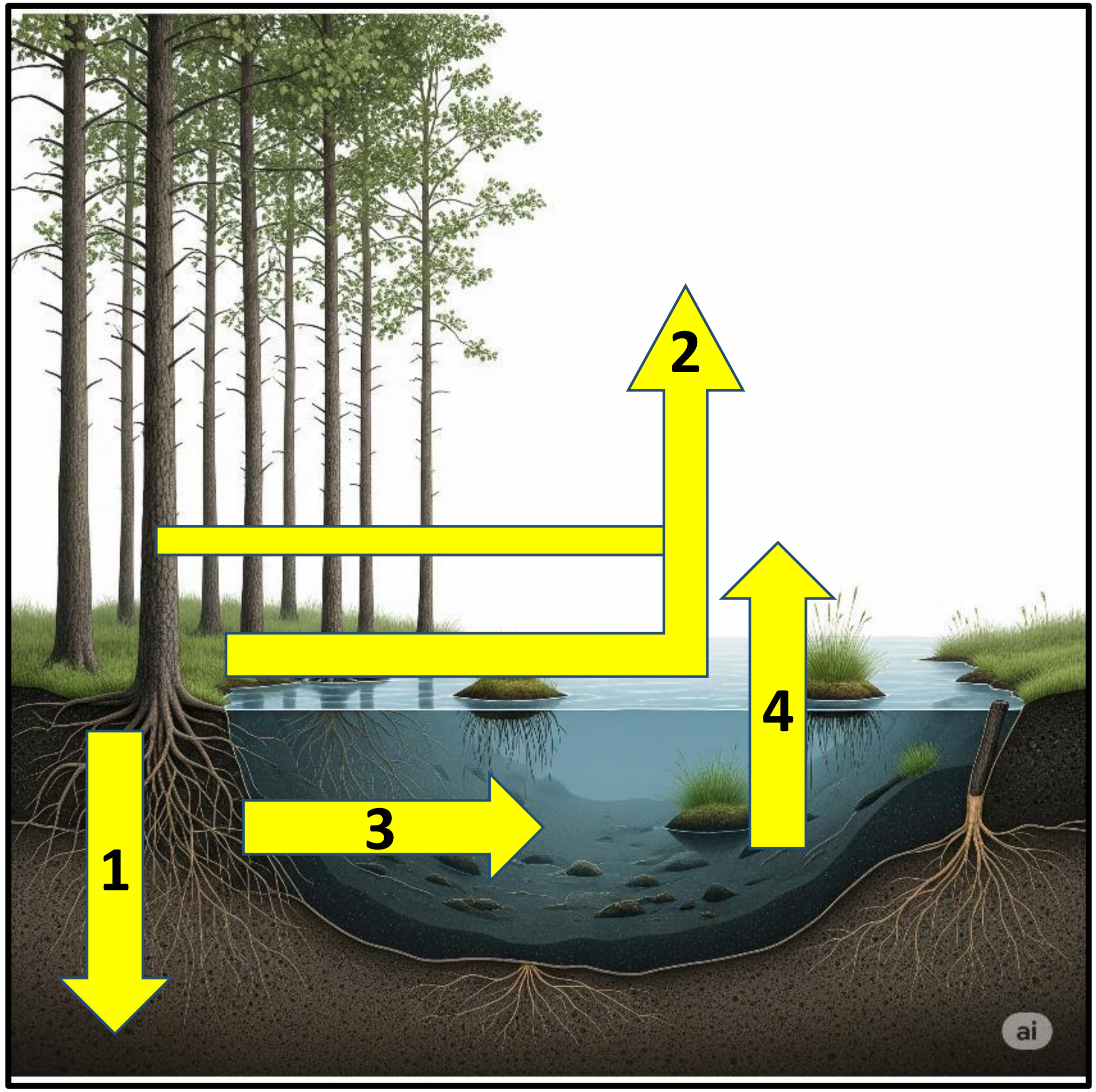
$$RB = CAR + J_{CH4(atm)} + J_{N2O(atm)} + J_{CH4(gw)} + J_{N2O(gw)}$$

burial (CAR) — Soil+veg ($J_{CH4(atm)} + J_{N2O(atm)}$) — GW+SW ($J_{CH4(gw)} + J_{N2O(gw)}$)

Sampling Approach

Metrics & Methods

1. Soil carbon sequestration: carbon content and accumulation via radiometric dating of soil cores.
2. Atmospheric CO_2 & CH_4 emissions from soil, and from tree stems.
3. Radon as a groundwater tracer to estimate discharge from the wetland to adjacent waterbody.
4. CO_2 & CH_4 in groundwater to estimate their lateral emissions into adjacent waterbody and ultimately into the atmosphere.



Sites

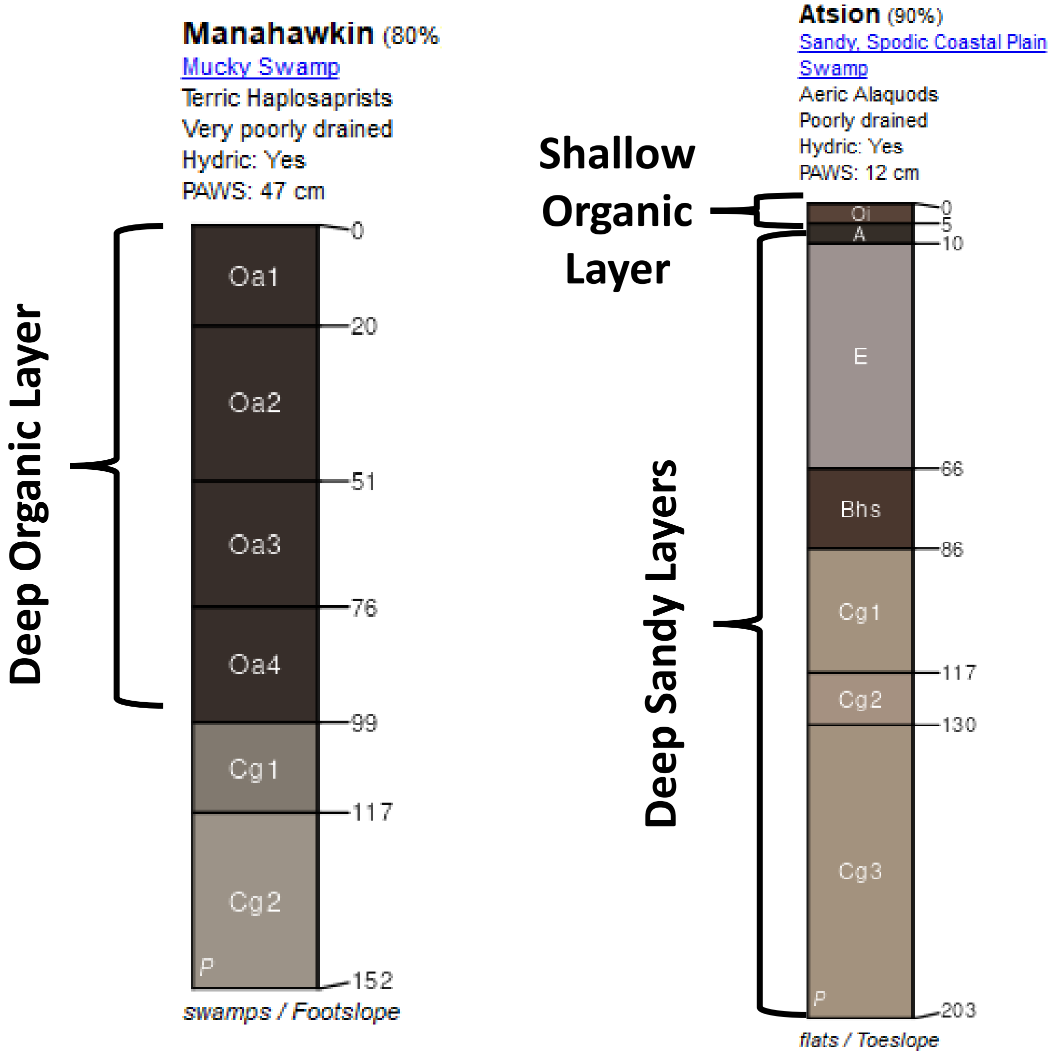
<u>Mullica River Watershed</u> – reference nontidal wetland types

Study Sites: 3/type, total =12

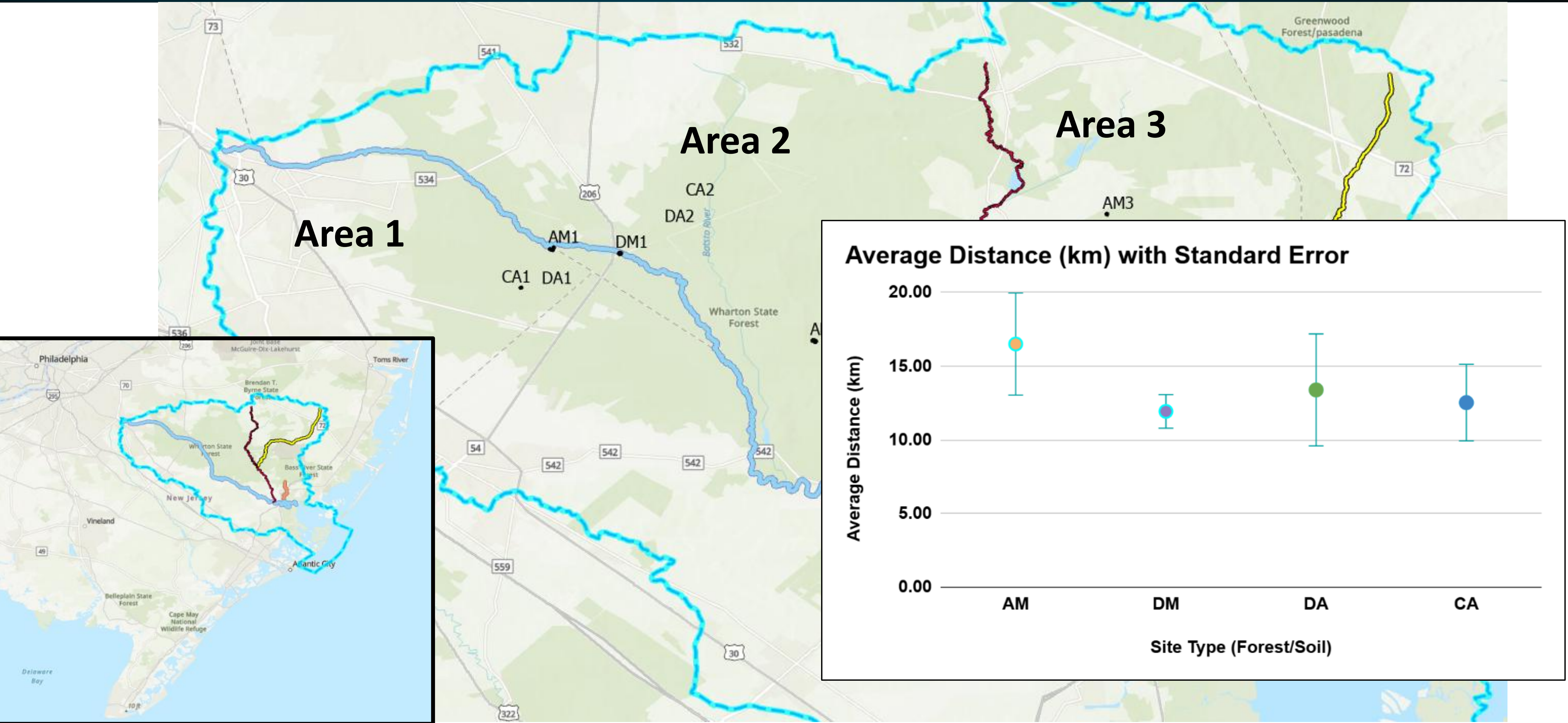
1. <u>Atlantic White Cedar Forest on Manahawkin Soil:</u> wet and carbon rich.
2. <u>Deciduous Forest on Manahawkin Soil:</u> Represent areas where AWC has been lost and hardwood forests have established on these soils (i.e., impacted by people)
3. <u>Deciduous Forest on Atsion Soil:</u> Hardwood forest on poorly drained sandy soil.
4. <u>Pitch Pine Lowland on Atsion Soil:</u> Signature species of the pinelands, and NJ, on poorly drained sandy soil.

<u>Considerations: Visited >50 sites; Forestry input</u>

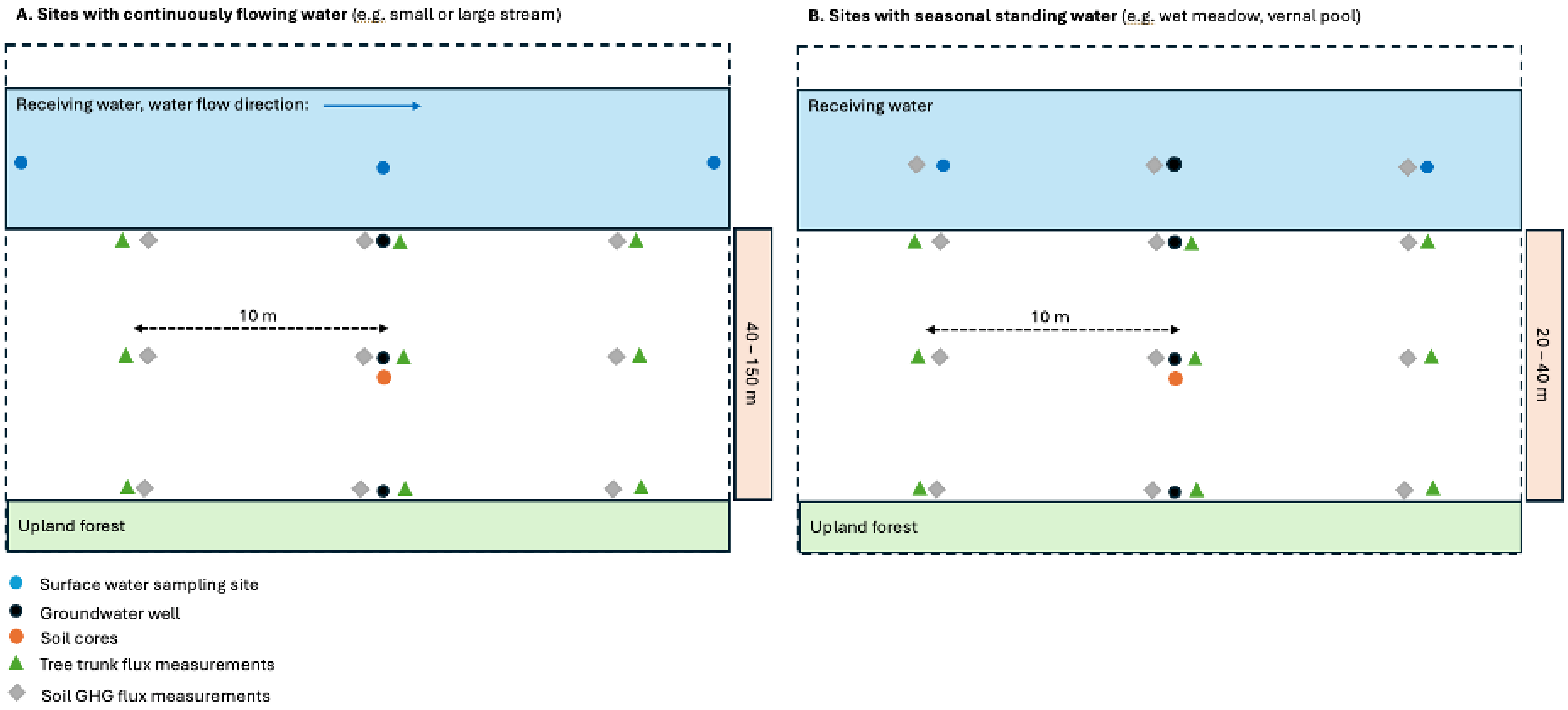
1. Confirmed forest/soil types
2. State land
3. Accessible
4. No planned restoration activities for 2 years



Sites

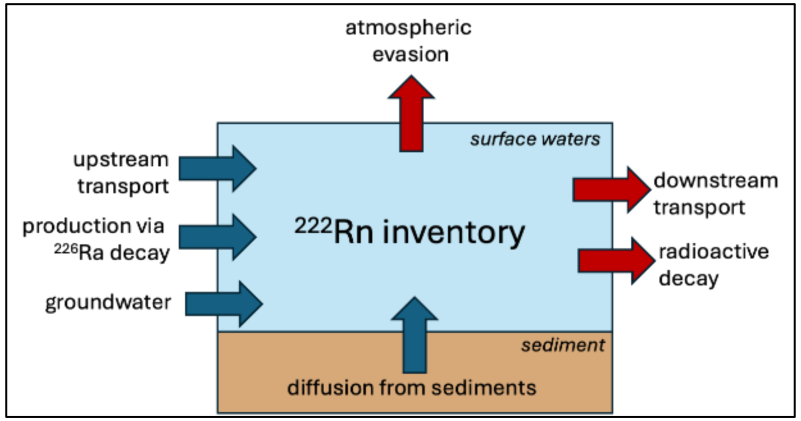

Area 1
Area 2
Area 3
AM1
DM1
CA1
DA1
CA2
DA2
AM3
Wharton State Forest
Greenwood Forest/pasadena
Philadelphia
Toms River
Vineland
New Jersey
Atlantic City
Belleplain State Forest
Cape May National Wildlife Refuge
Average Distance (km) with Standard Error
Average Distance (km)
20.00
15.00
10.00
5.00
0.00
AM
DM
DA
CA
Site Type (Forest/Soil)

Sampling Methods



Sampling Methods-Details

1. <u>Stored Carbon</u>
   - Central ~2m vibracore
   - Calculate horizon thickness
   - 1cm sections, bulk density, isotope, C-content
2. <u>Soil/Vegetation Gas Flux – Static Chamber Approach</u>
   - Soil collars, ~6” deep into soil, left in place
   - Tree collars attached for measurement then removed
   - 9/site; deciduous, a few more to capture diversity
3. <u>Surface Water (SW)/Groundwater (GW) Flux</u>
   - SW: Collected middle receiving waterbody
   - GW: 3 wells/site up to 4’ deep; kept in place
4. Stream Discharge Volume
   - Cross-section area with float/point flow methods
   - Radon mass balbalnce



Sampling Methods-Details

1. <u>Extrapolation Across Type/Site</u>
   - Trees: 1x, July-Sept
   - Non-tree:1-2x annually; phenological variability
   - Cover/class/strata
   - 5x5m grid on 10/30m swath (W,M,U)
     - 3 replicate flux measurements/swath
   - Data Collected:
     - *Sphagnum*/herbaceous/shrub cover (BB)
     - Canopy cover (Den)
     - Tree: Count, DBH, height class

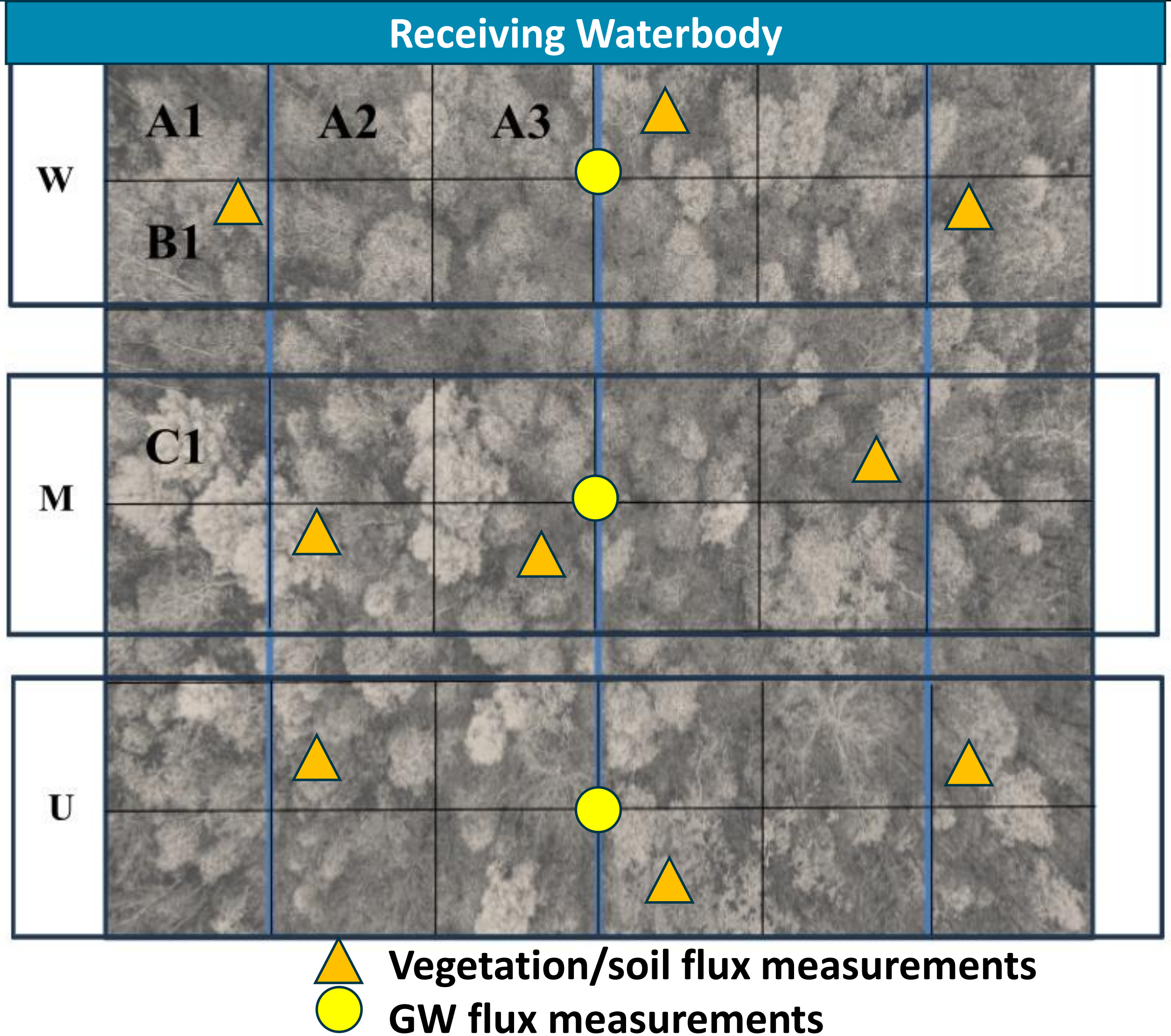


Table 1. Braun Blanquet Cover Classes.

Cover Class	Cover Range (%)	Cover Midpoint (%)
1	< 0.01	0.05
2	0.01-1	0.55
3	1-5	3
4	5-25	15
5	25-50	37.5
6	50-75	62.5
7	75-95	85
8	95-99	97
9	>99	99.5

Table 2. Height classes for vegetation assessment.

Height Class	Height (m)	Description
1	<1	Seedling (tree), short herbaceous
2	1-4	Juvenile (tree), shrubs, tall herbaceous
3	4-20	Sapling (tree), trees
4	20-30	Mature (tree)
5	>30	Mature/old (tree)

Timeline

	2025								2026												2027											
	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Start (6/1/24)																																
Original End																									5/31							
NCE 6mo																															11/31	
QAPP																																
Site Establishment																																
Sample Fall 1																																
Sample Winter 1																																
Sample Spring 1																																
Sample Summer 1																																
Sample Fall 2																																
Sample Winter 2																																
Sample Spring 2																																
Sample Summer 2																																
R1 : Site Estab						10/30		12/15																								
Data 1													5/30				9/30															
R2: Y1 Monitoring																		10/30		12/15												
Data 2																									5/30				9/30			
Final Report																															11/31	

2026: Carbon Sequestration Projects

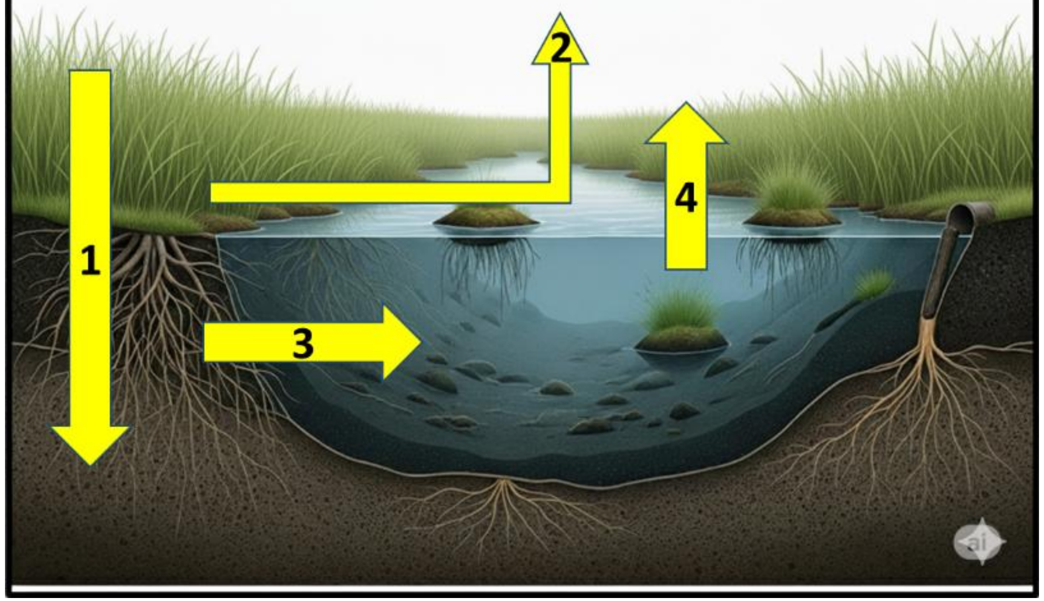
1. **Determining a Method in Non-tidal Forested Wetlands**
    - AWC on Manahawkin Soils
    - Deciduous on Manahawkin Soils
    - Pitch Pine on Atsion Soils
    - Deciduous on Atsion Soils

Presentation by Josh Moody

2. **Evaluating Climate Cooling Potential of natural Climate Solutions Projects & Tactic Types**
    - Baseline data NCS Round 1&2 Projects
    - Mature living shorelines and sediment placement projects (replicates, Barnegat & Del Bay)

- Partners on both
    - Rowan University: Drs Charles Schutte, Lauren Kipp
    - NRCS: David Stienmann
    - PDE: Dr. LeeAnn Haaf

1. Soil & vegetation carbon sequestration
2. Soil & vegetation emissions
3. Carbon release via groundwater
4. Carbon release via surface water

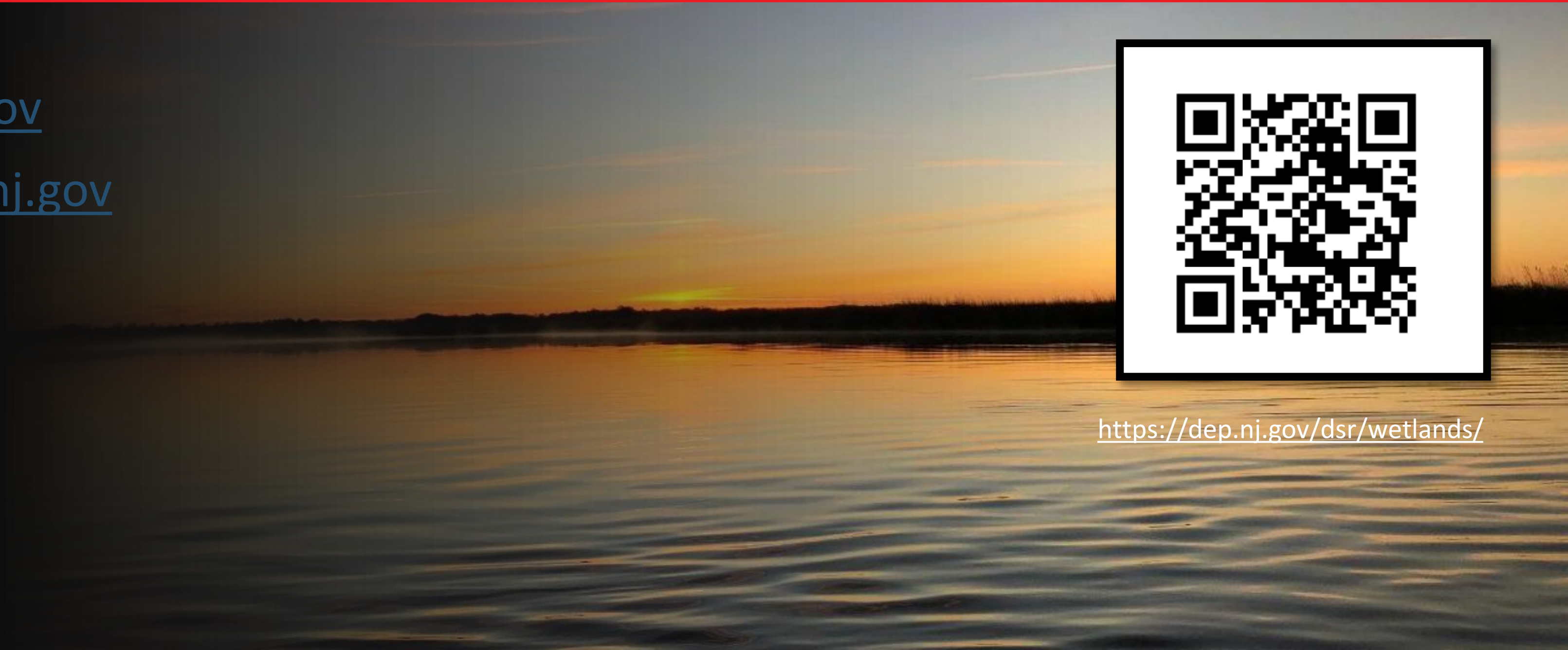


Questions & Discussion

Joshua Moody: Joshua.Moody@dep.nj.gov

Metthea Yepsen: Metthea.Yepsen@dep.nj.gov

Erin O’Brien: erin.obrien@dep.nj.gov



https://dep.nj.gov/dsr/wetlands/