

# PREMIS: A multidisciplinary approach to understanding the terrestrial-aquatic interface

This project is part of a multi-disciplinary effort to understand terrestrial-aquatic interface (TAI) ecosystems stressed by climate change. Monitoring sap flux and greenhouse gas fluxes offers a way to quantify the stability and resilience of terrestrial ecosystems in a changing environment.

## MOTIVATION

- The TAI may be especially vulnerable to global changes such as sea level rise and extreme weather conditions
- Transplanting soil cores allows us to manipulate the environment to simulate environmental changes
- Monitoring sap flow offers an observational approach, testing differences between lowland and upland trees

## APPROACH

- LOCATION:
  - Smithsonian Environmental Research Center – coastal forest on a tributary of Chesapeake Bay in Edgewater, Maryland
- DESIGN:
  - 124 transplanted soil cores (40 cm diameter, 20 cm depth) along natural salinity and elevation gradients, including true and disturbance controls
  - 30 trees with Granier-type sap flux sensors



(left to right) Nick Ward (PI), Vanessa Bailey (PI), and James Stegen (PI) sample the soil at SERC



(left to right) Stephanie Pennington and Mercedes Horn pose with a soil core



(left to right) Ben Bond-Lamberty (PI) and Stephanie Pennington dig a soil core at SERC



Wenzhi Wang uses a pressure chamber to measure the water potential of a Tulip Poplar leaf



Stephanie Pennington installs a sap flux sensor in a Tulip Poplar tree



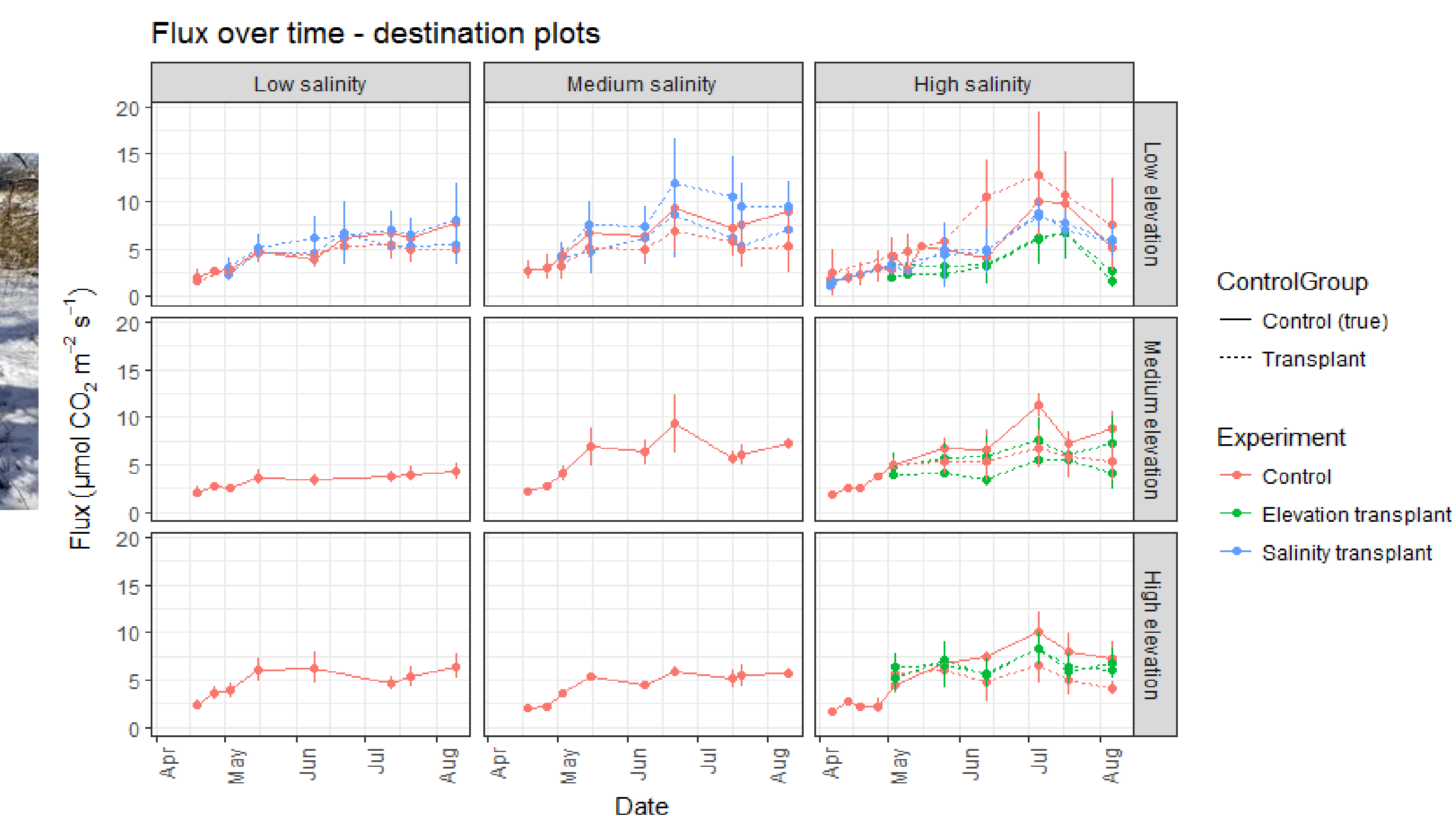
Nate McDowell (PI) measures photosynthesis of pre-dawn and mid-day leaf samples



Uzay Sezen uses a crossbow to gather leaf samples from high canopies

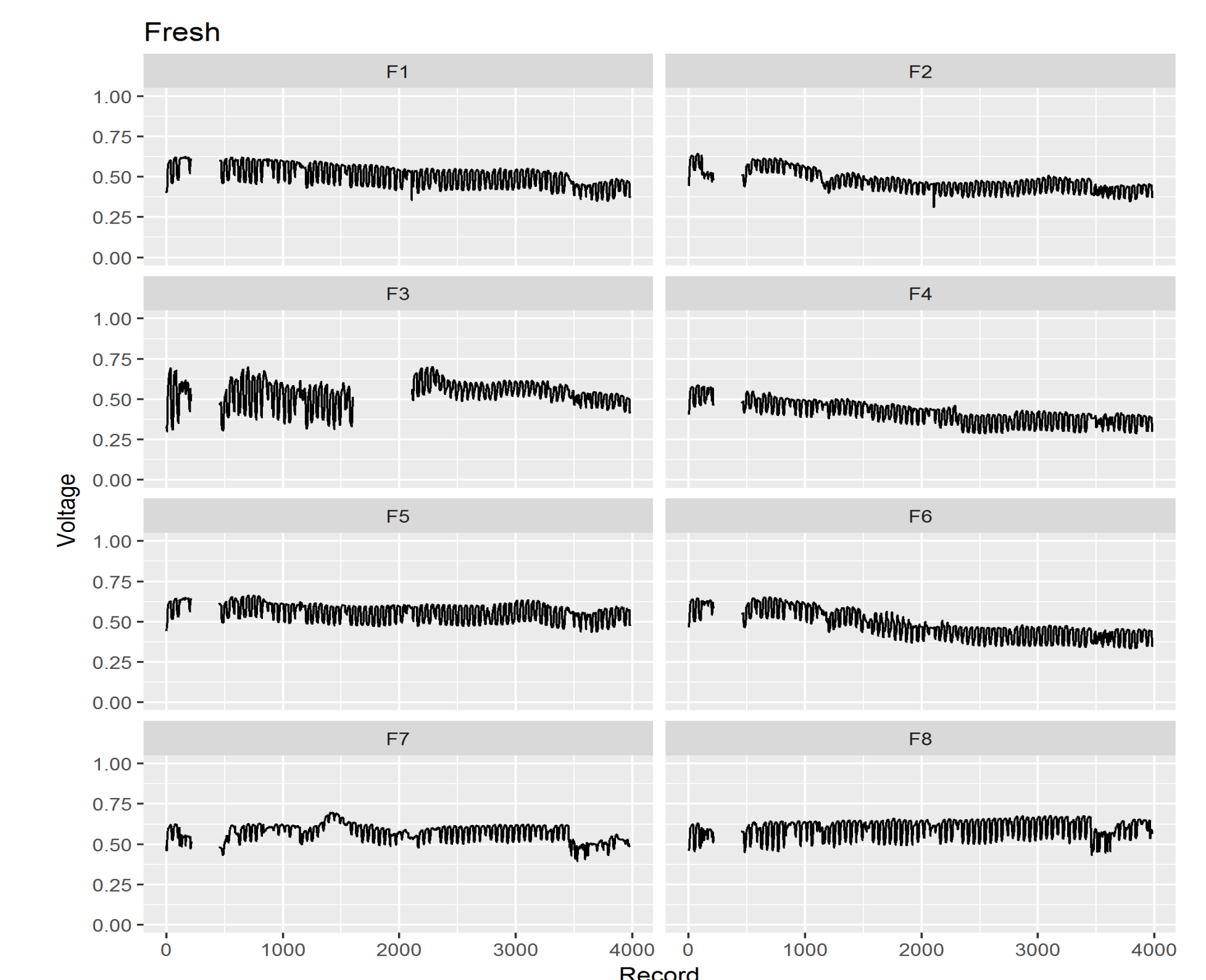
## PROGRESS + RESULTS TO DATE

- Weather stations installed at each salinity gradient
- Wells installed containing conductivity meters
- All soil collars installed – measurements taken every 7-10 days
- All sap flux sensors installed – measurements taken every 30 minutes



**Figure 2.** Mean CO<sub>2</sub> flux by sampling date and experiment; error bars show collar-to-collar variability (N=4). Large soil cores were transplanted along a natural salinity gradient (top row) and elevation gradient (right column).

**Figure 3.** Raw sap flux data (in mV) showing daily variation from May to August, for eight different trees in one of the upland plots.



## FUTURE WORK

- Analysis of tree distribution and spatial variability of soil respiration
- Quantify sap flow response to saltwater and freshwater treatment
- Install continuous soil respiration monitoring system around sap flow trees
- Integrated analysis of salinity and disturbance effects on both plant water and soil CO<sub>2</sub> fluxes

**PREMIS**  
PRedicting Ecosystem  
Resilience through Multiscale  
and Integrative Science

Stephanie Pennington  
Ben Bond-Lamberty (PI)  
Nate McDowell (PI)

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