

# Rapid Oxygen and Redox Responses to Flooding in a Coastal Forest: Insights from a Landscape-Scale Manipulation Experiment

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Curious about TEMPEST GHG responses? Chat with Nick Ward!  
B231-2196, Tues 15:10-19:30

## Background

The Terrestrial Ecosystem Manipulation to Probe the Effects of Storm Treatments (TEMPEST) experiment simulates how increased flooding via storms and sea-level rise will impact coastal forests. TEMPEST consists of three 40x50m forested plots in Maryland: Freshwater (flooded with fresh water), Estuarine (flooded with water from an adjacent estuary) and Control which receives no flooding treatment. In June 2023, we flooded Freshwater and Estuarine plots with ~300,000 L of water in back-to-back events.

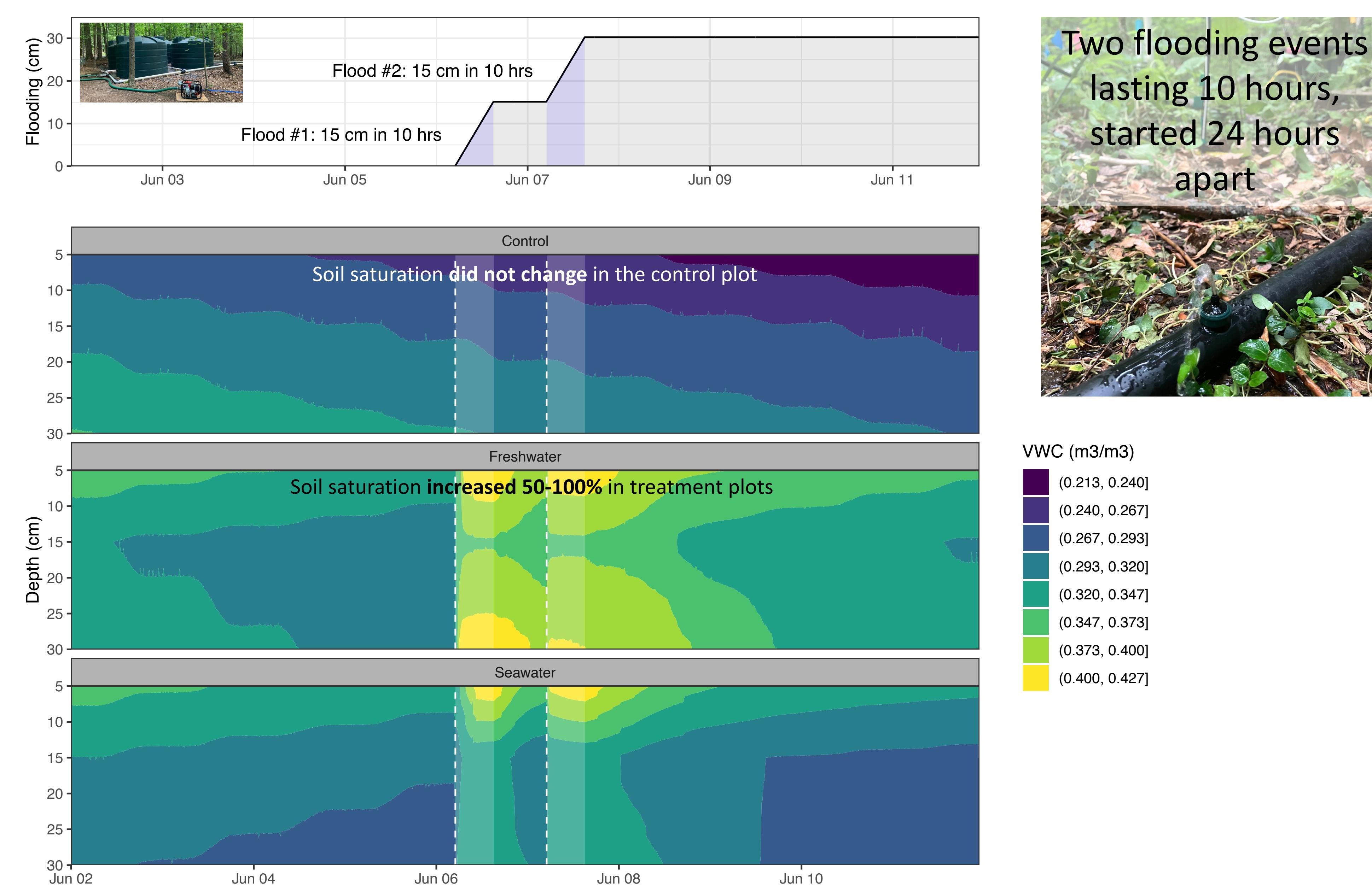
## Site and sensors



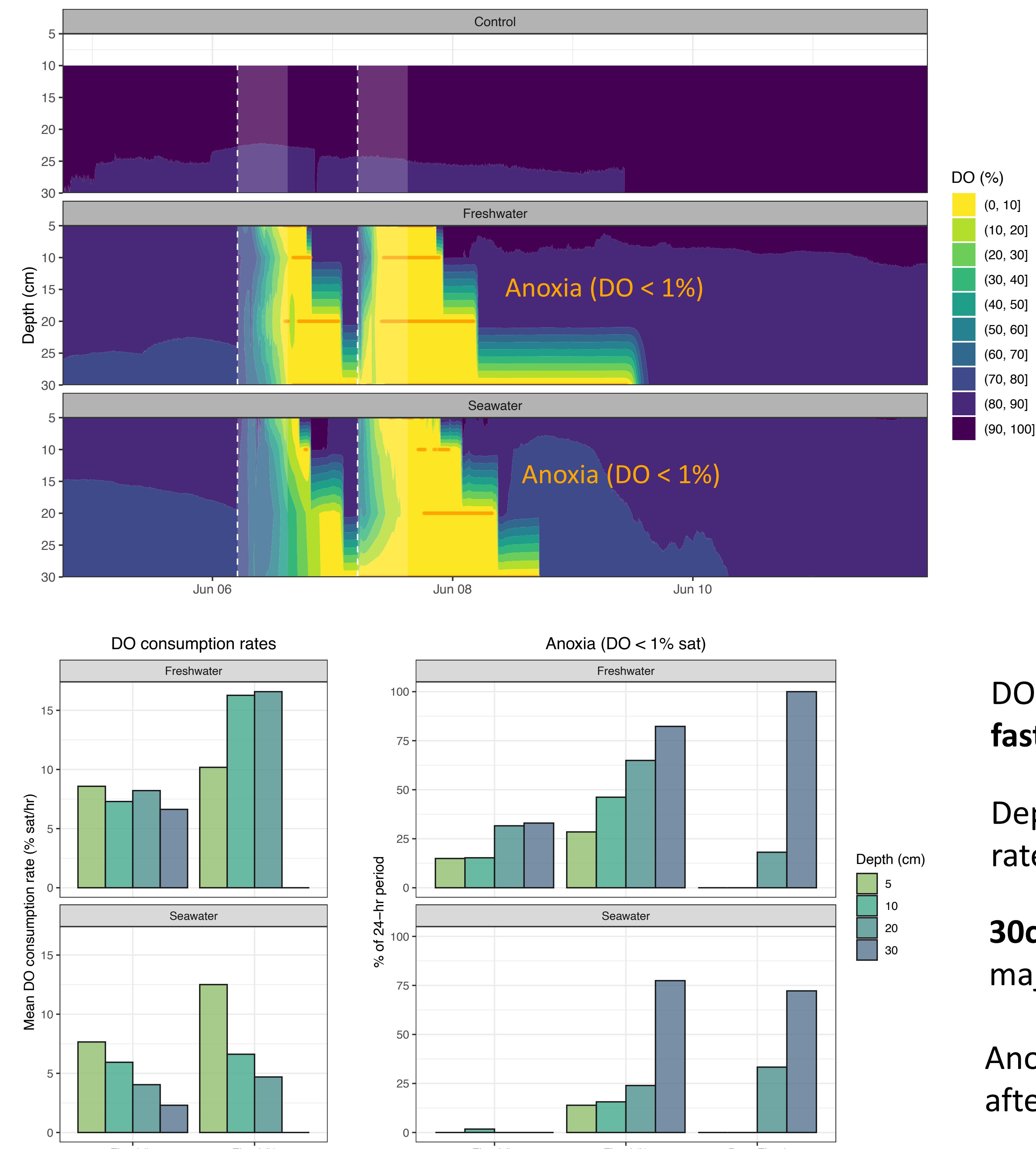
We monitored soil responses to flooding with in-situ sensors:

- >100 TEROS sensors (Meter) measuring volumetric water content (VWC), temperature, and electrical conductivity at 5-30 cm
- 11 Firesting sensors measuring dissolved oxygen (DO) at 5-30 cm, and
- 60 SWAP sensors measuring reduction-oxidation potential (Eh) at 5-50 cm

## Flooding events



## Oxygen responses to flooding



Flooding drove rapid oxygen consumption

Oxia returned quickly after first flood event

All depths went anoxic during the second flood event

Anoxia persisted longer at depth, especially in Freshwater plot

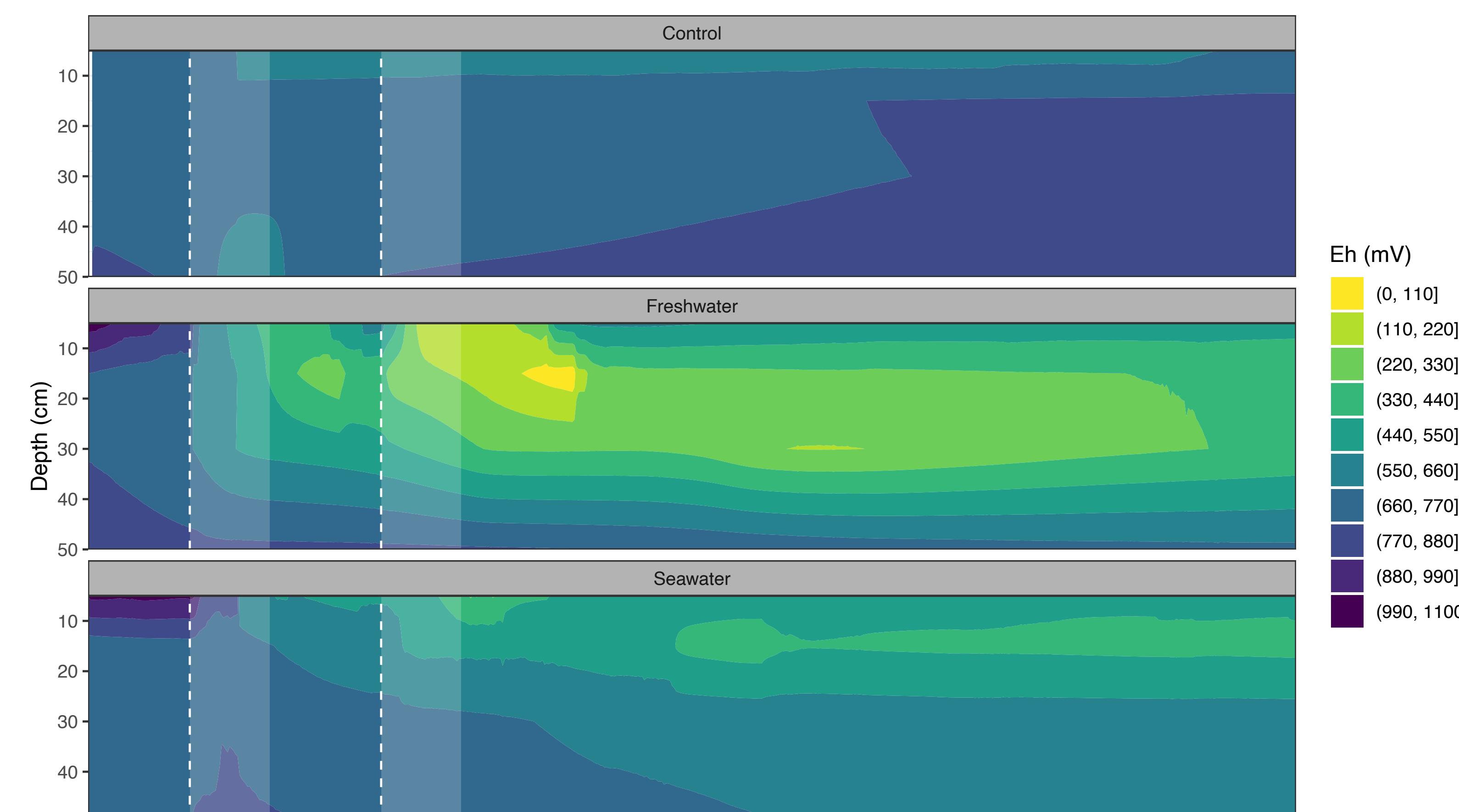
DO consumption rates were faster during Flood #2

Depth patterns in consumption rate varied by plot

30cm stayed anoxic the majority of the second flood

Anoxia persisted > 24 hrs after flooding at depth

## Redox responses to flooding



No significant change in Eh in the control plot

Eh decreased in both treatment plots at 5-30 cm, not for 50 cm

Average % decreases in Eh declined with depth:

- 5 cm: -79%
- 15 cm: -71%
- 30 cm: -46%
- 50 cm: -17%

## Take-home

Back-to-back flooding events saturated soils in a coastal forest, driving rapid, short-lived anoxia and slower decreases in Eh

Stay tuned for triple floods in 2024!