Case Study: Southern Flow Corridor (Tillamook, OR)

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TILLAMOOK ESTUARIES PARTNERSHIP

TILLAMOOK COUNTY
Land of Cheese, Trees and Ocean Breeze

OWEB

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NOAA
U.S. DEPARTMENT OF COMMERCE

RESTORE AMERICA'S ESTUARIES

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- Matthew Schultz
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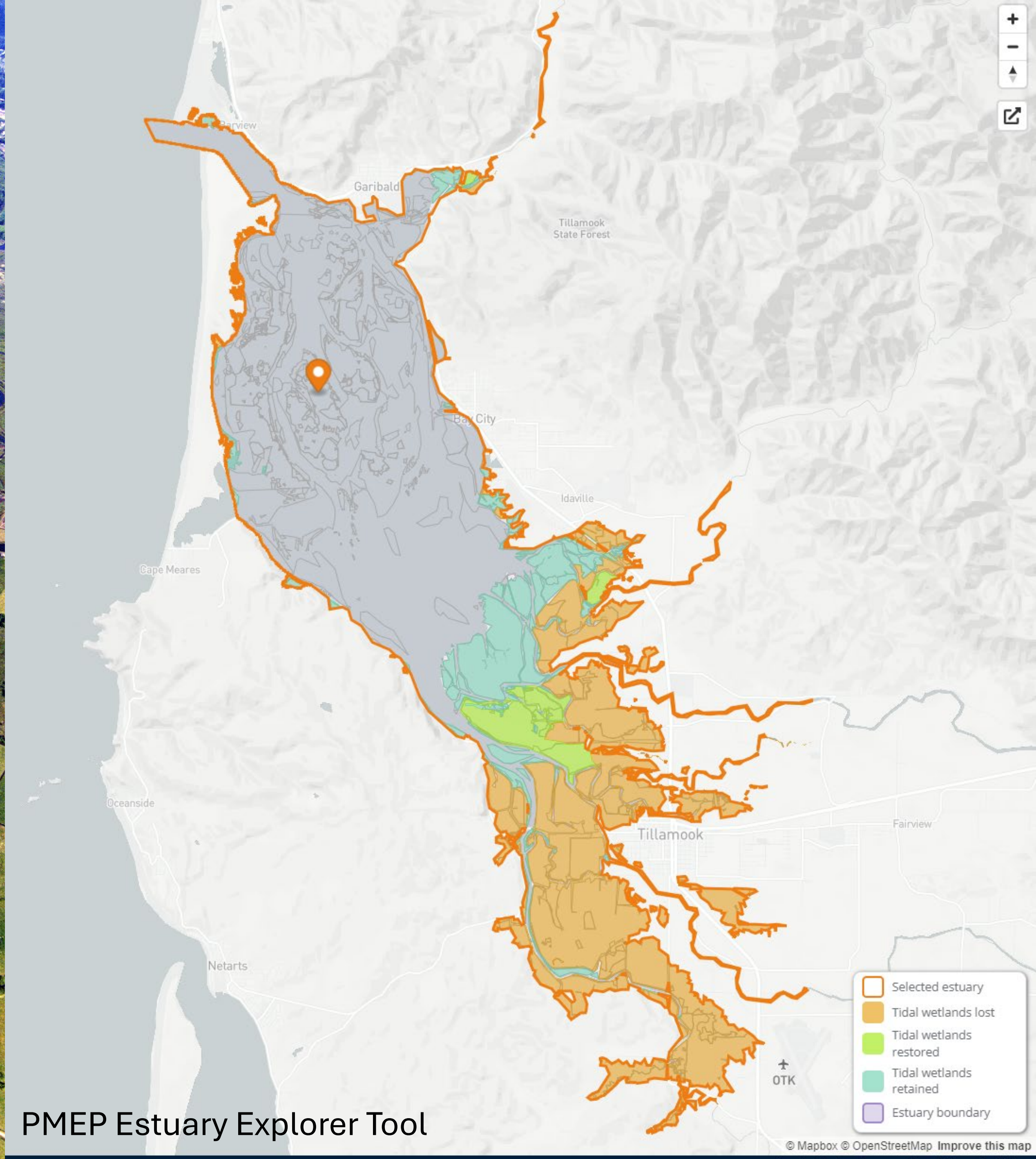
- Laura Brown
- Erin Peck
- Craig Cornu
- Robert Wheatcroft

Background: Tillamook Bay & TEP

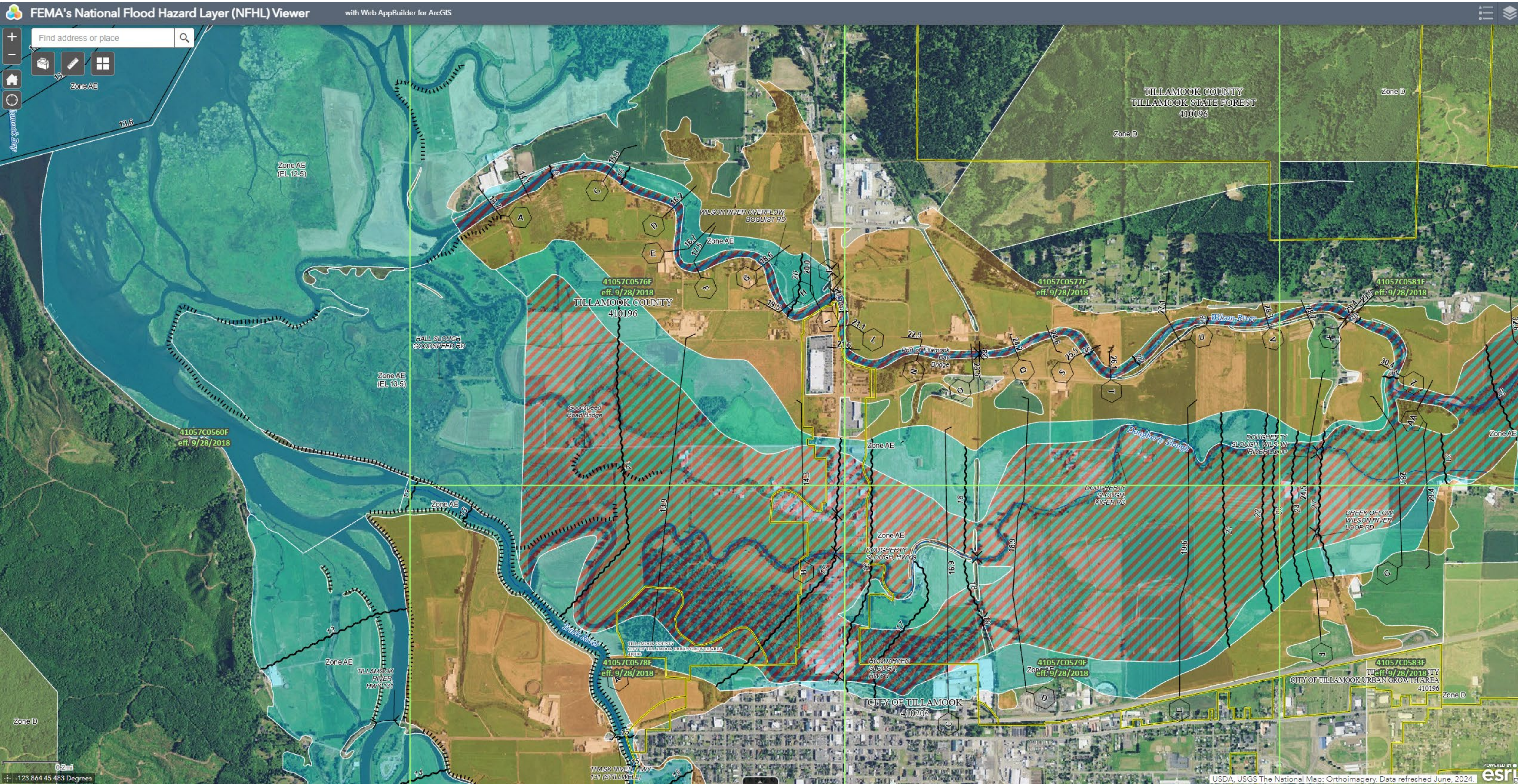
Southern Flow Corridor: Habitat

Don Best Photography



PMEP Estuary Explorer Tool

Southern Flow Corridor: Flooding



Southern Flow Corridor: Before

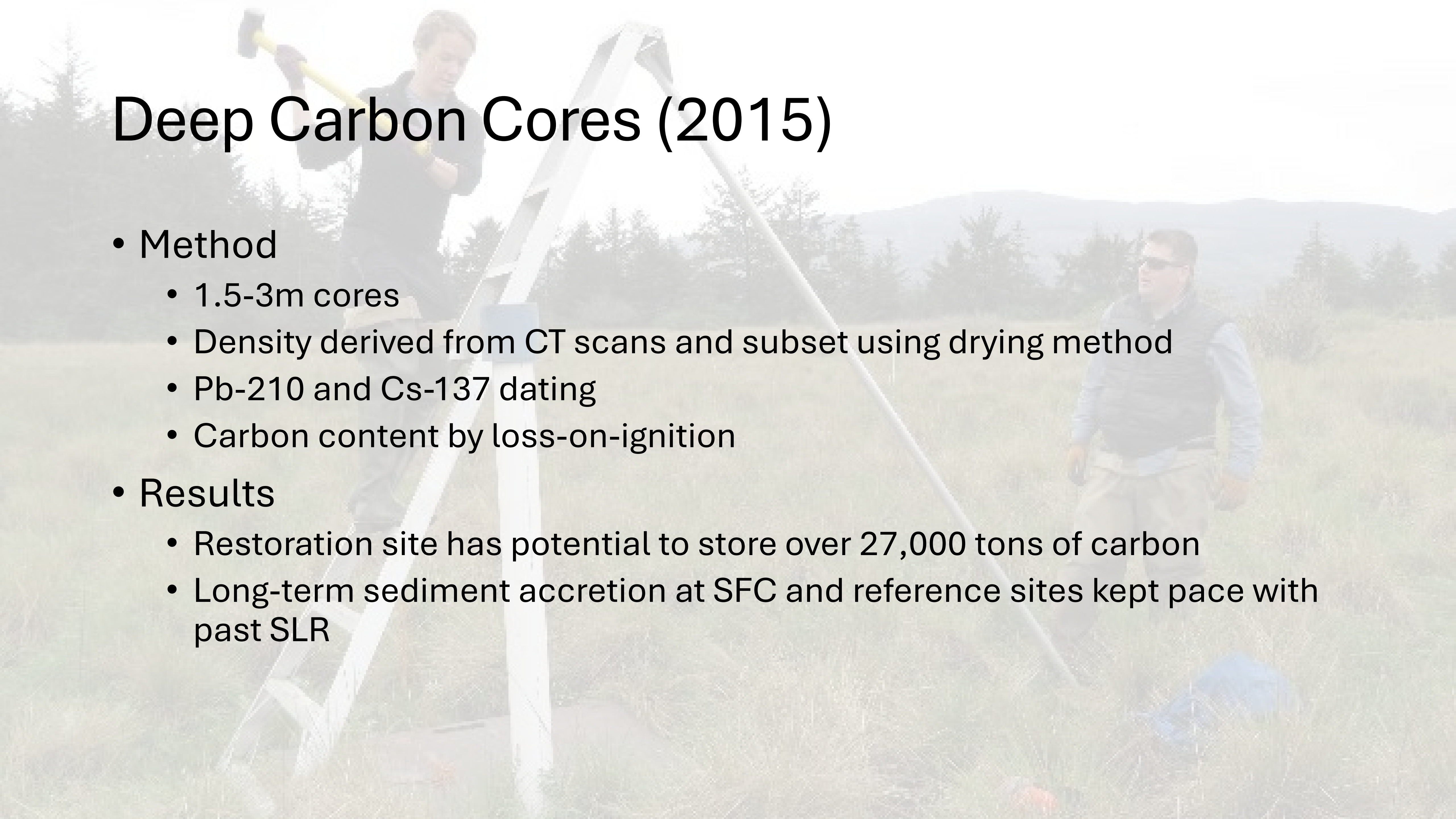
Southern Flow Corridor: After

Southern Flow Corridor: After (Flood)

Blue Carbon Monitoring

Sediment Accretion (2015-2024+)

- Method
  - Feldspar marker horizons
  - Cryocore or knife extraction
- Results
  - Higher accretion rates after restoration and compared to reference sites
  - Accretion higher than local SLR



Deep Carbon Cores (2015)

- Method
  - 1.5-3m cores
  - Density derived from CT scans and subset using drying method
  - Pb-210 and Cs-137 dating
  - Carbon content by loss-on-ignition
- Results
  - Restoration site has potential to store over 27,000 tons of carbon
  - Long-term sediment accretion at SFC and reference sites kept pace with past SLR

Chamber Measurements (2017, 2025+)

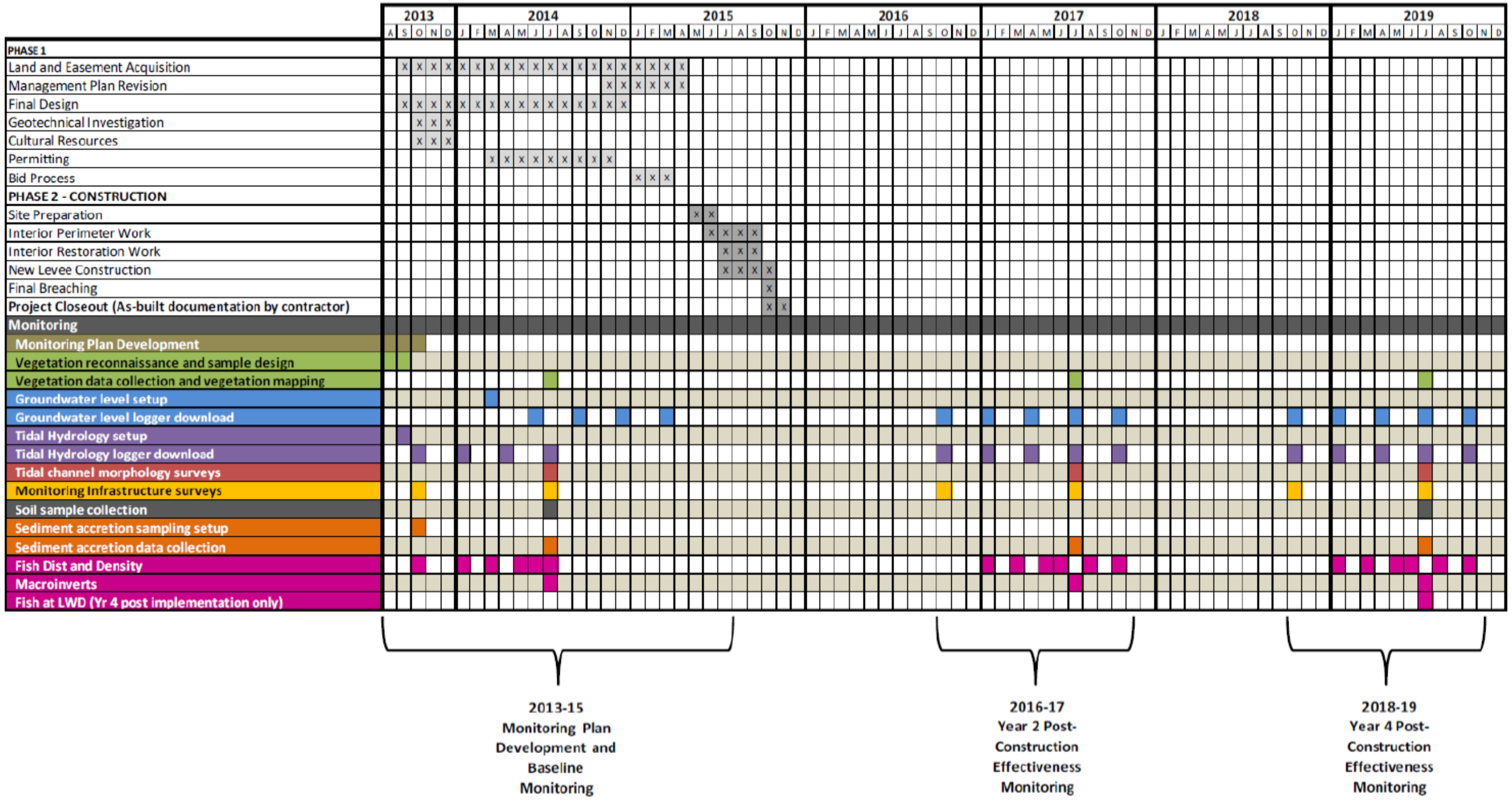
- Method
  - Portable FTIR gas analyzer (Gasmet DX4040)
  - Replicate chambers with boardwalks to minimize ground disturbance
  - Dark PVC chambers with monthly measurements
- Results
  - Methane emission complex and non-linear with environmental factors
  - Relatively high methane emissions immediately post-restoration
  - Positive relationship between methane flux and groundwater levels – designs should reduce ponding

Ongoing Efforts

- Continued blue carbon (and other!) monitoring
  - Sediment accretion plots
- Eddy covariance tower (GHG flux)
  - Combine with chamber stations, accretion plots, and groundwater data to model drivers of CO_2 and methane flux

Lessons Learned: Structure & Continuity

- Science-based and community-approved monitoring plan provided structure resilient to personnel change




Questions?

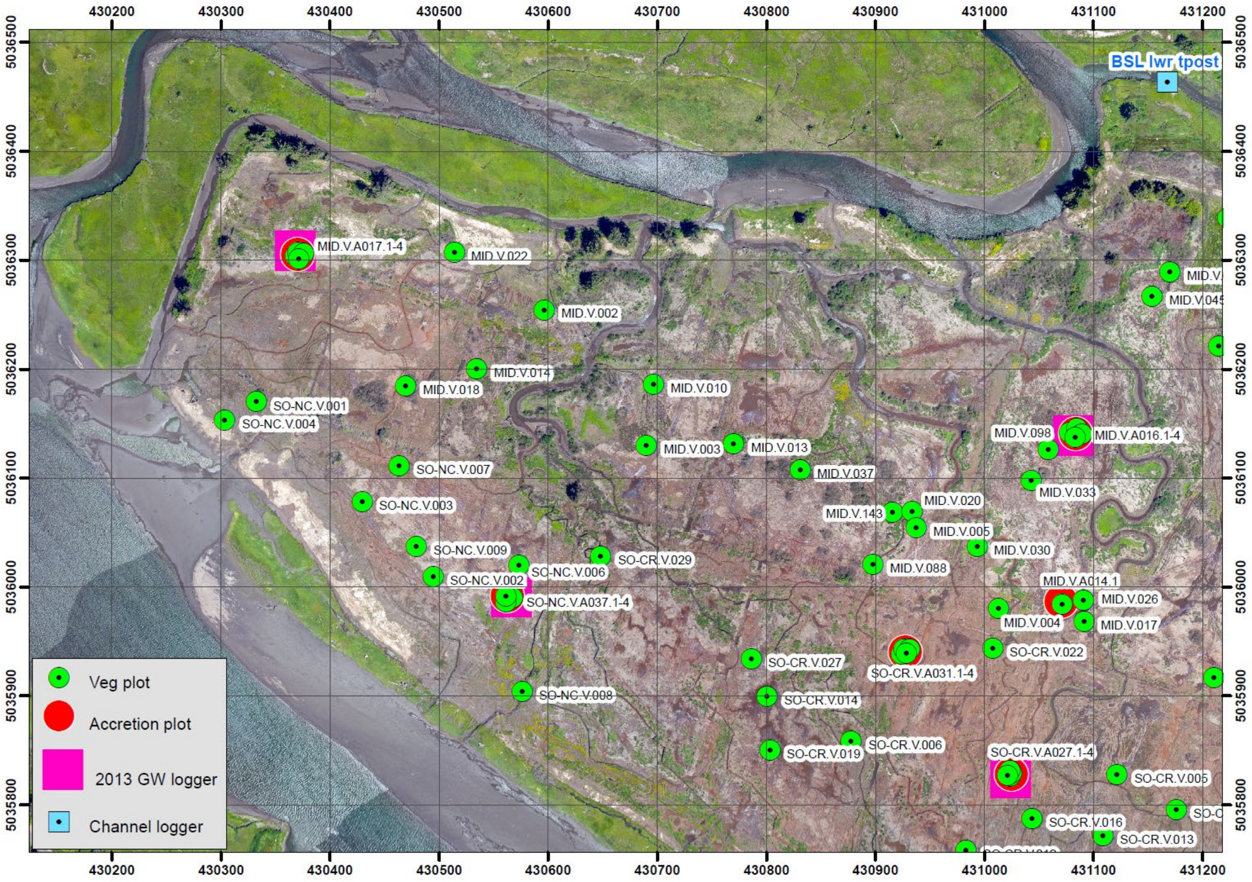
Background: Pacific Northwest Tidal Wetlands

Monitoring & Adaptive Management

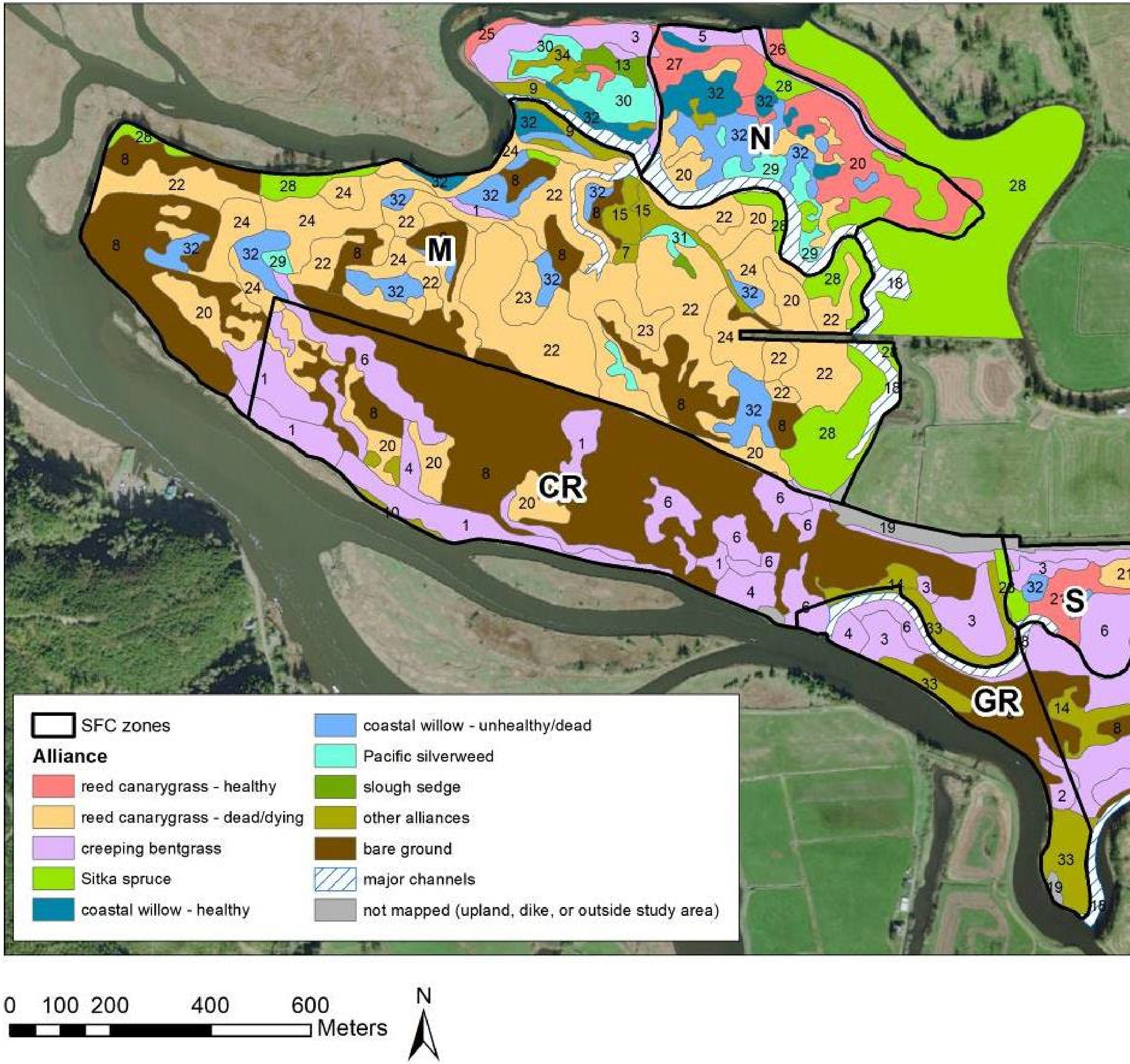
Monitoring: Monitoring Plan

- Before-After-Control-Impact (BACI) study design

- Vegetation
- Accretion Rates
- CO_2/CH_4 dynamics
- Groundwater salinity
- Channel morphology
- Fish population
- Macroinvertebrates
- Mosquitos
- Flooding
- Soil chemistry



Monitoring: Persistence of Invasive Species



Adaptive Management: Spruce Swamp Planting

- The plan: detailed biophysical assessment (elevation, groundwater, soil salinity), modeling, and planting plan (2025); planting (2026); maintenance and monitoring (through 2028)
- Excellent opportunity to enhance habitat at SFC AND contribute to nascent understanding of spruce swamp restoration
- Funded by Restore America’s Estuaries and the Oregon Watershed Enhancement Board (pending)
- Unique challenges associated with working in a restored area: e.g. no equipment access

Lessons Learned: Incorporating Advances

Restoring Tidal Swamps in the U.S. Pacific Northwest: Information for Restoration Practitioners

Fran Recht, Pacific States Marine Fisheries Commission

Laura S. Brophy, Estuary Technical Group, Institute for Applied Ecology

Joan Drinkwin, Natural Resources Consultants

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Comparing historical losses of forested, scrub-shrub, and emergent tidal wetlands on the Oregon coast, USA: A paradigm shift for estuary restoration and conservation

Sitka spruce-dominated tidal forested wetland ("tidal swamp") in the Nehalem River Estuary, Oregon. Historically, tidal forested wetlands made up over half of all tidal wetlands in Oregon, but 95% of these tidal forests have been lost. Photograph © Laura Brophy.

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Research Article

Assessment of Methods to Control Invasive Reed Canarygrass (*Phalaris arundinacea*) in Tidal Freshwater Wetlands

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ABSTRACT

Reed canarygrass (*Phalaris arundinacea*) is invasive in temperate freshwater wetlands throughout the United States and Canada and presents challenges to restoring tidal freshwater wetlands. Methods for the prevention or elimination of reed canarygrass in palustrine wetlands are generally well established, typically involving herbicide application, mechanical treatments, prolonged inundation, or establishment of competitive plant species. These methods are often not suitable for the unique conditions in tidal wetlands and alternative strategies remain poorly understood. Prolonging inundation of tidal wetlands requires a loss of habitat forming processes, connectivity, and other functions. Treatments such as mowing, discing, or fire are not feasible in the perpetually wet conditions of tidal wetlands. Restoration practitioners aiming to design self-sustaining wetlands in the lower Columbia River estuary and the U.S. Pacific Coast have found that reed canarygrass is widespread and quick to establish post-restoration creating a management burden and impacting restoration goals. Here we report the results of a comprehensive effort to develop methods for control in tidal wetlands through systematic review of the scientific literature, interviews with experienced practitioners, and field observations at nine Pacific Northwest sites. The review framework evaluated key environmental conditions affecting reed canarygrass, control methods, and practical considerations. Findings support an integrated long-term control strategy at the largest possible scale to establish effective and self-sustaining control. Appropriate and practical strategies for tidal freshwater wetlands include implementing control pre-restoration to suppress existing populations; topographic modification such as scrape-downs and mounds to support competitiveness of desired vegetation communities; seeding or planting strong native competitors; limiting nutrient availability; and periodic, targeted control to limit reinvasion. These strategies are supported by the study, but long-term results are generally not available. Formal field experiments are recommended by the authors to better evaluate factors that influence reed canarygrass control in tidal freshwater wetlands.

Index terms: control; intertidal; invasive; *Phalaris arundinacea*; reed canarygrass; restoration; river floodplain; tidal wetland

INTRODUCTION

Reed canarygrass (*Phalaris arundinacea* L.; RCG hereafter) is an invasive grass that forms monocultures that adversely affect freshwater wetland ecosystems through the loss of biodiverse native grasses and forbs, including rare species (Lesica 1997; Schooler et al. 2006; Spyreas et al. 2010). The highly successful reproductive strategies (Maurer and Zedler 2002), broad physiological tolerances (Miller and Zedler 2003), and morphological plasticity to environmental conditions (e.g., Herr-Turoff and Zedler 2007; Kercher and Zedler 2004) of RCG make it a very effective ecosystem invader in freshwater wetlands throughout the temperate region of the United States and Canada (Lavergne and Molofsky 2004). RCG presents an ecological problem within riverine landscapes because of its water-borne spread (Coops and Van Der Velde 1995; Soomers et al. 2011). It impacts the export of organic material from floodplains (Kukulski 2017) and can adversely affect aquatic food webs by altering secondary production, species composition, and abundance (Maerz et al. 2010; Spyreas et al. 2010).

In North America, the modern invasive population has long been thought to be a hybrid of a noninvasive native population and agronomic cultivars brought from Europe in the early 1800s (Merigliano and Lesica 1998). Genetic analysis concluded that the early North American herbarium species are distinct from the Eurasian species (Jakubowski et al. 2013). In the Pacific Northwest, RCG was introduced and cultivated for livestock forage by the late 1800s, in part because of its high productivity in the low-lying wet areas ubiquitous to the region. Early cultivation of RCG began on the southern Oregon coast, and the Coquille Valley ultimately provided much of the seed for establishment along the Pacific Coast (Schoth 1938). In the lower Columbia River and estuary (LCRE; Figure 1), RCG does not grow in brackish waters near the mouth, but through cultivation and successful natural reproduction, it now covers extensive wetland areas in the 176 river-kilometer tidal freshwater region (Borde et al. 2020).

Natural area managers and restoration practitioners in Washington State's Puget Sound, California's Sacramento River estuary, and the LCRE identify widespread establishment of RCG in tidal wetlands as a significant challenge for restoration planning and design. The Columbia Estuary Ecosystem Restoration Program (CEERP), for example, is a collaborative program of the Bonneville Power Administration, the U.S. Army Corps of Engineers' Portland District, the National Marine Fisheries Service, and five sponsors implementing tidal wetland restoration (Ebberts et al. 2018). CEERP focuses on the hydrologic reconnection of tidal wetland habitats to restore