



Tracking Soil Dynamics to Understand Plant Community Development in Restored Tidal Wetlands

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Columbia River
Estuary Conference



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TWO MONITORING PROGRAMS

Ecosystem Monitoring Program (EMP)






Status and trends monitoring of ecosystem condition
Provides basic understanding, fills knowledge gaps on estuarine - tidal freshwater section of lower river

Action Effectiveness Monitoring & Research Program (AEMR)

Allows evaluation of whether restoration actions achieved the goals of the project
Provides understanding of benefits of restoration actions



Vegetation Model: July 2018

Classifications	Acres	% Cover
 Open Water	5.6	4%
 Emergent <i>Wapato, Aquatic Mix</i>	16.6	11%
 High Marsh Mix <i>Rushes, Sedges, Reed <u>Canarygrass</u></i>	13.9	10%
 Reed <u>Canarygrass</u>	63.4	44%
 Riparian Forest/ Shrub Scrub	45.1	31%

MCNA South Unit

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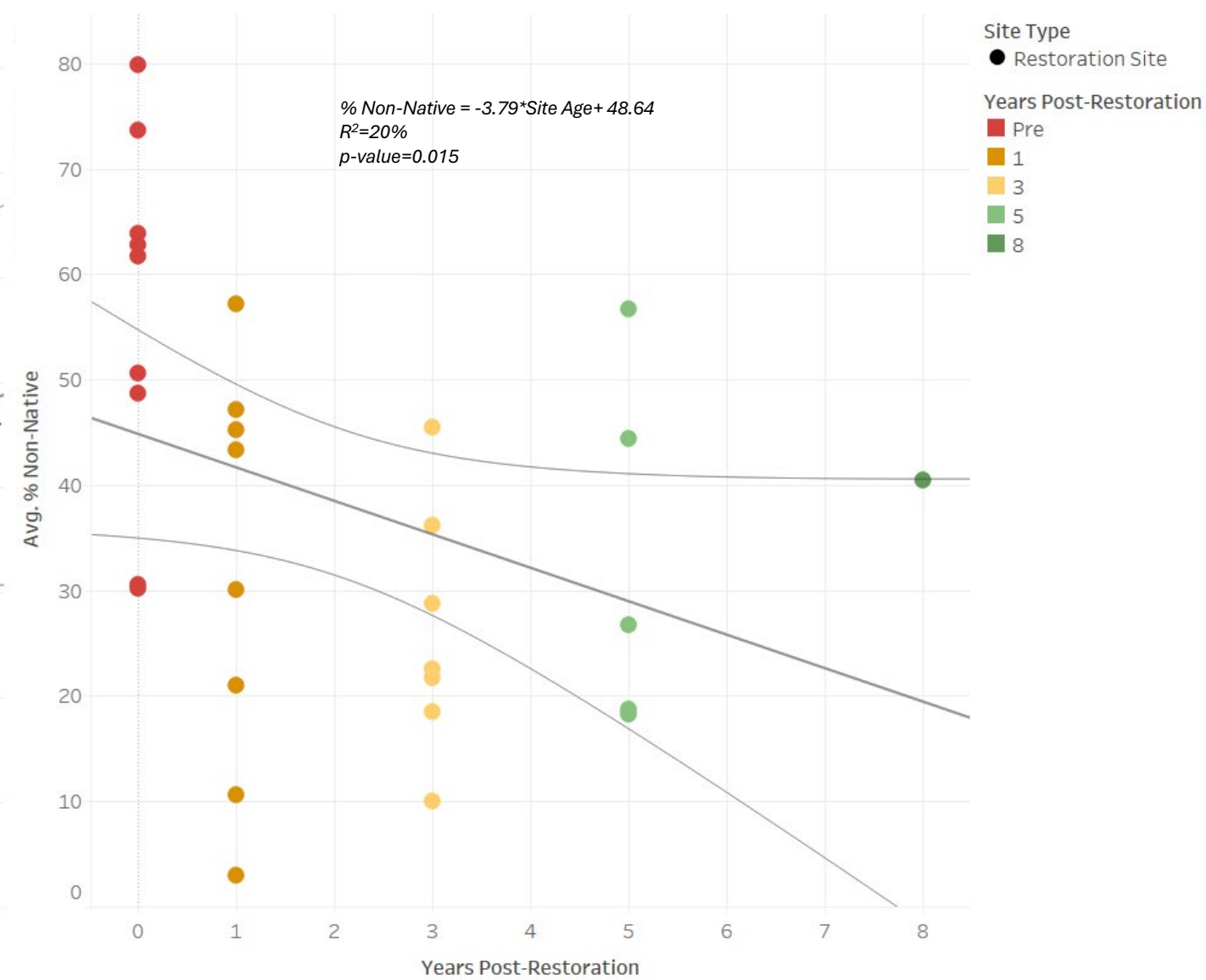
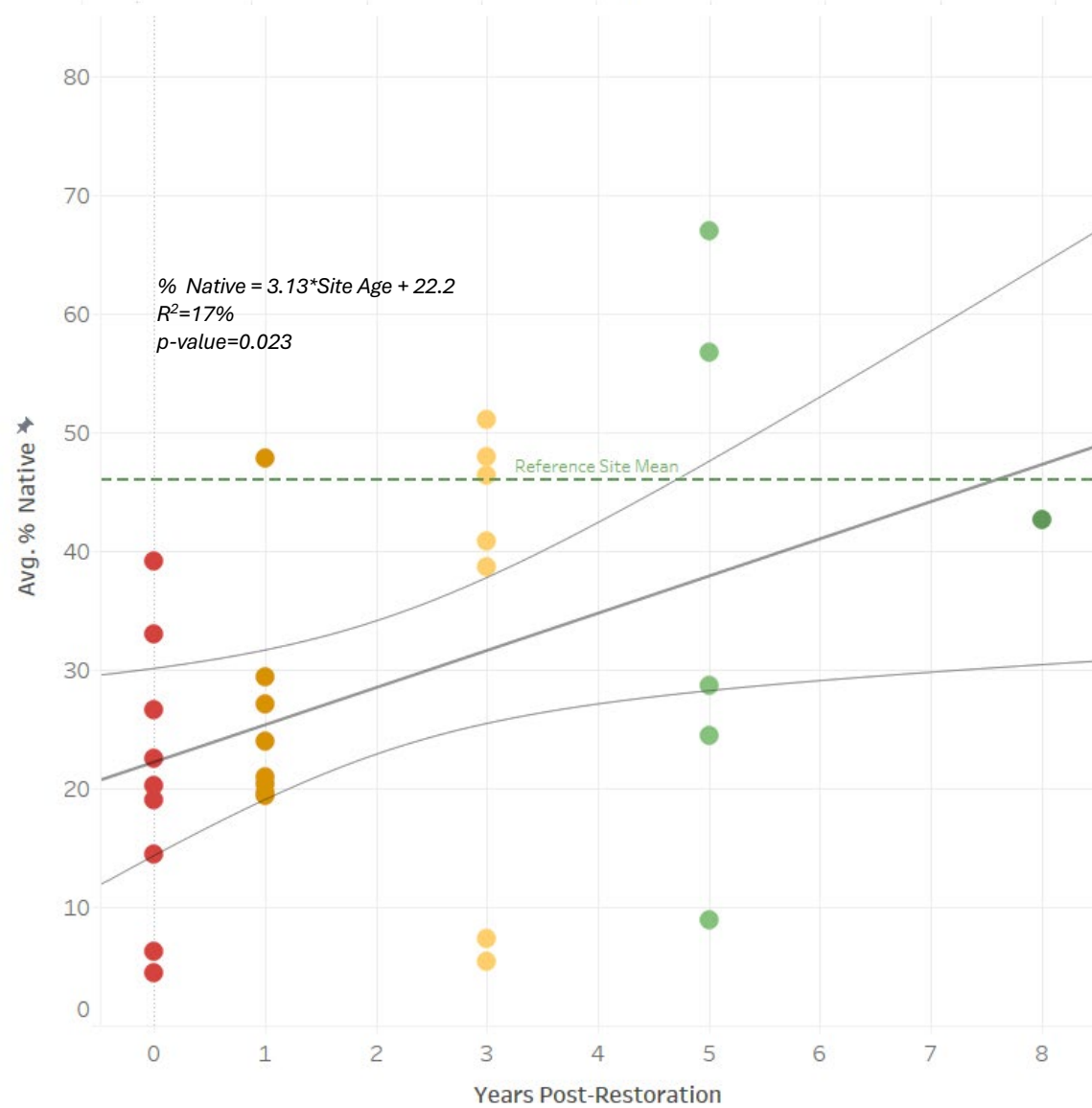
0.1

0.2 miles

Emergent - Wapato



Total Native and Non-native Relative Cover (%) vs Years Post-Restoration



↑ Years Elapsed = % Native ↑

↑ Years Elapsed = % Non-Native ↓

Why monitor soil?



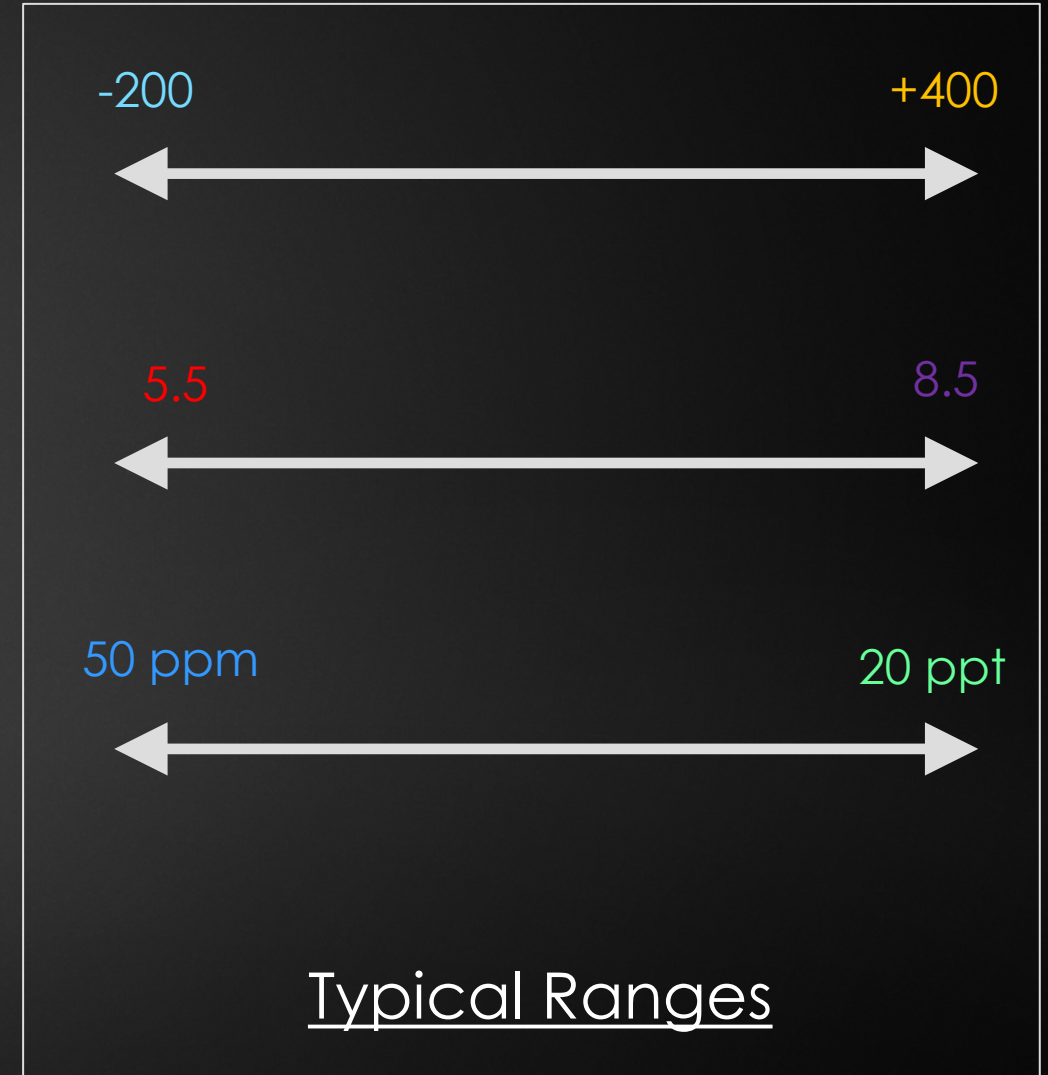
- Pre-restoration sites = typically have well-drained soils with high oxygen concentrations
- Wetland restoration often including reintroducing or shifting flooding regimes
- This causes a cascade of biogeochemical and microbial reactions in the soil, ultimately driving plant community development

Soil Parameters Measured

Oxygen Reduction Potential (ORP): The amount of oxygen present

pH: Acidity vs Basicity

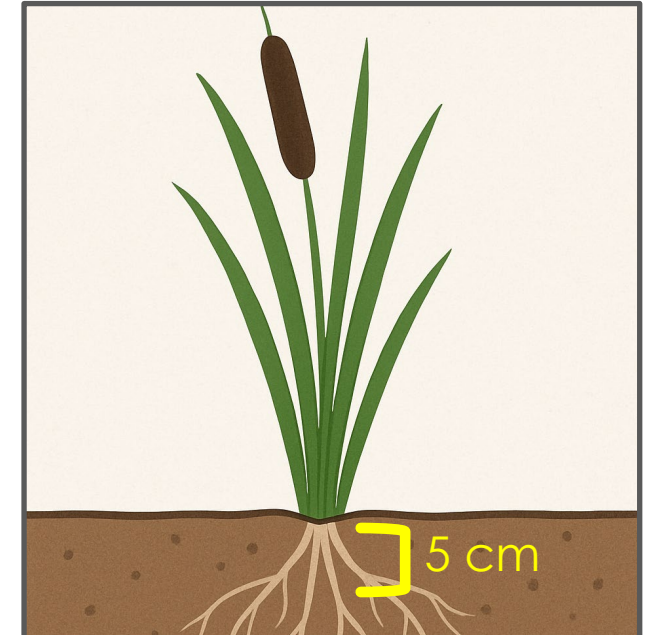
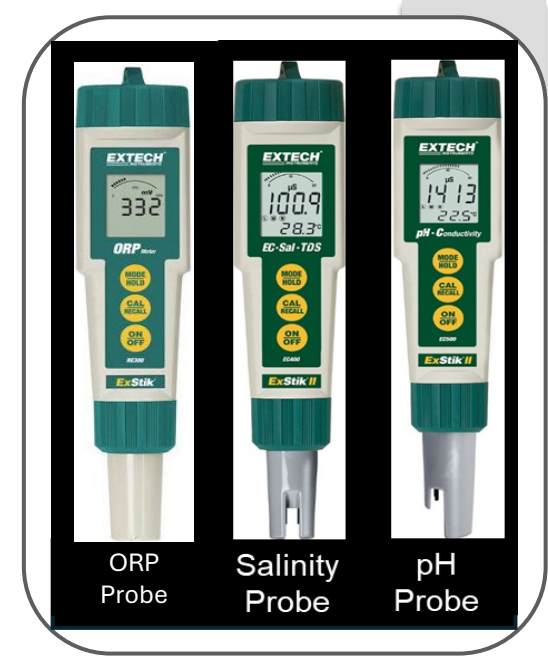
Salinity: The amount of dissolved salts present



Method

Materials: ExTech soil probes

Method: Probes are inserted ~5cm deep into the soil. Measurements are taken within vegetation quadrat.



What does the data show us?

WHEN:

Years
Elapsed

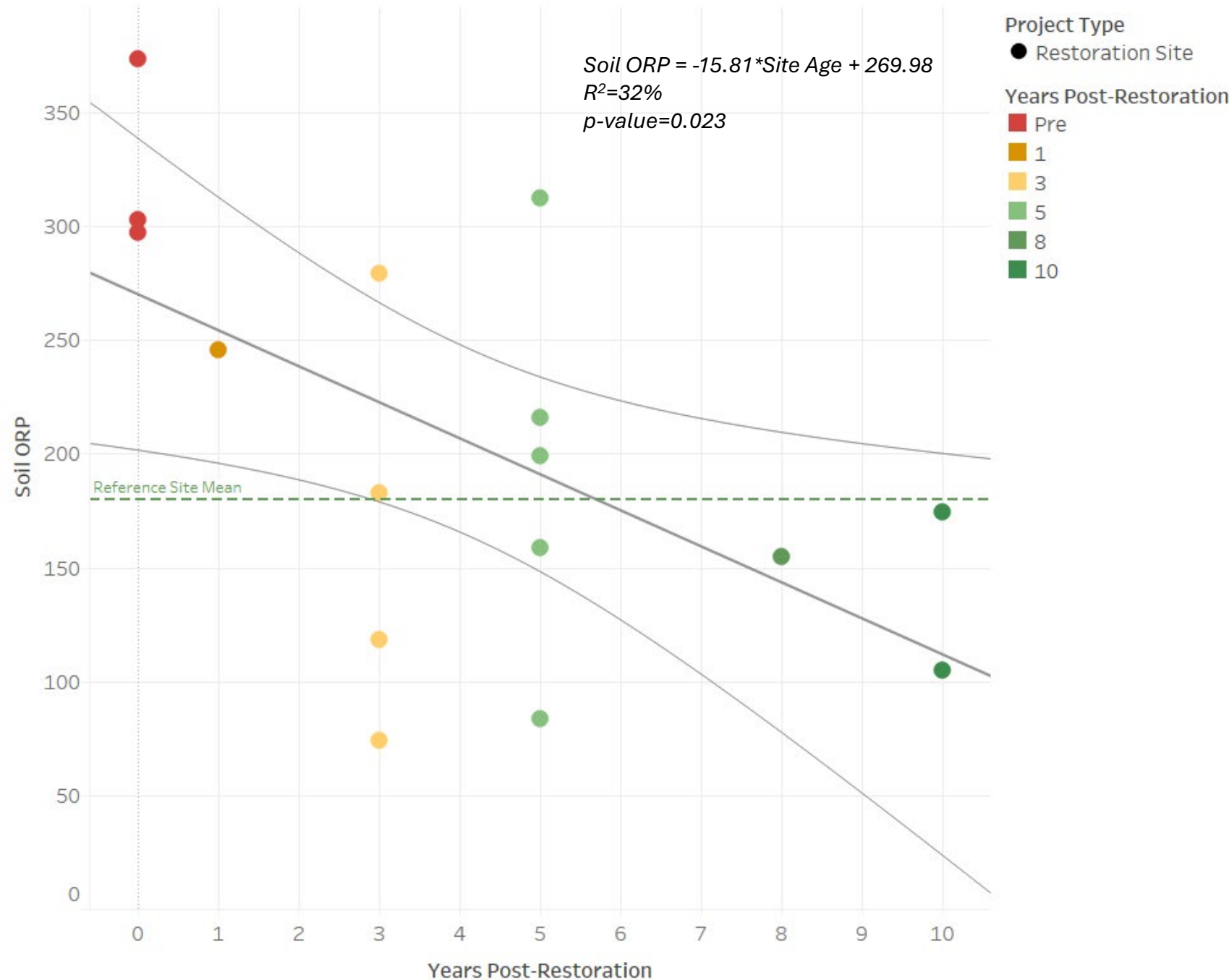


THEN:

ORP



Soil ORP vs Years Post-Restoration



WHEN:

ORP

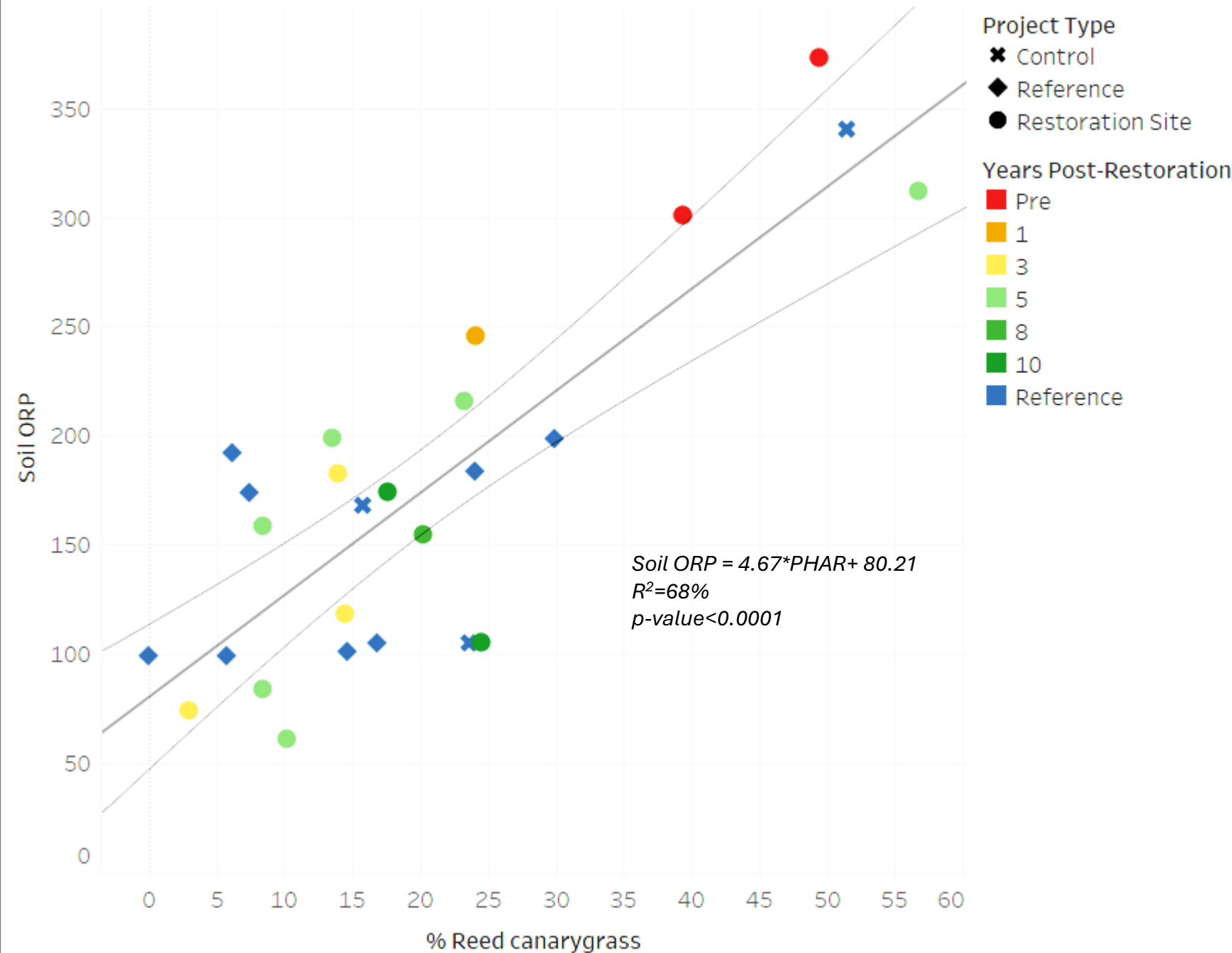


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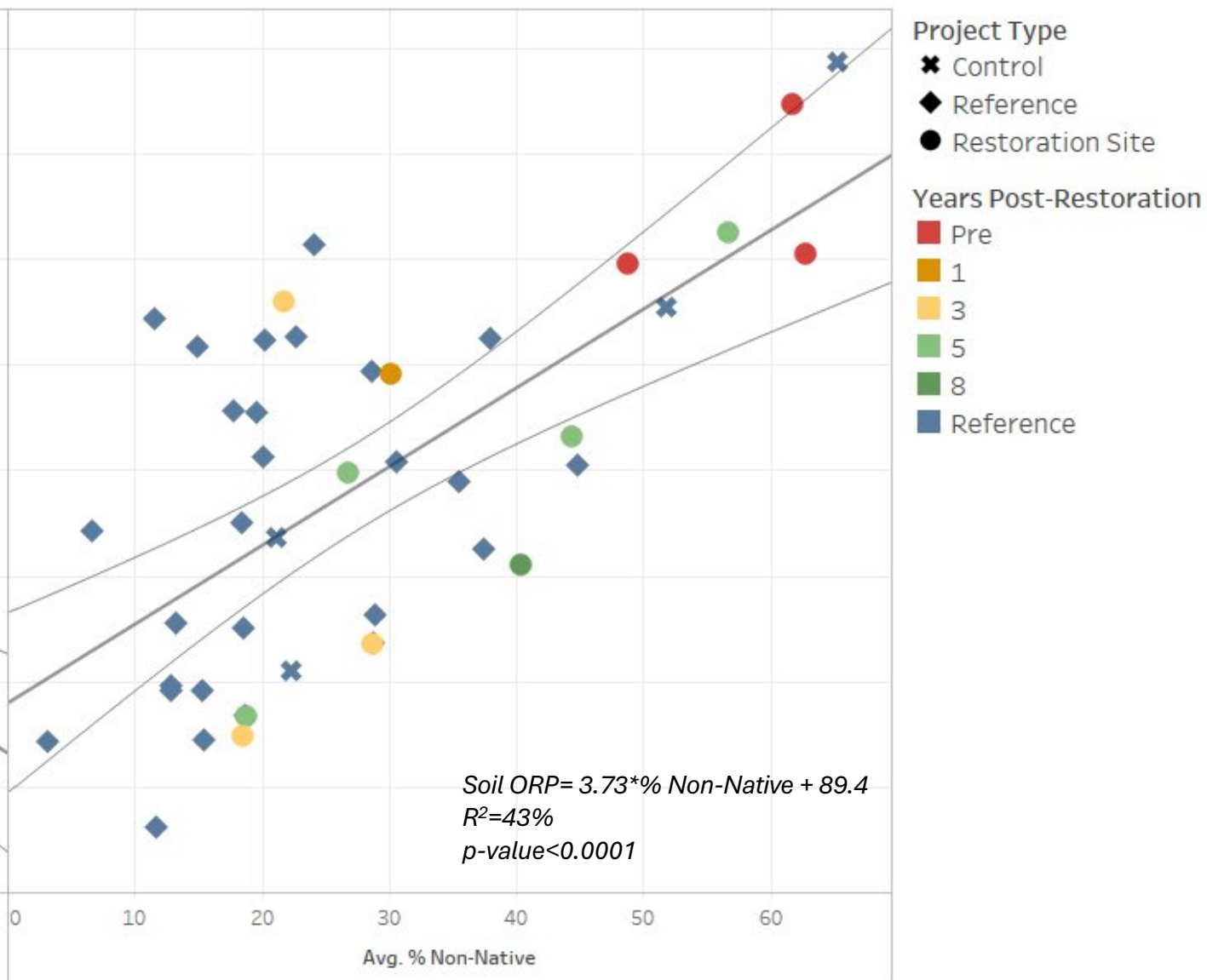
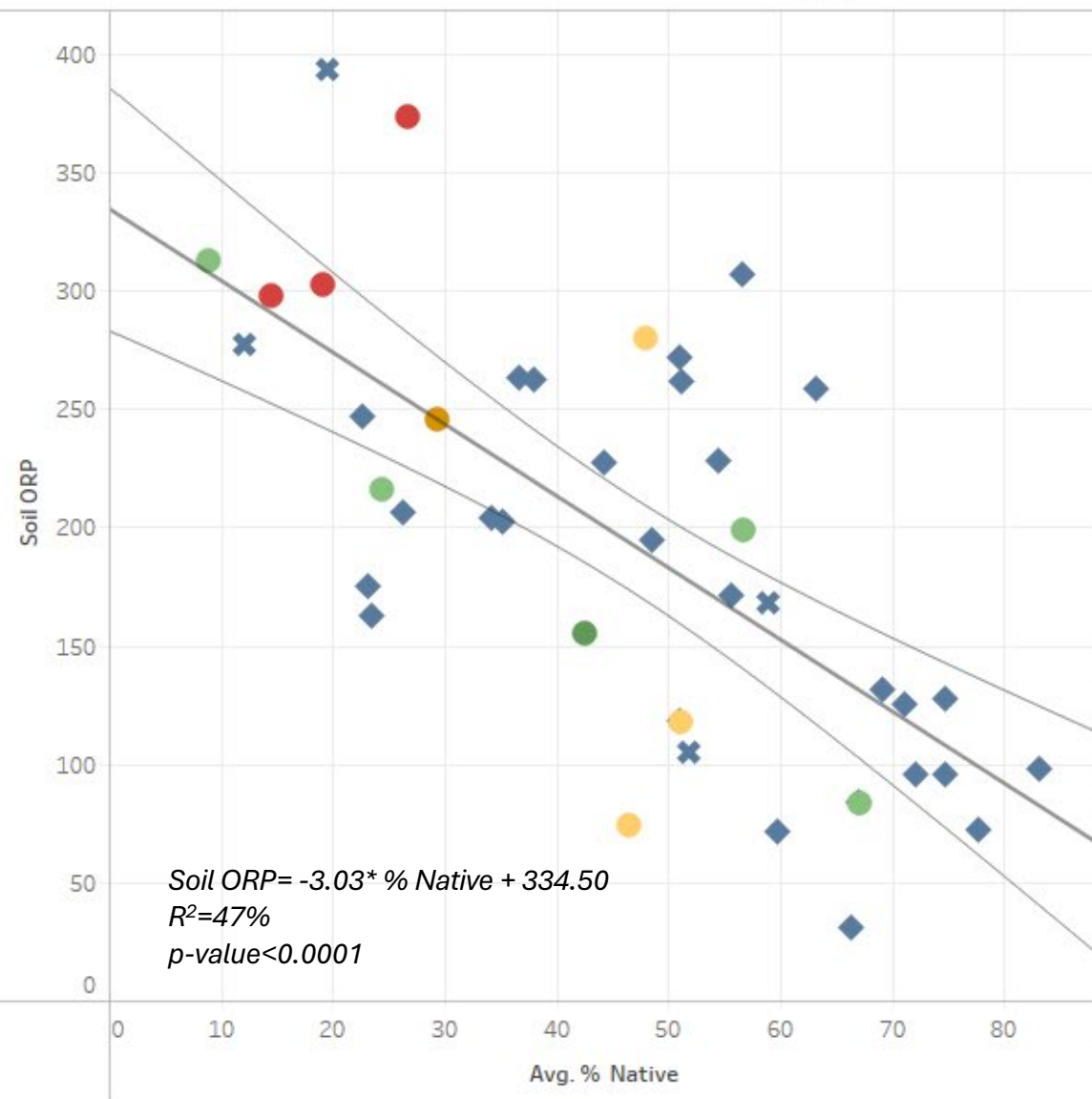
Reed
Canary
Grass



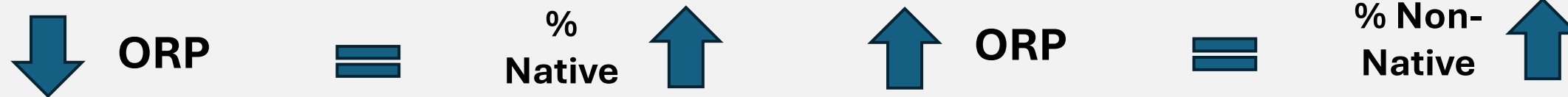
Reed Canarygrass and Soil ORP



Total Native and Non-native Relative Cover (%) vs Soil ORP



- Project Type**
- ✕ Control
 - ◆ Reference
 - Restoration Site
- Years Post-Restoration**
- Pre
 - 1
 - 3
 - 5
 - 8
 - Reference



WHEN:

Years
Elapsed

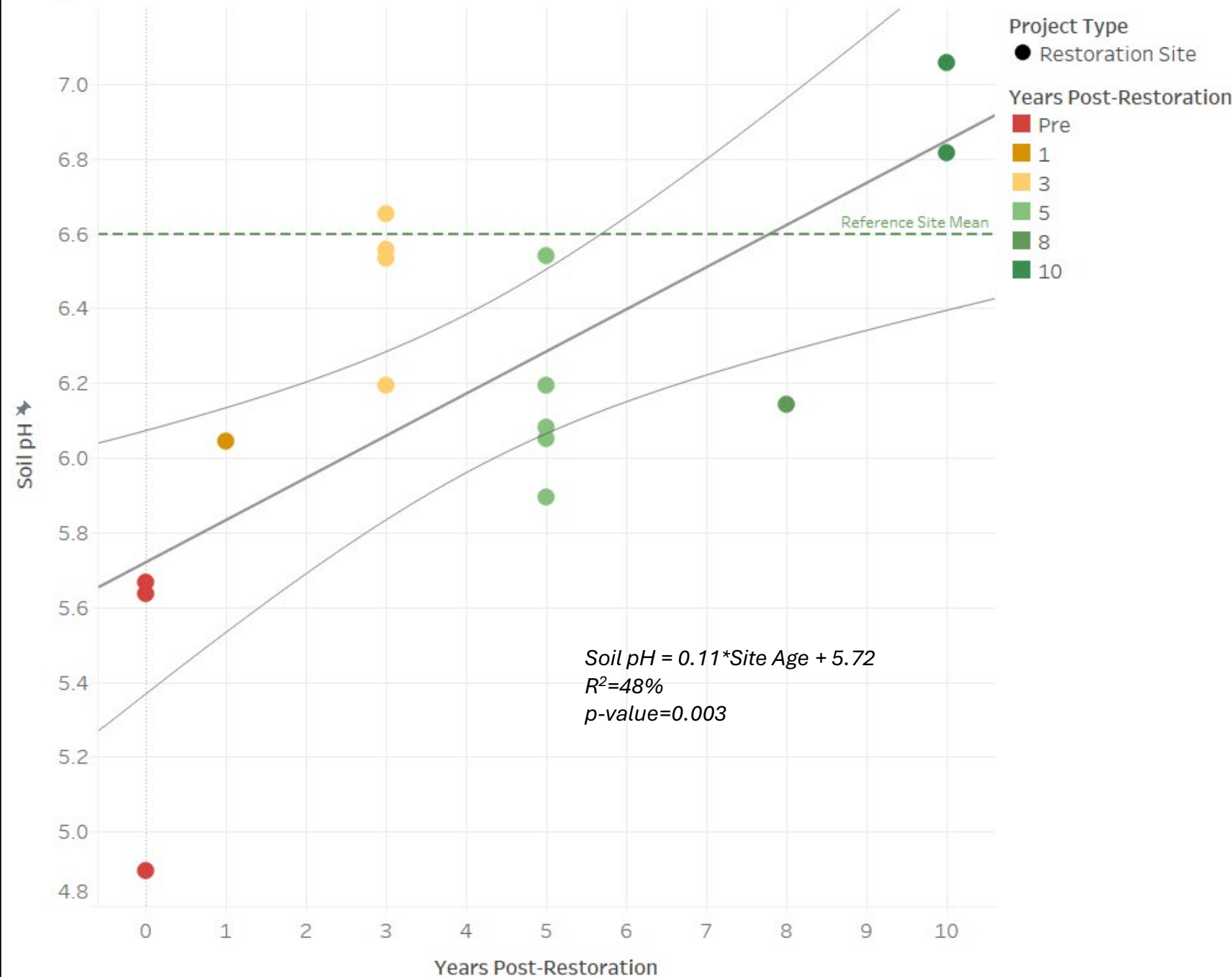


THEN:

pH



Soil pH vs Years Post-Restoration



WHEN:

pH

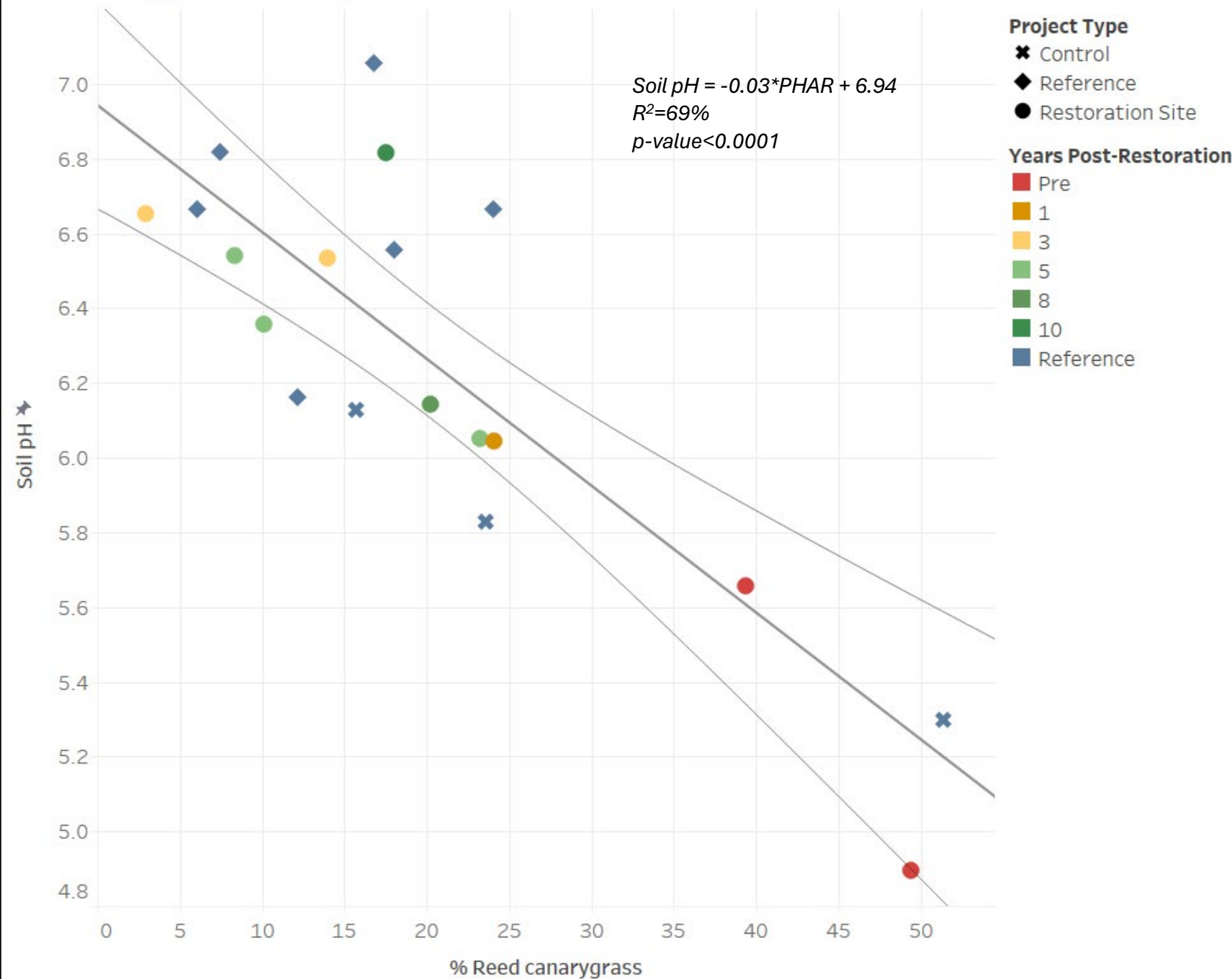


THEN:

Reed
Canary
Grass



Reed Canarygrass and Soil pH



Reaches of the Columbia River

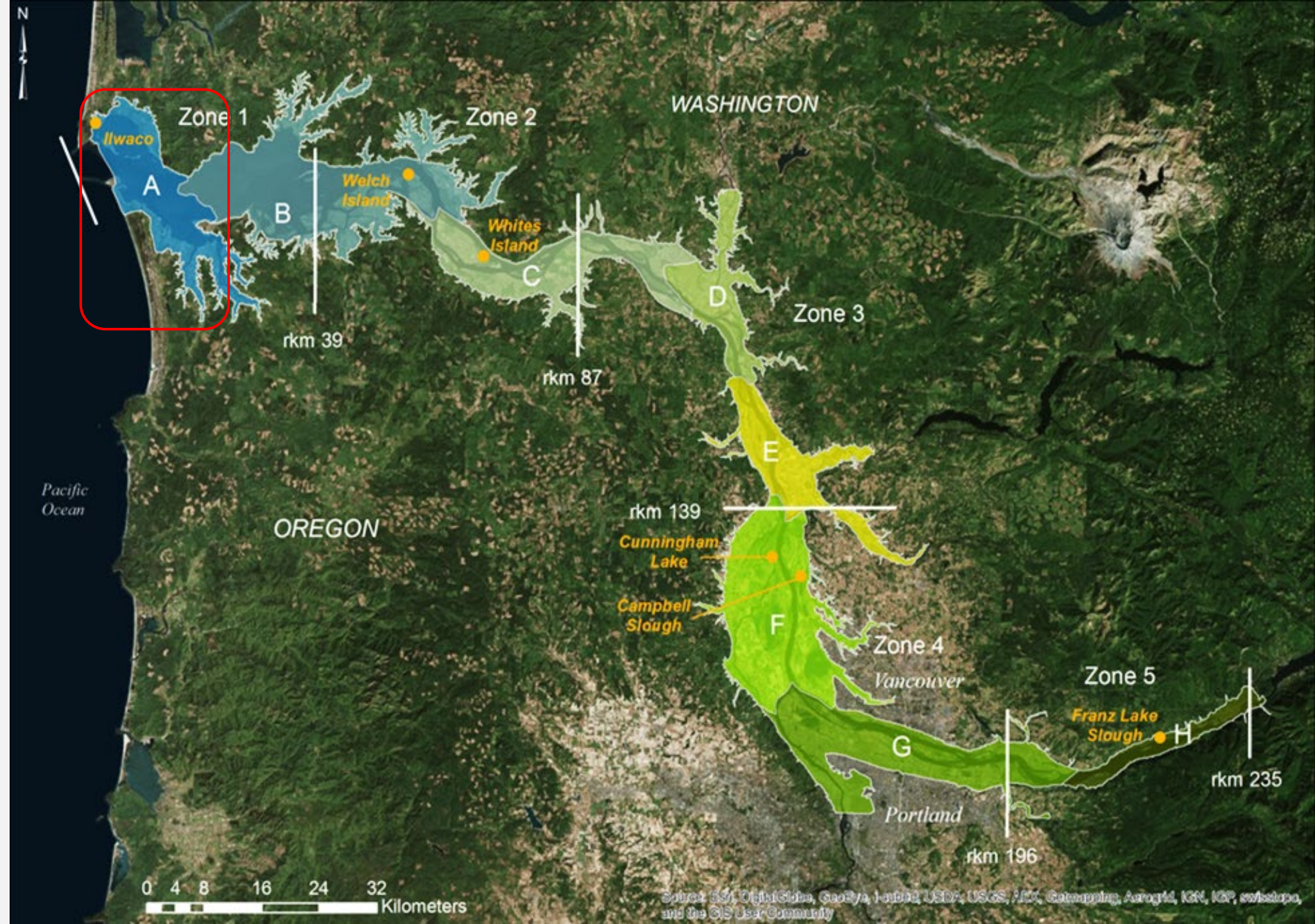


Figure 1. Lower Columbia River and estuary with hydrogeomorphic reaches (A-H) specified by color (Simenstad et al. 2011) and wetland zones (1-5) delineated by white lines (Jay et al. 2016). The 2022 EMP trends sites are shown in orange.

WHEN:

Elapsed
Years

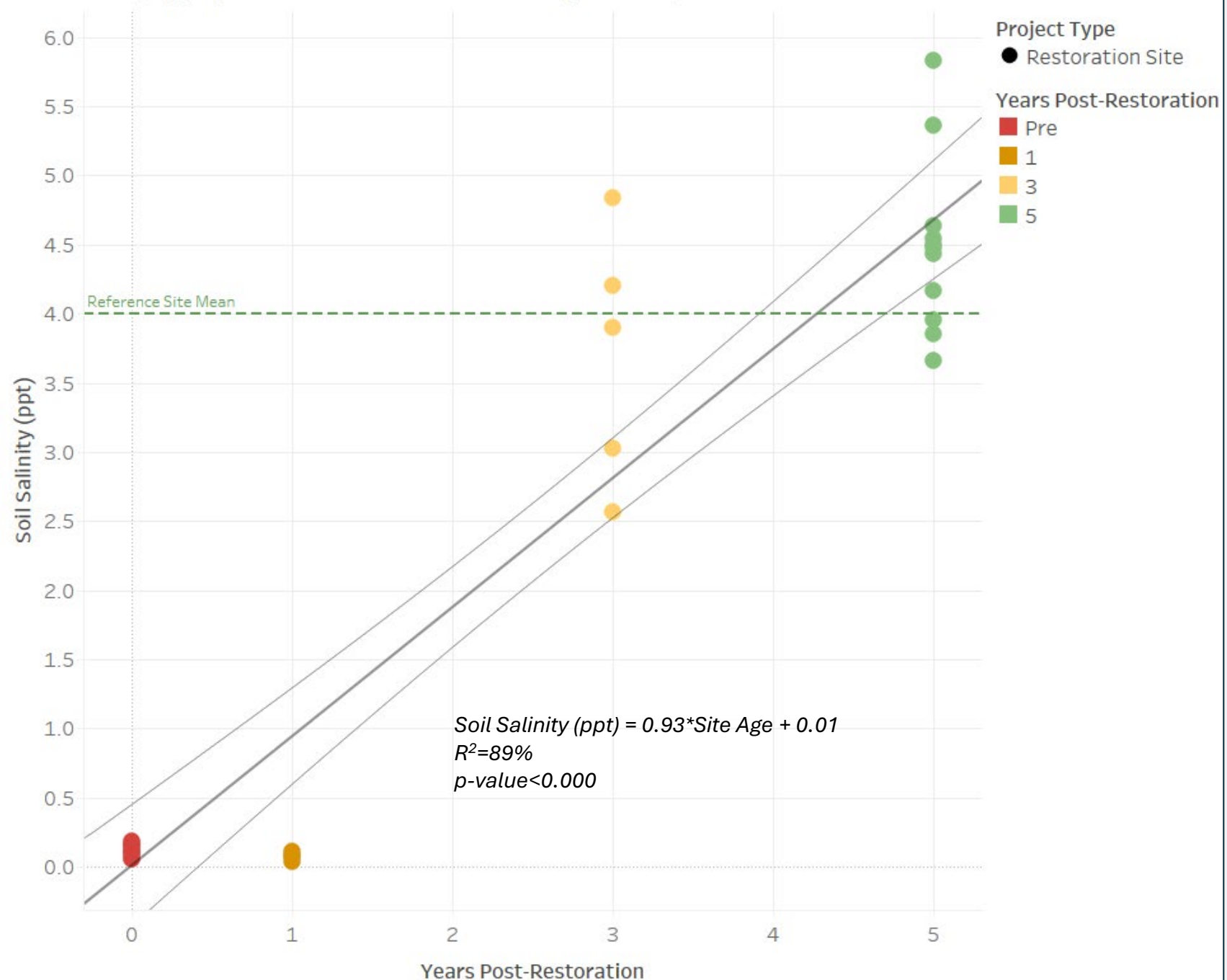


THEN:

Salinity



Soil Salinity (ppt) vs Years Post-Restoration (Reach A)



WHEN:

Salinity

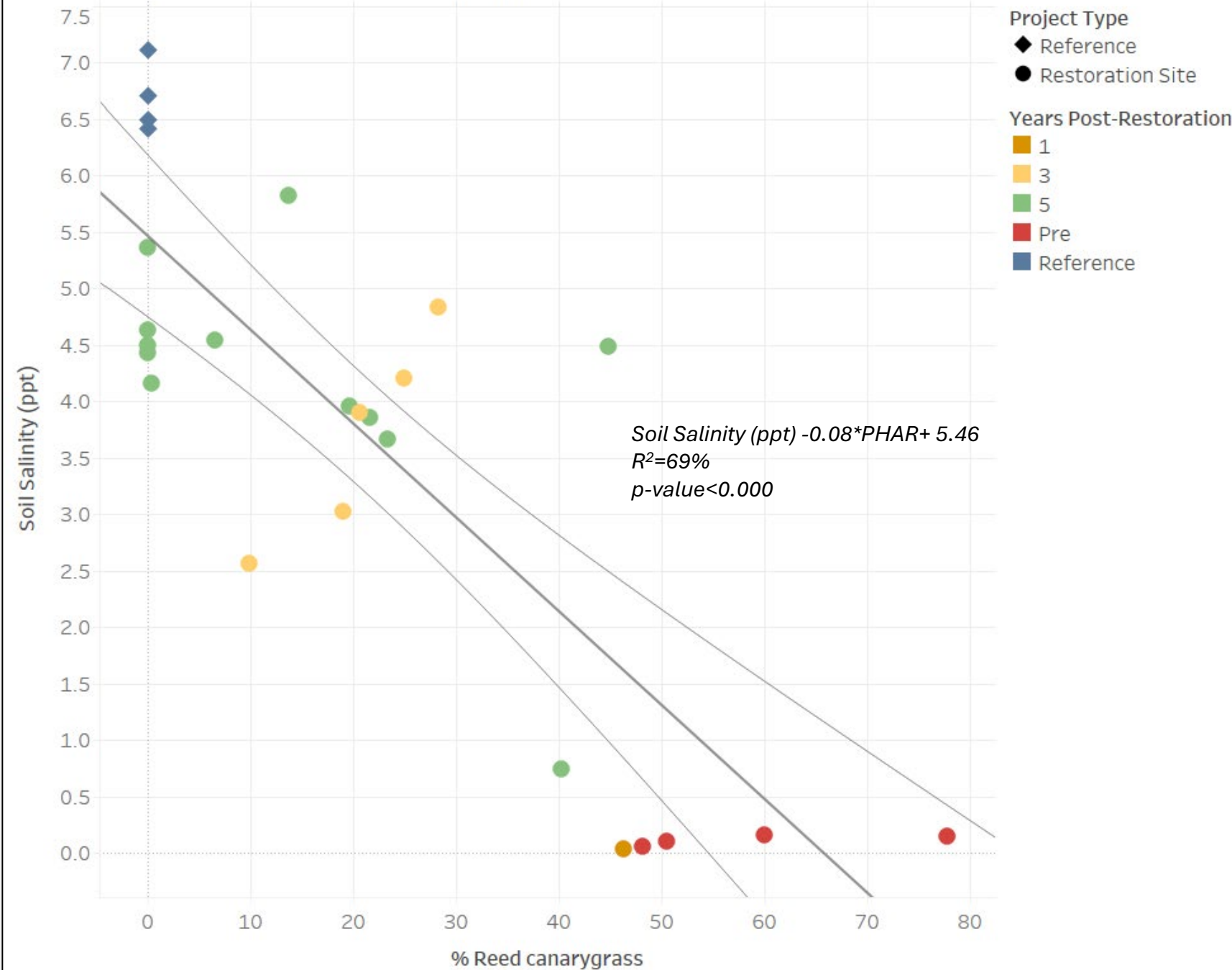


THEN:

Reed
Canary
Grass



Reed canarygrass and Soil Salinity (ppt) (Reach A)



Takeaways

- ▶ With the reintroduction/shifting of flooding regimes:
 - ▶ **ORP decreases**
 - ▶ **pH increases**
 - ▶ **Salinity increases**
- ▶ The shift of these parameters correlates with a reduction of Reed Canarygrass and other non-native species
- ▶ Further understanding soil dynamics and the impact on microbial communities and nutrient cycling post-restoration can offer insight into plant community development and adaptive management post-restoration

Next Steps

- Manuscript in prep, for a more comprehensive analysis
- Expanding this analysis to incorporate inundation
 - Targets for soil chem ranges to assess potential for veg community development



RESEARCH PARTNERS

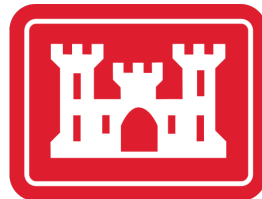
THANK YOU



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Fun in the field, I, Edgar, S. Kidd, S. Rao, D. Marquis, ongoing