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Monitoring vegetation response to culvert removals in a salt marsh: education for college interns, citizen scientists and the local community.

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Monitoring vegetation response to culvert removals in a salt marsh: education for college interns, citizen scientists and the community.



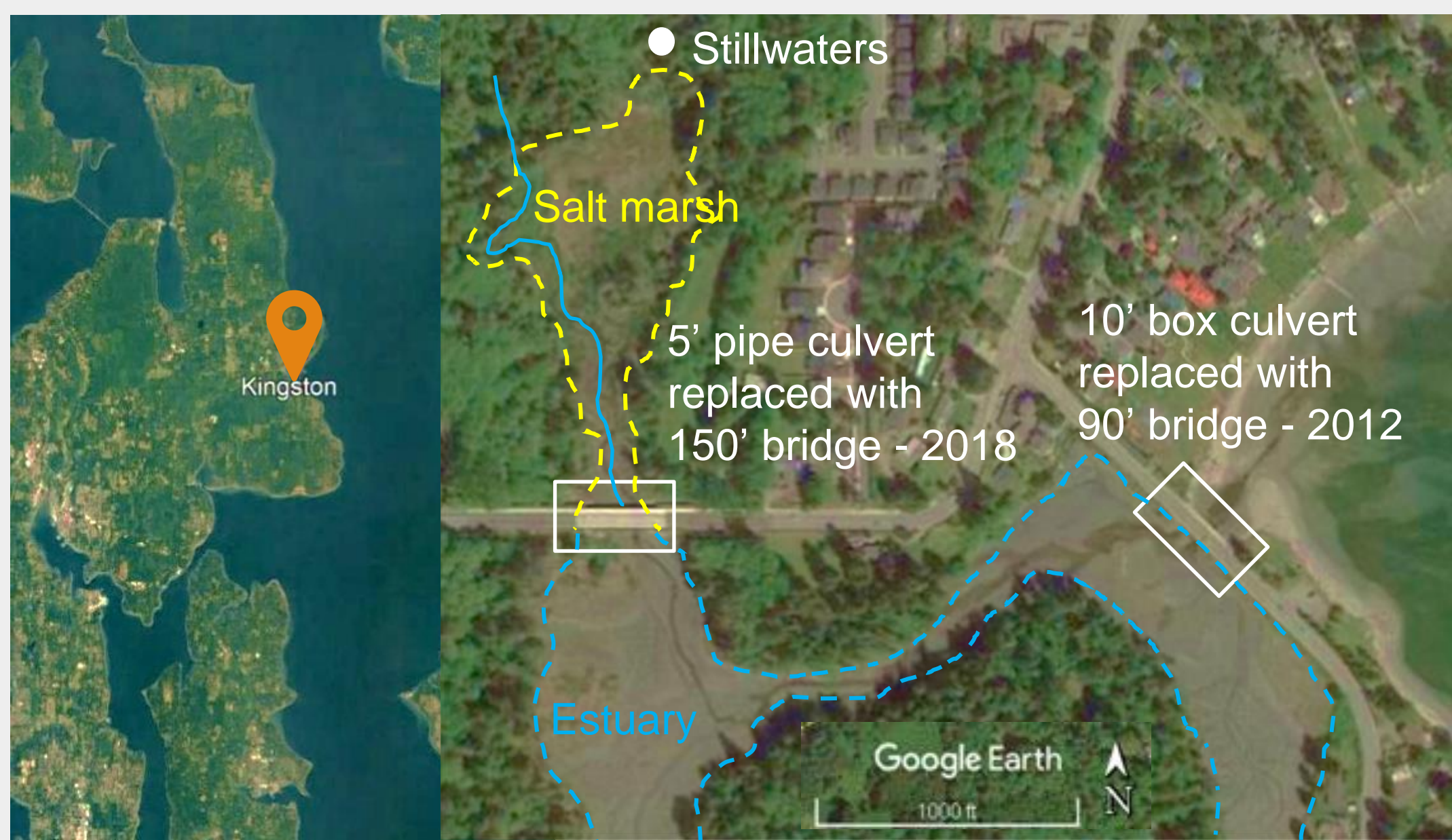
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Stillwaters Environmental Center

Stillwaters is a place-based environmental education center with a focus on monitoring and protecting lowland streams and pocket estuaries.

We use our long-term monitoring program on Carpenter Creek as environmental education for our volunteers and college interns, while using our education programs in the community to promote stewardship of our natural environment.

The Carpenter Creek Estuary Restoration Project replaced two undersized culverts with long-span bridges; first at the mouth of the creek in 2012 and then between the salt marsh and lower estuary in 2018.



Monitoring Salt Marsh Recovery

Culvert removal restored natural tidal flow and improved drainage during heavy winter rains.

We have been documenting the responses of salt marsh vegetation to these changes, including:

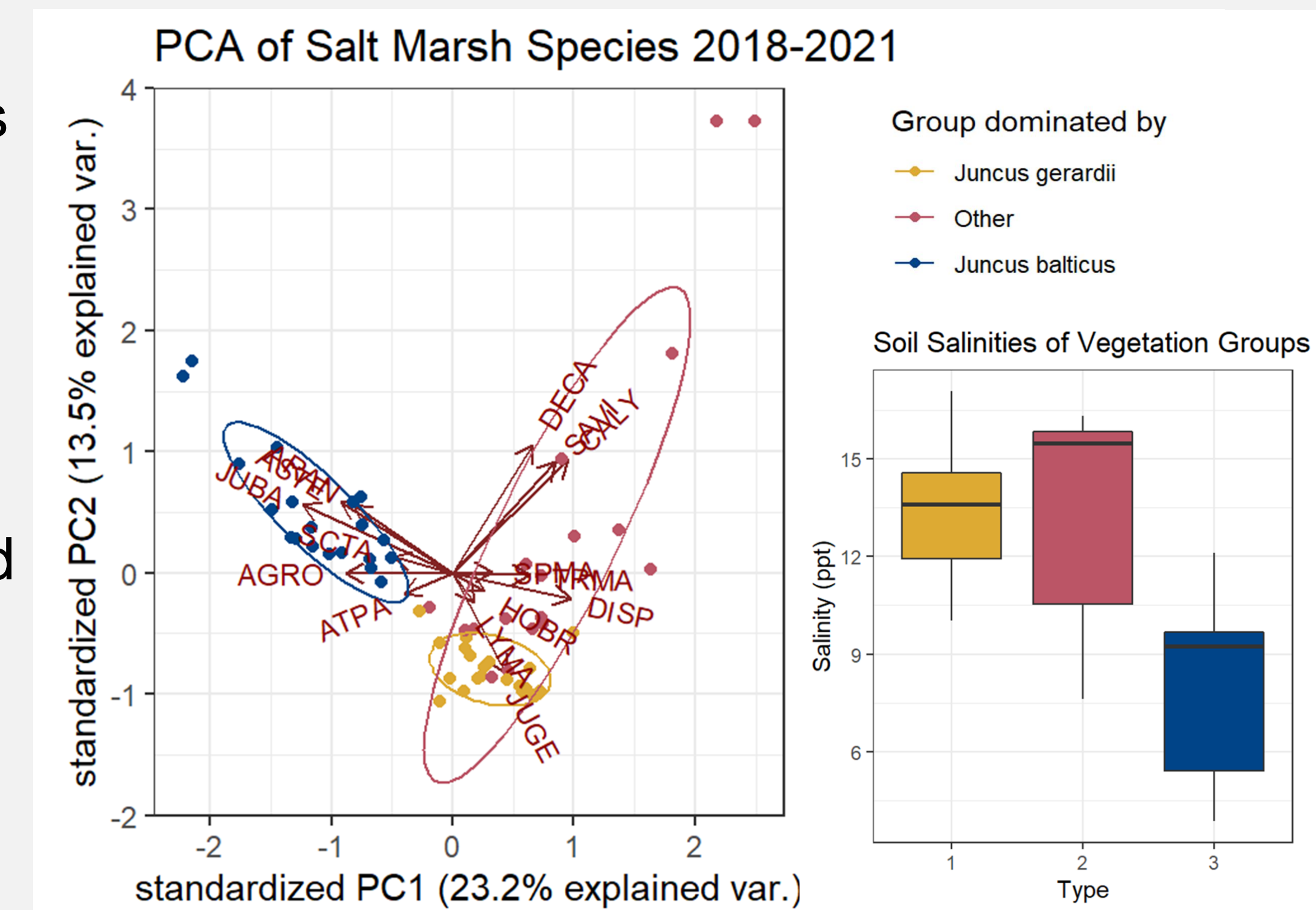
- The distribution of native salt marsh plants and invasive reed canary grass relative to the salinity of water in their root zones (pore water).
- The health of Sitka spruce along the marsh edge relative to soil moisture and salinity.

Salinity and Species Composition in Salt Marsh Vegetation Plots

- 15 1-m² randomly-sited vegetation plots were used to compare pore water salinity and species composition.
- Volunteers surveyed plots using an easy and replicable point-intercept method (50 points).

Results

- Two species of rush were each predominant (> 90%) in 5 plots while the other 5 plots had mixed compositions of other species
- Juncus balticus* (JUBA) was predominant at lower salinity sites than *J. gerardii* (JUGE) or Other.

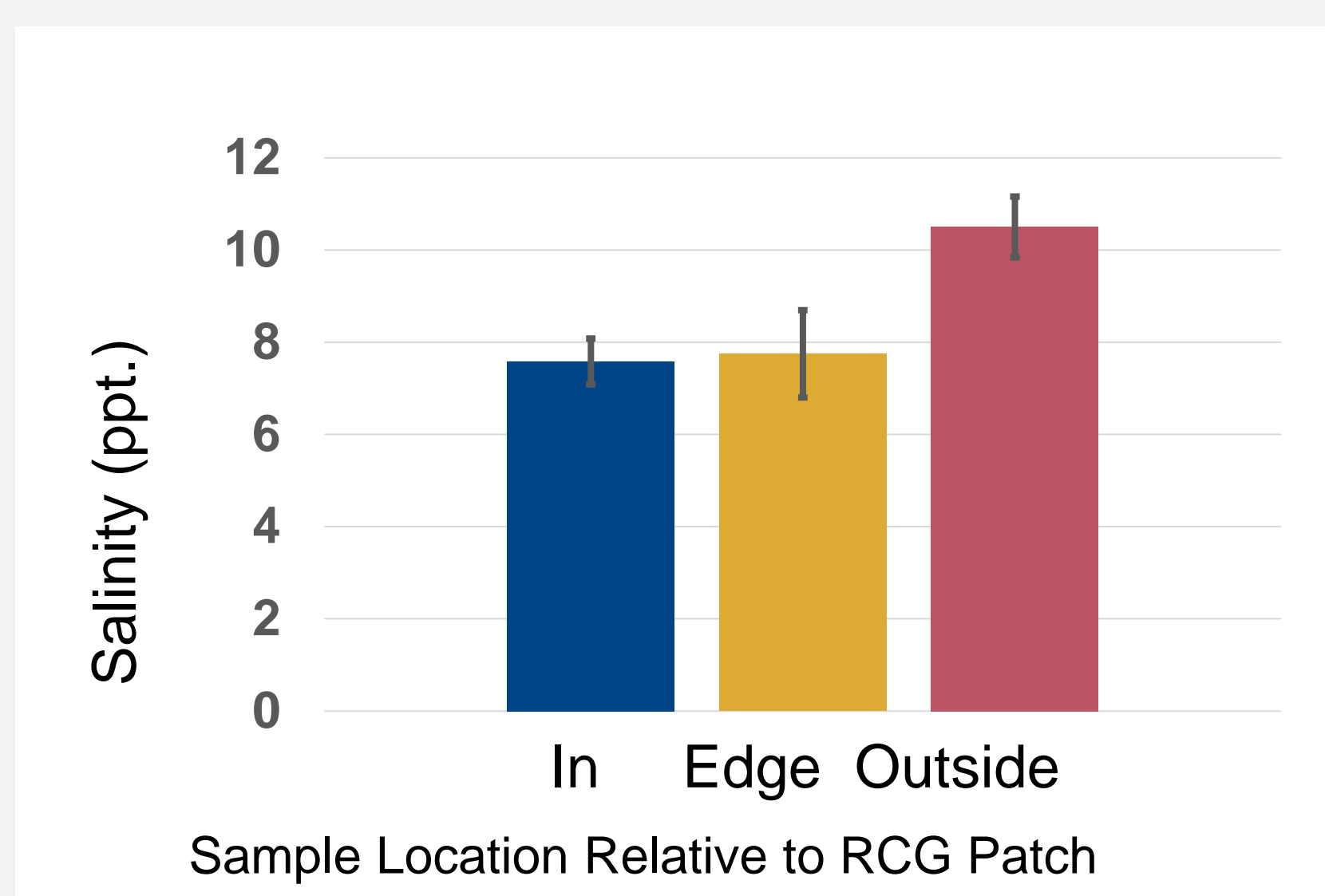


Salinity and Invasive Reed Canary Grass (RCG) Retreat in Salt Marsh

- Prior to culvert removals, reed canary grass (RCG) was abundant throughout the upper marsh. Since culvert removals, RCG persists only along the creek.
- Interns measured pore water salinity at 12 sites along the edge of a 33 m long RCG patch and 1 m to either side (12 additional sites 'In' the patch and 12 'Outside').

Results

- Salinity was significantly lower where RCG persists ('Edge' & 'In').

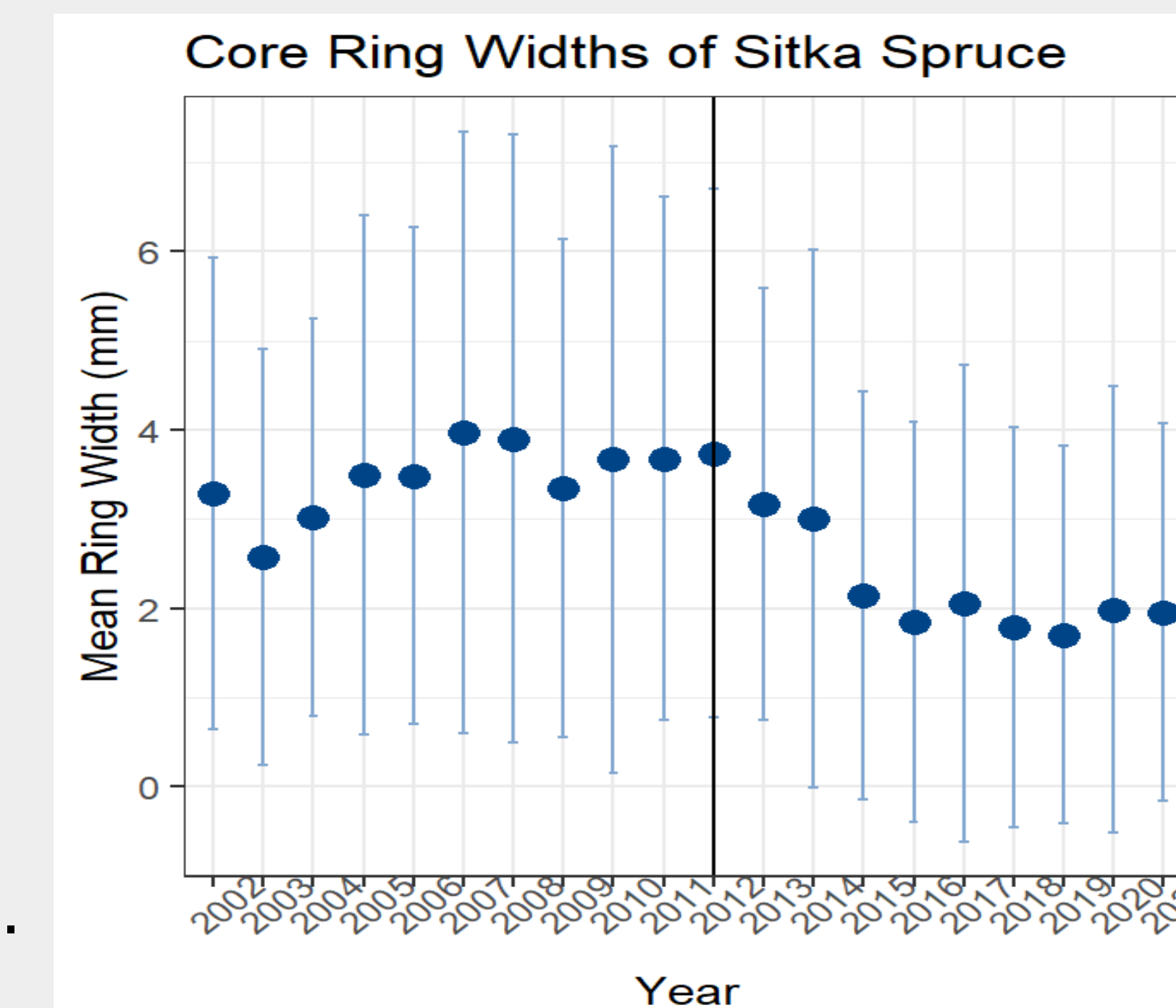


Sitka spruce Mortality Study

- Selected 20 trees at least 25 cm DBH and determined percent live foliated crown via ocular estimation.
- Measured soil moisture and salinity from 10 ml soil cores taken at a depth of 0.35 m for each tree.
- Conducted dendrochronological analysis on cores from each tree to examine changes in growth.

Results

- Tree health decreased with increasing soil moisture.
- Tree growth decreased significantly after the first culvert removal in 2012 and has not recovered in the decade since.



Monitoring as Education

Interns – Participate in ongoing field/lab studies with volunteers, include past years' data in their analyses, and share their work via our education & outreach.

Volunteers – Enjoy hands-on experience in protecting/restoring natural habitats and share what they learn with the community.

Community – Learn why habitat restoration is necessary to maintain/improve the quality of life they enjoy on Puget Sound

Lessons Learned

Salt marsh vegetation – Changed more quickly than expected and primarily in response to the first culvert removal.

Interns & Volunteers – Interns learn from discussing their projects with volunteers, who are inspired by working with young people who share their interests.

Community – Interested as individuals, K-12 classes, and small groups, but we are experimenting with effective ways to reach a wider audience.



Acknowledgements

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- Interns** - UW: Robert Cassis, Maddie Rutter; WWU: Jonathan Olsen, Cory Osterhoudt, Jenna Wright, Valerie Mansfield, Sara Mahmud

