

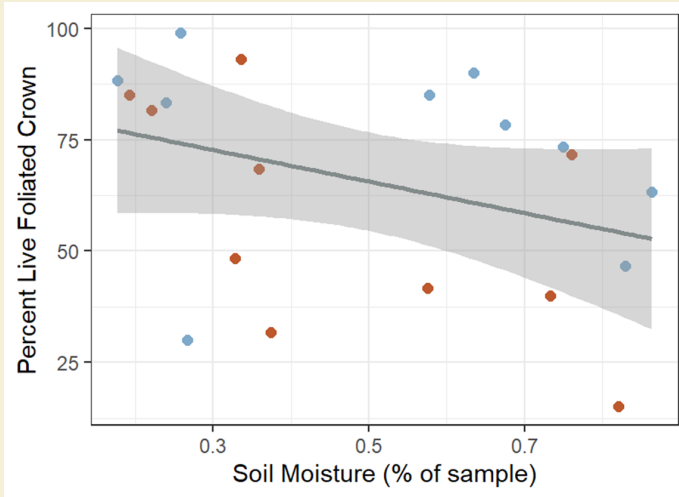
# HOW ESTUARY RESTORATION IMPACTS SITKA SPRUCE



Over the past ten years, our volunteers noticed many Sitka spruce trees in the Carpenter Creek salt marsh were starting to die. To better understand our ecosystem, we decided to find out why!

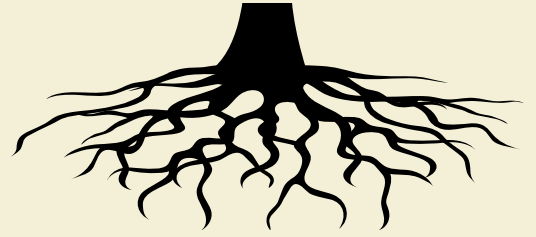
Forests respond to big environmental changes. The biggest recent change in the estuary was the removal of two undersized culverts in 2012 and 2018. We wanted to see if this change had anything to do with this decline in Sitka spruce.

## WHY ARE SITKA SPRUCE DYING IN THE CARPENTER CREEK SALT MARSH?



## SOIL CONDITIONS

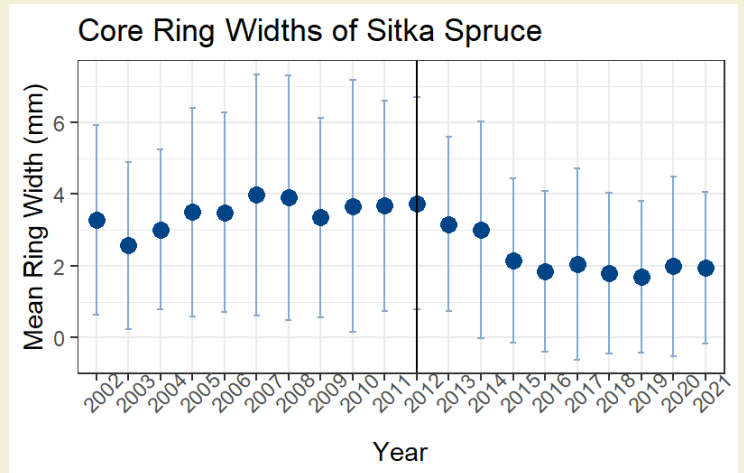
In many Sitka spruce, soil moisture was correlated with tree health. Healthier trees grew in drier soil, and less healthy trees grew in wet soil.



## GOING BACK IN TIME

By measuring the width of tree rings we found out how much Sitka spruce grew each year.

Annual tree growth declined right after the first culvert removal, and hasn't recovered since.



## CULVERT REMOVAL CHANGED THE FOREST

Our data supports the hypothesis that removing the culvert in 2012 was directly related to the decline of Sitka spruce in the salt marsh. We think that when the marsh was opened up to the sea, increased water levels were too much for many of the trees.

## IMPACTS

Tree death isn't necessarily bad! Dying trees will make new habitat for birds, bugs, mammals, and more! fallen logs will make the perfect place for a new generation of salt marsh plants to grow.

## MOVING FORWARD

To make sure we still have a healthy forest, we're planting new Sitka spruce farther upland to create a resilient plant community.

