Regional Drought Response

- Which species are experiencing drought stress?
- What is happening in coastal species compared to inland mountain species?
- What do these data mean for tree species' future with more drought?

Reading and Understanding the Data

Introduction

In the video, we learned that grit was required to execute this research project. There were long drives, steep hikes, and concentrated data collection—followed by hikes back out and drives back home. Once the data was back in the lab, cores were aged and then tree rings samples were cut for each year (2013-2016) then repeated. In pages that follow, you and your team will analyze the final data and decide: **How is drought affecting the conifers of northwest California?**

Measuring Tree Stress

We first need to understand how a tree's level of stress was measured. The first way is through Basal Area Index (BAI) which basically measures the area of growth within a tree ring for a particular year.

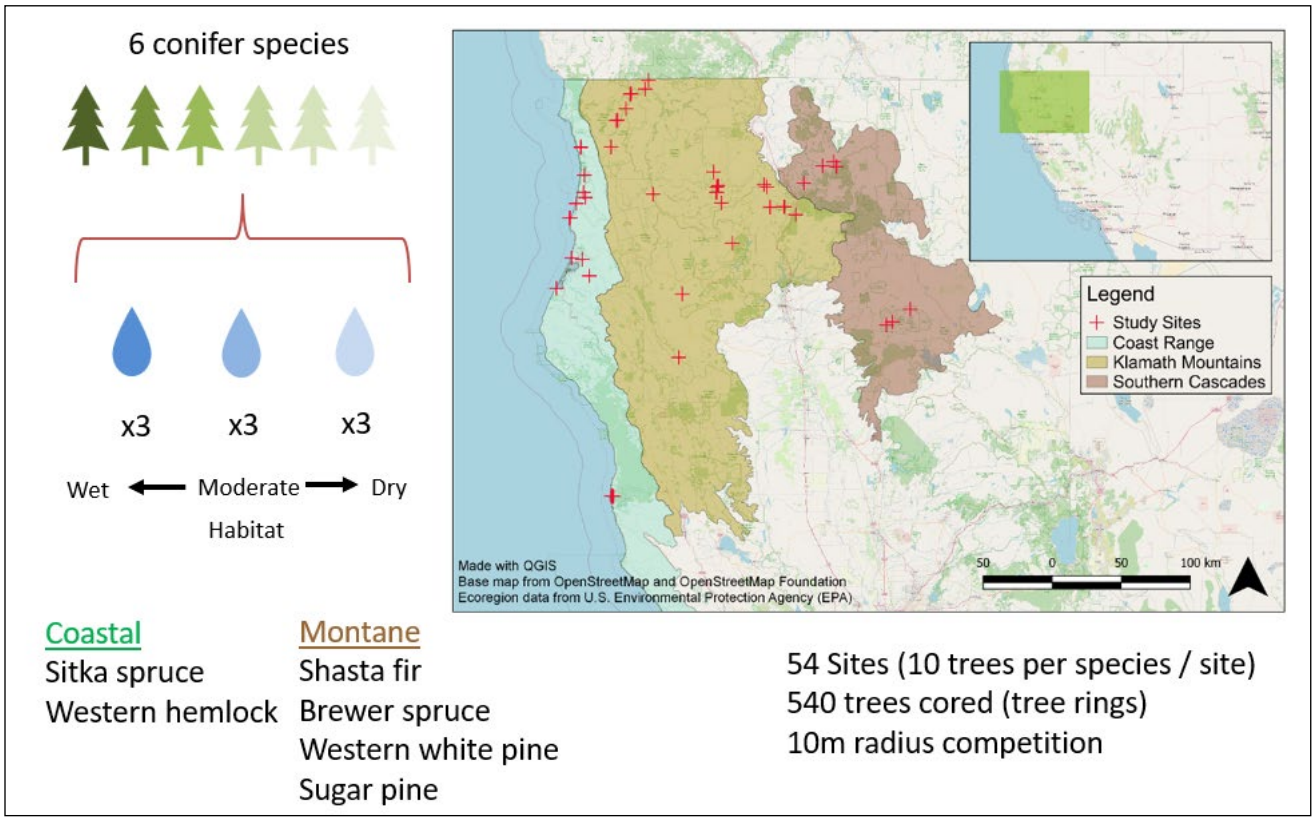
The second approach is through the fixing of two different carbon isotopes during photosynthesis. Trees prefer to fix the lighter and smaller ^{12}C over the heavier and larger ^{13}C. When a tree is experiencing water stress, it closes its stomata and is thus stuck with the ^{13}C that has entered the leaf during transpiration. Scientists are able to look at the concentration of ^{13}C in the tree rings to test for drought stress: the more ^{13}C locked in the tree ring, the more drought stress a tree was experiencing.

The team from Cal Poly Humboldt is measuring distance from a western white pine in the Klamath Mountains.

The team from Cal Poly Humboldt uses and increment borer to core a sugar pine.

Study Design

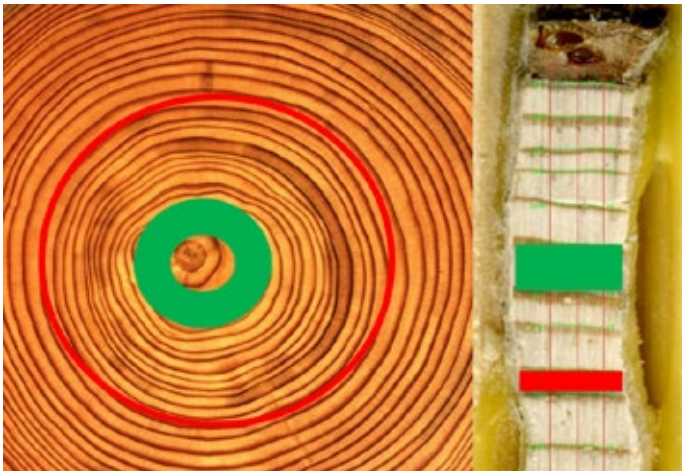
The team from Cal Poly Humboldt had to select what trees to sample and then where to sample them. They chose two coastal species (Sitka spruce and mountain hemlock) and four mountain species (Shasta fir, Brewer spruce, western white pine, and sugar pine). They then designated areas were the trees grow that are either wet, moderate, and dry. This equates to 54 sites to visit, 10 trees per site to core, for a total of 540 tree core samples! That is a significant amount of time for driving to the sites, drilling the trees, and organizing the data.



This is the study design for the Conifer Response to Drought research by the team at Cal Poly Humboldt.

Measuring Tree Growth

Using computer software and the tree cores they collected, scientists measured the amount of wood created through photosynthesis on a year by year basis starting in 2013 (beginning of the drought) and going through 2016 (the year the rain returned). They then compared this across the range of species and climate gradients and averaged their data.



Green highlights a good (wet) year for growth and red indicates a bad (dry) year with poor growth.

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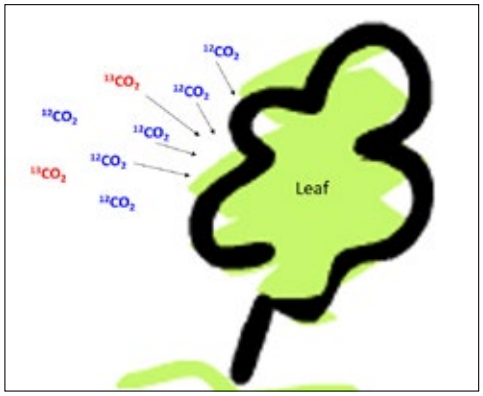
Measuring Carbon Isotopes

Their next measurements were based on carbon isotopes. To do this, they sliced pieces of the tree rings out and sent them off to be analyzed by a mass spectrometer. This data creates a ratio of carbon-12 and carbon-13 within the tree rings.

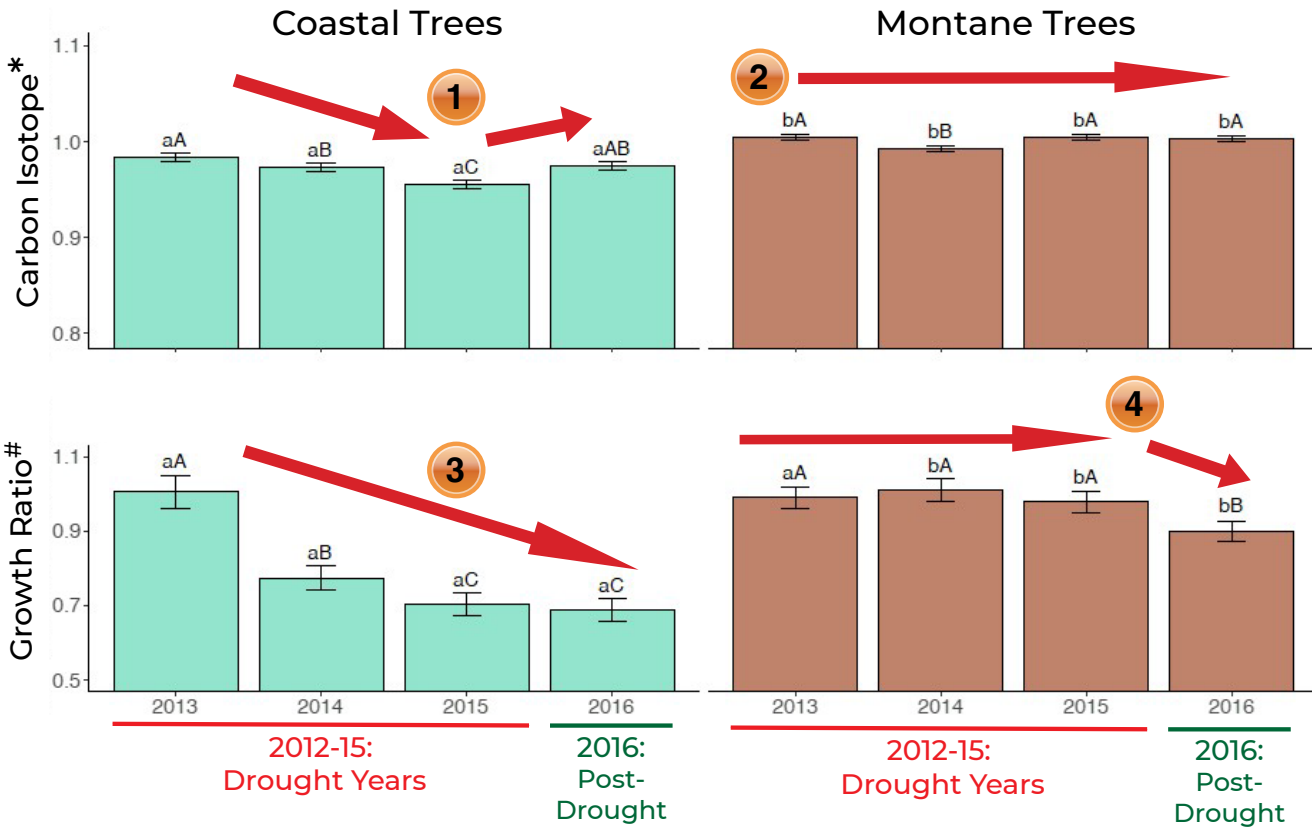


Conifers prefer one form of carbon-12 but are forced to use the isotope carbon-13 during drought.

A mass spectrometer.

The Data

Take a minute to look at the data by yourself. After some thought, share between members of your group. End by answering the questions that follow.



***Carbon Isotope:** Closer to 1.0 means more normal use of ^{12}C for photosynthesis.

***Growth Ratio:** Closer to 1.0 means the tree is experiencing a normal growth year.

- 1. What is the main question scientists are hoping to answer?

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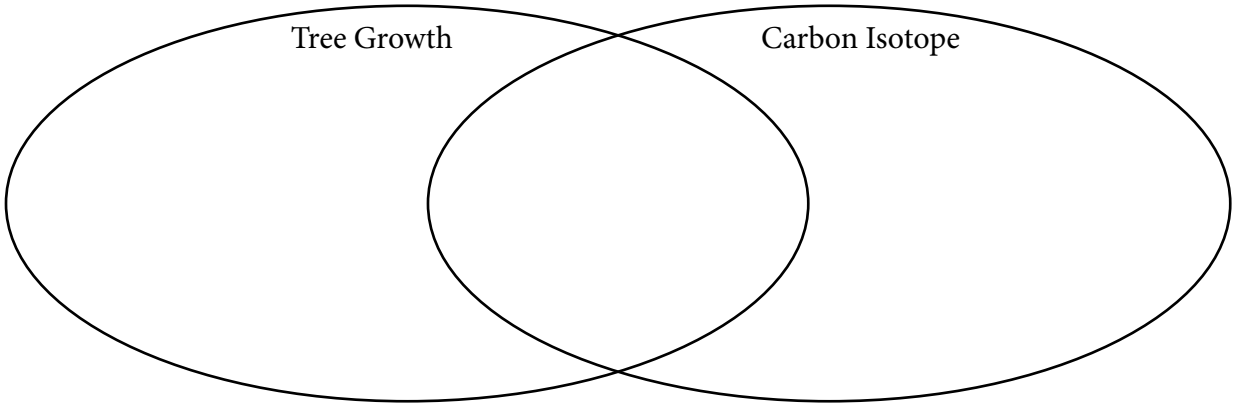
- 2. Complete this Venn Diagram to compare and contrast the two tree ring measurements the scientists are using to look at drought stress.



- 3. Use the following table to write your interpretation of the data the scientists collected, analyzed, and presented. Refer to the numbers and arrows imbedded in the graphs.

	Coastal Trees	Montane Trees
Carbon Isotope Measurement	1	2
Tree Ring Growth Measurement	3	4