

# Northwest California: How Climate Nurtures Diversity

- What is the difference between climate and weather?
- What is a conifer and how are they similar and different to other plants?
- Why do some conifer species live on the coast and others in the mountains?

## Climate Across Northwest California

### Introduction to Regional Climate and Weather

When you look out the window, you're seeing what the weather is like today. Weather is only temporary. For example, a blizzard can turn into a flood after just a few warm spring days. Climate, on the other hand, is more than just a few warm or cool days. Climate describes the typical weather conditions in an entire region for a very long time—30 years or more.

The Northwest California a distinctive climate with wet, cool winters and dry, warm summers. High variation in precipitation (rain and snow) is the norm, with most precipitation occurring between November and April followed by a long dry season from May through October.

Across this vast region, however, there is variability in these patterns (figure 1). In the western part of the region, closer to the Pacific Ocean, there are rainforests fed by wet and cold winter storms. These storms drop over 100 inches of rain and snow in Del Norte County, California, and Josephine County, Oregon. When the storms move across the mountains and reach the eastern Klamath much less rain and snow fall. There is also variation due to elevation. Low elevations rarely receive snow while higher mountains receive much more frequent snow from storms creating deep snowpack.

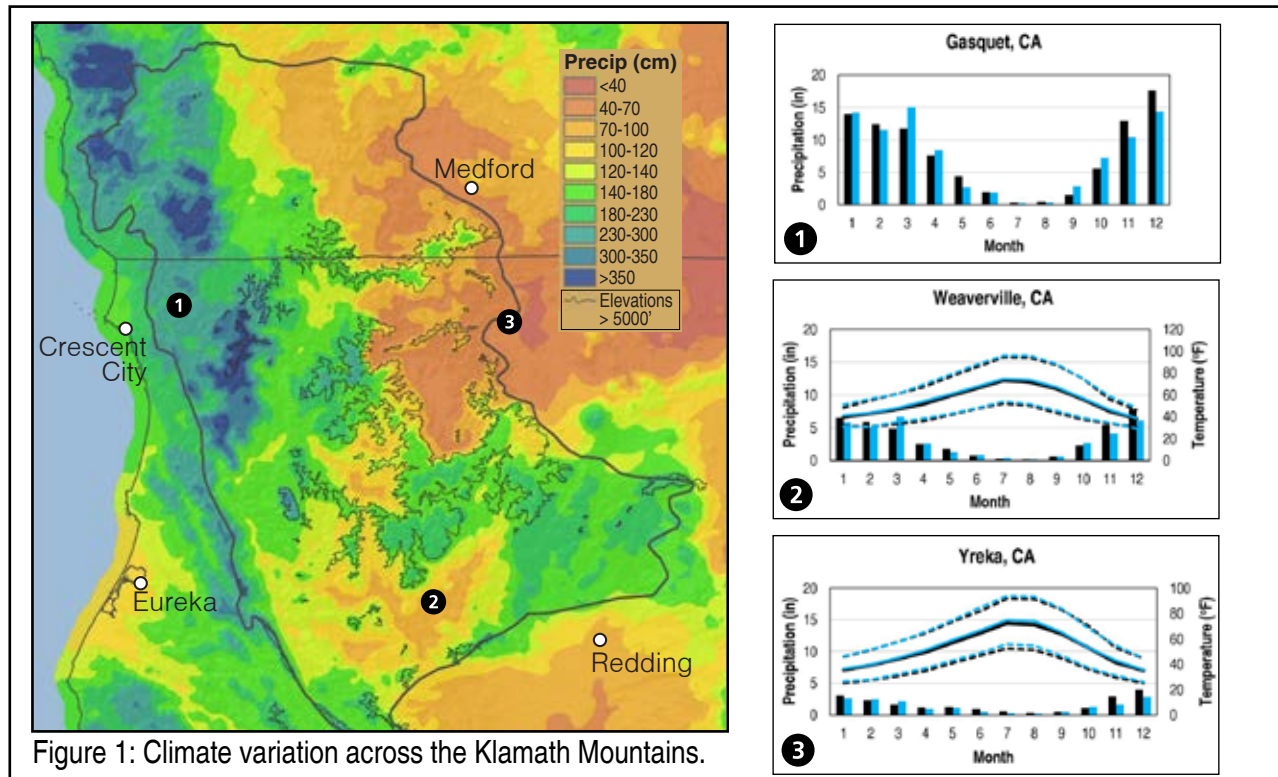


Figure 1: Climate variation across the Klamath Mountains.

# Conifer Diversity in Northwest California

## What is a conifer?

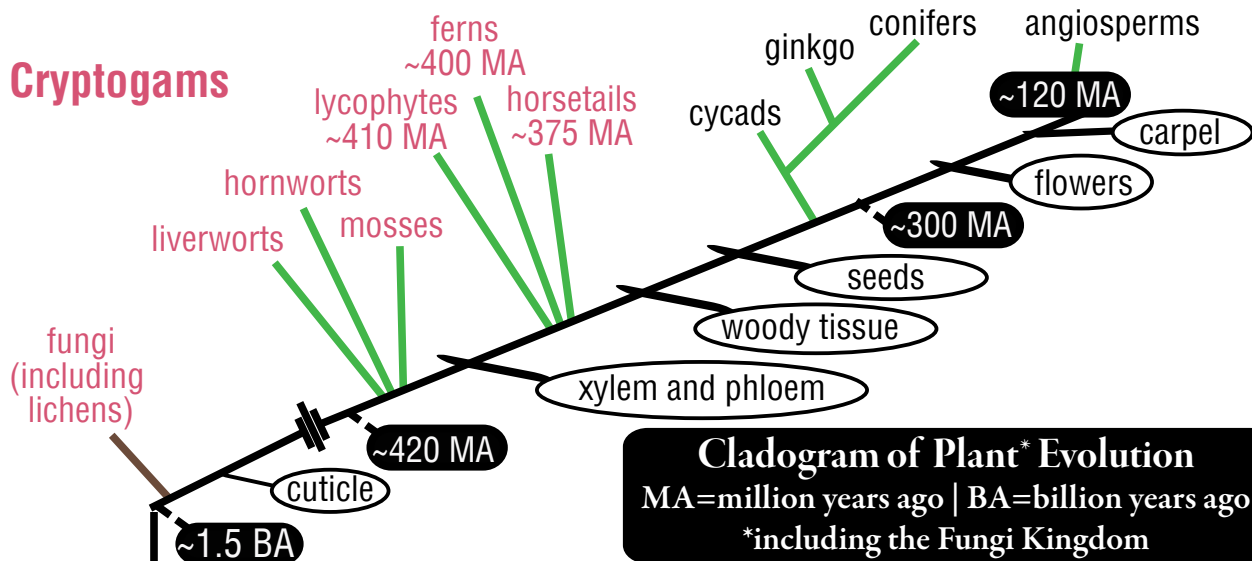
Plants are classified as either nonvascular or vascular, based on the presence or absence of specialized tissue. Vascular plants grow tall, non-vascular plants lay close to the ground (think redwoods versus mosses). Some of the earliest plants to inhabit Earth, such as mosses, are examples of nonvascular plants. About 425 million years ago (Ma) plants developed vascular tissue and became compatible with life on land. Examples of early vascular plants include ferns and horsetails (Figure 2). Gymnosperms (which include conifers) emerged soon after these early vascular plants, about 350 Ma. Fossil evidence suggests that flowering plants emerged about 140 Ma. The majority of land plants can be divided into these three groups: ferns and their allies, angiosperms, and gymnosperms.

Together, gymnosperms and angiosperms comprise the seed plants of the world. The development of seeds opened up new pathways for plant survival because the seed is protected more than a simple spore, which can dry out and die easily. Seeds can endure for long periods of time, without additional food or water, before germinating. Angiosperm seeds form in a carpel, which is part of the female reproductive structure that protects the seed. Gymnosperm seeds form on a variety of structures, the most familiar being a cone, and remain “naked” after development.

At the beginning of the Cenozoic (65 Ma-present) the planet warmed and angiosperms began their proliferation. Flowering plants adapted to diverse habitats



Figure 2: Vascular plants that produce spores include horsetails (top) and ferns (bottom).



across the mid- to lower-latitudes while co-evolving with numerous animals, like bugs and birds, that helped pollinate them and spread their seeds. If the late Triassic (235-200 Ma) was the “heyday of conifers,” then the Tertiary (65-2.5 Ma) was the “age of angiosperms.”

Since the beginning of the Tertiary, the number of angiosperm species has increased rapidly, while conifer species have declined. Today, there are about 1,000 species of gymnosperms, two-thirds of which are conifers. This is a significant decline from the Jurassic when it is estimated there were about 20,000 species of gymnosperms. Angiosperms have radiated into well over 300,000 species today. The two largest families of angiosperms, Orchidaceae (orchids) and Asteraceae (sunflowers), each contain more than 20,000 species alone.

### Conifer diversity across the landscape

Northwest California contain some of the most exceptional temperate plant communities in the world including over 3,500 taxa (species, subspecies, and varieties) of vascular plants, 35 conifer species, and 20 species. The coastal forests of the north coast are classified as a temperate rainforest, receiving over 80 inches (200 cm) of precipitation per year. In the summer, fog is as persistent as the rains in the winter. The montane, or snow forests, of northwest California are characterized warm, dry summers with frequent wildfires and cold winters with deep snowpack (figure 3). In both of these regions, conifers are the dominant plant of the overstory, meaning if you look up you will see evergreen, cone-bearing trees.

However, the tree species you will see on the coast are vastly different that those of the inland montane forests. This is due to where and how each conifer species evolved. Trees that live close to the coast have different needs than those of the inland mountains. Check out the species maps and descriptions below and decide what some of these needs might be!



Figure 3. Coastal forests (top) are characterized by a moderate, year-round wet climate while montane forest (bottom) are wet and cold in the winter but dry and warm in the summer.

# Coastal Forest Conifers

## Sitka spruce (*Picea sitchensis*)

A hallmark of the Pacific Northwest's temperate rainforests, Sitka spruce flourishes along the cold and wet Pacific Coast. The species rarely attempts to cope with dry conditions, preferring instead to grow in the lowland next to the sea. Under the right conditions, Sitka spruce achieves tremendous size when sheltered from wind. The southern end of the temperate rainforest is also the southern extent of Sitka spruce's range.



■ Sitka spruce (*Picea sitchensis*) along the Pacific Slope\*

## Western hemlock (*Tsuga mertensiana*)

In the land of giant trees, western hemlock is often overlooked in the temperate rainforests of northwest California, literally overshadowed by redwood, Sitka spruce, Douglas-fir. Western hemlock is relatively smaller, slower-growing, and shorter-lived than these other species, but it survives here among some of the largest and oldest living things on Earth.



■ western hemlock (*Tsuga heterophylla*) along the Pacific Slope\*



# Montane Forest Conifers

## Sugar pine (*Pinus lambertiana*)

Perhaps no other pine exhibits the individuality of sugar pines—with charismatic windswept branches clasp enormous cones offering sugary seeds to the birds. This is the tallest of the world's pines, owing its success to mountain environments that see long, sunny growing seasons with wet winters full of snow. Sugar pines thrive in this type of environment because many other plants struggle to survive with such wide fluctuations in temperature and moisture.



■ sugar pine (*Pinus lambertiana*) along the Pacific Slope\*

## Western white pine (*Pinus monticola*)

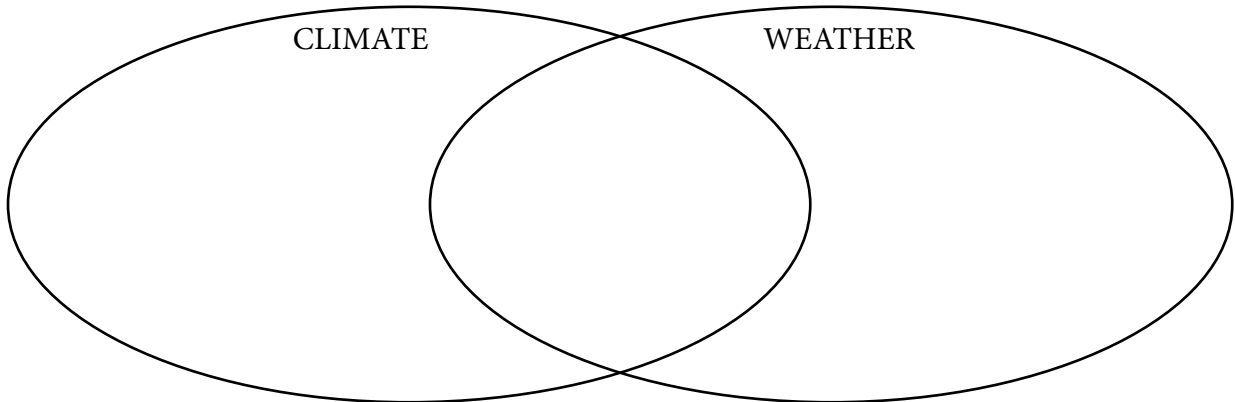
John Muir deemed this pine the “king of the alpine woods” and described them as “...towering above companions and becoming stronger as other species begin to crouch and disappear.” Western white pine is shade intolerant and thus enjoys open, well-spaced forests. with warm summer sun and deep snow in the winter. These harsh conditions keep other species away and allows the king of the alpine woods to thrive in the highest mountains of northwest California.



■ western white pine (*Pinus monticola*) along the Pacific Slope\*

# Discussion Questions

1. Compare and Contrast



2. Describe several differences in the climates of the three sites in figure 1.

---

---

---

3. What makes conifers unique from flowering plants?

---

---

---

4. What are some differences between the conifers that grow along the coast of northwest California and those that grow in the mountains? Write about at least three.

---

---

---

---

---

5. How are the coastal forests and montane forests of northwest California similar and different?

---

---

---

---

---

---