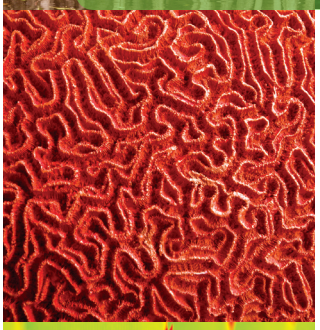
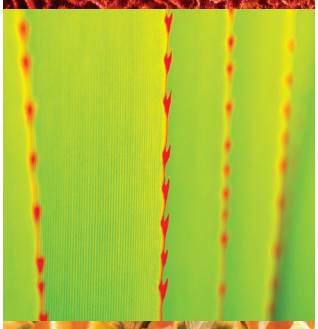
ECOREGION: WESTERN FORESTS AND MOUNTAINS





The forests and mountains of western North America stretch east from the Sierra Nevada and Cascade Ranges to the great Rocky Mountains and are among the most magnificent natural wonders in the world. Across western North America, from the Rocky Mountains to the Pacific Ocean, these successive mountain ranges and alternating lowlands form a deeply ridged landscape characterized by extremes of elevation, climate, and vegetation. Most likely created by the collision of tectonic plates millions of years ago, the landscape has been shaped since then by precipitation, temperature, and events such as fire, avalanches, and windstorms.[1,2]

Western forests are dominated by **conifer**s and boast some of the largest, tallest, and oldest trees found on the planet. The climate varies widely by season and location. The region encompasses nature's extremes, ranging from hot, dry lands that push the limits for sustaining life, to cold alpine areas perched on high mountains. At present, much of the West is semi-arid and subject to variable precipitation that can result in drought and floods. Throughout much of the region, fires play a critical role in the development of forest, woodland, and shrubland vegetation.[3]

The grand landscapes of the West provide both abundance and scarcity. Diverse habitats found throughout the western forests provide homes to a host of wildlife. During the summer months, bears, elk, and moose stockpile energy for the leaner winter months. However, nature's extremes also make this ecoregion a difficult place to live. Water, the essential ingredient for life, is scarce when it is most needed and long dry spells set the conditions for wildfire.

IMPACTS OF CLIMATE CHANGE

Most climate models project wetter winters and warmer summers for the western United States in the decades ahead.[4] These impacts imply that both the availability of water and prevalence of wildfire will be affected by the changing climate. Ecosystems and wildlife species of western mountains and forests are deeply dependent on snow and ice melt. Spring and summer snow cover has decreased in the western mountains by 15–30% since 1950, and stream flow peaks from snow-melt occurred 1–4 weeks earlier in 2002 than 1948. Reduced availability of summer water will likely result in a loss of cold-water dependent ecosystems such as high alpine areas and cold, mountain aquatic systems.[5] While the high alpine areas may experience a decline in growth, wetter winters may mean increased woody growth across the West.[6]

Variations in amount and timing of snow and rain also have important effects on fire frequencies. Drier years make the mountain forests more prone to fires and wetter years increase fire frequencies in arid, low elevations due to increased amounts of burnable materials.[7]

Due to variations in the effects that climate change will have on each ecosystem within the western forests ecoregion, there will be differences in the ways plant and animal species respond to the changing climate.

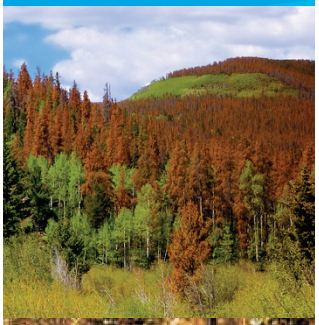
SPOTLIGHT ON A SPECIES

Unlike some species, the mountain pine beetle, *Dendroctonus ponderosae*, is benefiting from a warming climate. As the climate warms and winters become milder, this insect is beginning to multiply and expand its range. In fact, without cold winter temperatures limiting their numbers, outbreaks of these insects are occurring at unprecedented levels across western North America.[8]

The mountain pine beetle is at home in western mountains and forests. Living on lodgepole, ponderosa, sugar, and Western white pines, the mountain pine beetle spends most of its life living in and feeding on tree tissue beneath the outer bark. Under the bark, female beetles construct straight, vertical egg galleries. Once hatched the larvae usually spend almost a year in safe comfort under the bark. When they finally make the transformation to adults, they eat their way into the outside world. Within only 1 or 2 days after emerging, the adults will begin attacking other trees.[9]

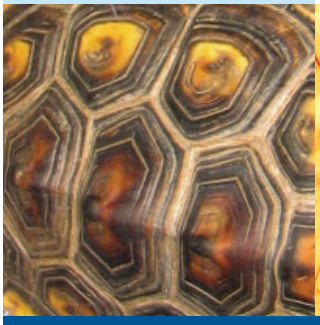
When mountain pine beetle populations get too large in a certain area, millions of trees may be killed each year. Mountain pine beetles and other bark beetles affect an area of forest almost 45 times as great as that affected by fire. Areas of outbreak have been tied to warmer temperatures, which changes the historical relationship between the bark beetle and its host forests.[10]

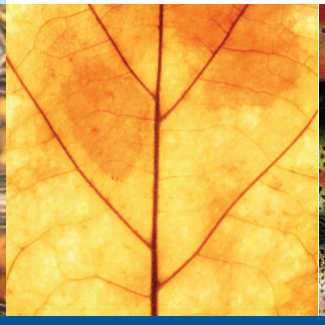
During epidemics, widespread tree mortality alters the forest ecosystem. Beetles have almost totally depleted commercial pine forests and in some cases have converted valuable forests to less desirable timber species. Sometimes, forested areas are converted to grass and shrubs. The large numbers of beetle-killed trees can affect wildlife, and the dead trees left after epidemics are a source of fuel for wildfires that will burn unless they are removed.[11]



Did you know?

Discolored foliage is one sign that lodgepole pines have been killed by the mountain pine beetle.





PROFILING A CLIMATE STEWARD

Students in Colorado pull on their wading boots to test the water quality of Sand Creek, which runs through Northeast Denver into the South Platte River. The students are part of Environmental Learning for Kids (ELK)'s Denver Youth Naturally's Water Testing Program (www.elkkids.org/calendar.html). On the second Tuesday of every month, they test the creek's pH, alkalinity, and dissolved oxygen concentration to figure out how healthy Sand Creek is. For example, lower dissolved oxygen levels often means the water is polluted, while higher levels indicate good quality water.

The students also collect and identify macroinvertebrate (aquatic invertebrate animals such as insects, crustaceans, and worms) samples from the creek. Macroinvertebrates help keep water ecosystems healthy by eating bacteria and decaying plants and animals. They are great indicators of water quality because they are very sensitive to changes in the water quality and can be collected easily from most rivers with inexpensive or homemade equipment. Some macroinvertebrates, such as stoneflies and mayflies, need high dissolved oxygen and their abundance indicates high water quality. Other macroinvertebrates, such as leeches, can survive at a lower dissolved oxygen level and may indicate low water quality.

Climate change could result in earlier snowmelt in the Western United States, which will affect seasonal river flows and the organisms that live in them. That's why it is so important for groups like Denver Youth Naturally to regularly monitor our rivers and make sure they are staying healthy![12]

Most of the kids in Denver Youth Naturally have had little experience in the outdoors, but they commit to becoming educated and dedicated stewards. In addition to water quality tests, they also perform extensive cleanups of the creek banks and learn about aquatic ecology and urban wildlife.

To get involved with Denver Youth Naturally, check out the Environmental Learning for Kids website at www.elkkids.org/dyn.html

FOR MORE INFORMATION

- The U.S. Forest Service's Western Wildland Environmental Threat Assessment Center generates and integrates knowledge and information to provide credible prediction, early detection, and quantitative assessment of environmental threats in the Western United States. www.fs.fed.us/pnw/wwetac/
- The National Wildlife Federation Report "Fueling the Fire, Global Warming, Fossil Fuels and the Fish and Wildlife of the American West" provides an overview of how climate change is affecting the West. www.nwf.org/globalwarming/pdfs/FuelingTheFire.pdf
- The Western Regional Climate Center has detailed historic climate information regarding each Western state. www.wrcc.dri.edu/
- The Natural Inquirer is a middle-school science education journal that brings Forest Service research to life. There are numerous editions of Natural Inquirer, with many articles related to climate change research. www.naturalinquirer.usda.gov/
- The U.S. Forest Service posts publications about climate change, fire, and the carbon cycle. www.nrs.fs.fed.us/units/climate/
- The U.S. Forest Service's Rocky Mountain Research Station posts information regarding the biology, ecology, and management strategy of Western bark beetles. www.usu.edu/beetle/
- The Intergovernmental Panel on Climate Change (IPCC) is the definitive source of unbiased climate change science. www.ipcc-wg2.org/index.html

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