Climate Change in the U.S. Northwest

Mount Rainier is seen behind a stream. Warming temperatures and declines in snowpack and streamflow have been observed in the Northwest in recent decades.

Overview

The Northwest is best known for its vast Pacific coastline and rainy weather. The region is home to the Cascade Mountain Range that runs north-south through Washington and Oregon, resulting in large differences in climate on the western and eastern sides of the range. West of the mountains, year-round temperatures are mild, winters are wet, and summers are dry. East of the mountains, it is typically sunnier and drier throughout the year, winters are colder, and summers can be significantly hotter.

The Northwest United States includes Washington, Oregon and Idaho. The region has a wide variety of ecosystems. As a result, climate change poses a number of different threats in the Northwest. Map: EPA.gov

Over the last century, the average annual temperature in the Northwest has risen by about 1.3 degrees Fahrenheit. Temperatures are projected to increase by approximately 3 to 10 degrees by the end of the century, with the largest increases expected in the summer. Precipitation in the region has seen a decline in both the amount of total snowfall and the proportion of precipitation falling as snow. In Washington state, record low snow was measured in April 2015 and in 74 percent of long-term monitoring stations. Changes in average annual precipitation in the Northwest are likely to vary over the century. Summer precipitation is projected to decline by as much as 30 percent, with less frequent but heavier downpours. [1]

Effects On Water Resources

A reliable supply of water is important for energy production, agriculture, and ecosystems. Much of the Northwest's water is stored naturally in snow that accumulates in the mountains, called "snowpack." The snowpack melts and feeds streams and rivers in the late spring and summer, when there is very little rainfall. Climate change threatens this natural storage by changing the timing of snowmelt and the amount of water available in streams and rivers, also called streamflow, throughout the year. Warmer springs contribute to earlier melting of the snowpack, higher streamflows in late winter and

early spring, and lower flows in summer. Spring snowmelt is projected to occur three to four weeks earlier by mid-century and summer streamflows are likely to decline. In the Cascade Mountains, measurements of snowpack taken on April 1 (when snowpack is usually at its peak) have decreased by about 20 percent since the 1950s.

Climate change can also lead to changes in the type of precipitation. Warmer winters cause more precipitation to fall as rain instead of snow, particularly at lower elevations. This reduces soil moisture, snow accumulation, and the amount of water available from snowmelt. Further, increased flood risks around rivers that receive waters from both winter rains and peak runoff in late spring are expected.

Changing streamflows are likely to strain water management and worsen existing competition for water. Increasing temperatures and populations could deepen demand. This would further stress water supplies that are already at risk of diminishing because of climate change.

Forty percent of the nation's hydropower is generated in the Northwest. Lower streamflows will likely reduce hydroelectric supply and could lead to large economic losses in the region. Reduced streamflows combined with rising temperatures and a growing population are raising concerns about the ability to meet electricity demands. [2]

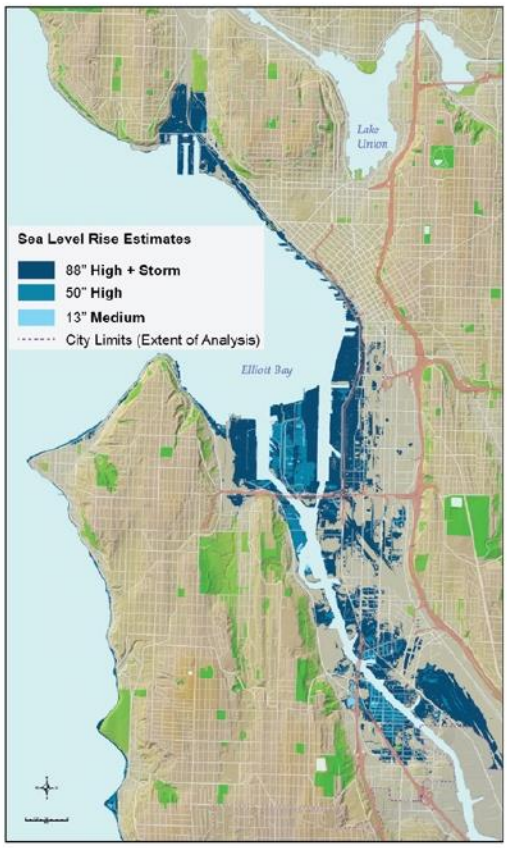
Effects On Coastal Resources

Climate change is damaging the Northwest coastline. Projections indicate an increase of 1 to 4 feet of global sea level rise by the end of the century. 140,000 acres in the region lie within 3.3 feet of high tide. Sea level rise and storm surge pose a risk to people, infrastructure, and ecosystems, especially in low lying areas, which include Puget Sound. Warming waters and ocean acidification threaten economically important marine species and coastal ecosystems.

Flooding, seawater inundation, and erosion are expected to threaten coastal infrastructure. Coastal wetlands, tidal flats, and beaches are likely to wear away or be lost from seawater. That heightens the vulnerability of coastal infrastructure to coastal storms.

Some coastal habitats may disappear if animals are unable to migrate inland. This is expected to affect birds and fish. Warmer waters can contribute to an increase in harmful algae growth, which could result in beach closures and declines in recreational shellfish harvests. Ocean acidification is also expected to negatively impact species important to the local economy, including oysters and Pacific salmon. [3]

Rising Sea Levels and Changing Flood Risks in Seattle



Many areas of Seattle are projected to fall below sea level during high tide by the end of the century. Shaded blue areas depict three levels of sea level rise. Map: EPA.gov.

Effects On Ecosystems And Agriculture

Forests make up nearly half of the Northwest landscape. These areas provide important habitat for fish and wildlife and support local economies, recreation, and traditional tribal activities. Forests have become warmer and drier. Trees are in greater danger of insect outbreaks and disease. Forests become flammable. The number and size of wildfires have increased. These impacts are expected to worsen in the future, resulting in larger areas burned each year and expanded spread of pests. Some types of forests and other ecosystems at high elevations are also expected to disappear from the region by the end of the century. These changes are likely to have significant effects on the local economy.

The Northwest harvested $480 million worth of fish in 2011. Warming waters have already contributed to earlier migration of sockeye salmon in some streams and earlier growth of algae in some lakes. Warmer waters are likely to increase spring and summer disease among fish. Suitable habitat for the trout species in the region will decline by an average of 47 percent near the end of this century. [4]

Ocean acidification is also expected to negatively impact sea life. Warmer coastal waters may alter migratory patterns and areas of suitable habitat for marine species. Agriculture is important to the economy and culture of rural areas of the Northwest. In the short term, a longer growing season and higher levels of atmospheric carbon dioxide may be beneficial to crops. In the longer term, reduced water availability for irrigation, higher temperatures, and changes in pests, diseases, and weeds may harm crop yields.

1. **Based on this section, how did scientists arrive at the conclusion that the Northwest is experiencing climate change? What evidence supports their conclusion?**

2. **How does climate change affect the type of precipitation that falls in the Northwest?**

3. **Based on this section, what have scientists learned about how climate change is affecting the Northwest coastal areas? Why is this information important?**

4. **Why is the conclusion that "forests have become warmer and drier" important?**

5. **Look at the graphic labeled "Rising Sea Levels and Changing Flood Risks in Seattle" and read the sentence from the article below.**

   140,000 acres in the region lie within 3.3 feet of high tide.

   Based on the information in the sentence and the graphic, which of the following predictions is <u>most</u> reasonable?

   A. Almost all of Seattle will be completely underwater at high tide, but not at low tide.
   B. Most coastal areas in Seattle will be underwater at high tide, and some even at low tide.
   C. Almost all of Seattle's infrastructure and businesses are threatened by sea level rise.
   D. Most areas of Seattle are sure to remain safe from sea level rise through the next century.

6. **Look at the graphic labeled "Rising Sea Levels and Changing Flood Risks in Seattle." The graphic shows potential flooding far inland along a river. Based on the article, what is one factor besides rising sea levels that could contribute to this?**

   A. coinciding winter rains and early runoff from snowmelt in the mountains
   B. additional winter and spring precipitation falling as snow in coastal areas
   C. changing migration patterns of birds and fish away from their coastal habitats
   D. algae growth in lakes and streams as a result of pests and disease in forests

7. **Which sentence would be <u>most</u> important to include in an accurate and objective summary of the article?**

   A. Rising sea levels due to climate change make it obvious that authorities must take action to protect Northwest cities before it is too late.
   B. Rising temperatures due to climate change are likely to damage Northwest economies and ecosystems from the coast to the mountains.
   C. Rising sea levels and algae growth due to climate change in the Northwest will have devastating effects for those with fond memories of the beach.
   D. Rising temperatures due to climate change may cause a long-term boost in the production of agriculture and hydropower in the Northwest.

8. **One central idea of the article is that water resources in the Northwest will be dangerously decreased by climate change. Which sentence from the article <u>best</u> supports the central idea above?**

   A. A reliable supply of water is important for energy production, agriculture, and ecosystems.
   B. The snowpack melts and feeds streams and rivers in the late spring and summer, when there is very little rainfall.
   C. This reduces soil moisture, snow accumulation, and the amount of water available from snowmelt.
   D. Changing streamflows are likely to strain water management and worsen existing competition for water.