New Understanding of Aquatic Ecosystems and Climate Change in the Pacific Northwest

Joint research by the USDA Forest Service Pacific Northwest Research Station and the U.S. Geological Survey

The Pacific Northwest is a region noted for an abundant supply of cold and clean freshwaters. These waters support many coldwater species, including salmon and trout, as well as a rapidly increasing human population. The future of freshwater in the region is highly uncertain as human development proceeds and climates change. Climate impacts to freshwaters in this region will lead to altered hydrology and water temperatures, with the potential loss of habitat for coldwater species and declines in water quality.

Water temperature is one of the most important components of water quality, yet little is known about existing and potential impacts of climate change for stream temperature in the Pacific Northwest. We know little about trends over time as well as how stream temperatures vary through the year. Unlike measures of terrestrial climates, such as air temperature and precipitation, water temperatures are typically measured only during summer. Furthermore, the relationships between climate, hydrology, and water temperature are likely very location specific. Finally, we know little about species requirements for temperature beyond their responses to summertime peak temperatures. We know terrestrial climates are important throughout the year, but our understanding of climates below the water surface is minimal.

Background

In 2010, the U.S. Geological Survey and U.S. Forest Service have teamed up to study how aquatic systems are responding to climate change in the Pacific Northwest. With a set of three interrelated tasks, researchers are increasing the understanding of climate effects on water temperature and biota in freshwater streams. The multi-year project, with a total budget of $500,000, is led through the U.S. Geological Survey, Northwest Area Office and the U.S. Forest Service, Pacific Northwest Research Station.

Activities

New science is needed to anticipate likely effects of climate change, including understanding past variability, unraveling the complex relationships between current climate and biological resources, and projecting future change. With such understanding, managers can conceive and implement strategies for climate adaptation. The new science makes use of existing data, observational studies, and modeling. A key component is a retrospective analysis of past change in water temperatures. Past changes can help us reveal actual responses of water temperatures to climate change. This understanding is critical for evaluating approaches to forecast climate impacts. Another key component involves studies of actual processes that cause water to heat or cool in natural settings. To implement restoration and protect coldwater streams, it is essential to understand the major factors that influence stream temperatures. A third component involves understanding and predicting how changes in stream temperatures influence the resilience of coldwater biota in Pacific Northwest streams. As climates change, so too will many species. What responses can we anticipate, and when will changes associated with climate impacts exceed a species' basic requirements?

Photo Courtesy of U.S. Geological Survey

Outcomes

Technical assistance is an important part of the project. Information gained during this research will be provided to managers primarily through meetings and publications. There is the potential for managers to integrate the information in recovery plans for threatened and endangered species, such as Pacific salmon, trout, and char, which depend on coldwater habitats. The information also could help guide land-use decisions by the Bureau of Land Management, National Park Service, U.S. Forest Service, and others engaged in long-term planning for climate adaptation within the region.

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