



Oregon Builds Ecosystem Resilience to Climate Change with Thermal Refugia and Temperature Standards

Overview

Warmer air and water temperatures resulting from climate change are placing additional pressure on the capacity of rivers to maintain the processes that create thermal diversity. Oregon adopted revised water temperature standards in 2003 to help protect and restore thermal diversity and improve critical habitat conditions for the survival of salmonids. Their progress toward protecting temperature sensitive species and their habitat from increasing water temperature under the Clean Water Act is a prime example of building ecosystem resilience to climate change.

Background

Oregon identified key risks from climate change as increases in average annual air temperature and extreme heat events, as well as changes in hydrology and water supply (See [2010 Climate Change Adaptation Framework](#)). In more than 17,000 miles of Oregon's streams and rivers, water temperatures already exceed optimal values established by the State. Reduced streamflow will exacerbate the rise in water temperature as low volumes of water heat up more quickly. Changes in the timing and quality of available water may affect aquatic, wetland, and riparian ecosystems and species; especially those already identified as threatened or endangered. As waters warm, the distribution of cold water species is expected to shrink and become disconnected. The social and economic importance of fish in the Pacific Northwest and their dramatic decline over the last century has brought water temperature to the forefront as a significant habitat requirement. Projections show suitable habitat for cold water species may shrink as much as 40% by 2090. To address these concerns and minimize additional warming, the State established protective water quality standards for stream temperatures, including cold water habitats, as critical for the protection of aquatic life.

Revising Oregon's Temperature Standards

To respond to both current and expected changes in stream conditions, Oregon identified several adaptation actions under the State's *Framework* and [Integrated Water Resources Strategy](#). These actions

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Project Date: 2003



include considering water quality, quantity, and ecosystem needs; and also developing reliable projections of impacts on various life stages of aquatic species and their distribution. The State's research efforts, temperature standards, and restoration programs reflect Oregon's combined approach for building ecosystem resilience to climate change by providing habitats required for the long term viability of cold water fish.

Protecting Cold Water Habitats and Refugia: Nearly all of Oregon surface waters are currently designated for cold-water fish and aquatic life use. Because these species have specific ranges of thermal tolerance, Oregon's temperature water quality standards include sub-designations for specific types of fish and life stages. In addition, the standards include a provision to protect cold-water refuges (refugia) in migration corridors, where identified as necessary for the support of these designated uses. Refugia are habitats and locations where temperature sensitive cold water species may find refuge when ambient stream temperatures become stressful.

Protecting cold water habitats and refugia are a key element of Oregon's water quality standards. The challenge is to ensure these features are identified, protected, and restored. To make informed policy decisions regarding cold water habitats and refugia, Oregon began to (1) identify the processes that create refugia and maintain thermal diversity; (2) monitor

and evaluate the distribution of cold-water on the landscape as a baseline for prioritizing habitat areas for protection; and (3) create approaches and tools to evaluate and restore thermal diversity at large and small scales.

Standards and Criteria Requirements: Oregon's temperature standards consist of numeric criteria, narrative criteria, exceptions and implementation provisions, and human use allowances (de minimis exceptions). For rivers and streams, numeric criteria establish water temperatures for each use and sub-use (See map). In contrast, narrative criteria for lakes, oceans, and bays mandate that no more than a 0.3 °C (0.54 °F) increase is allowed "above the natural condition unless a greater increase would not reasonably be expected to adversely affect fish or other aquatic life." Specific details on the criteria, designated uses, mixing zone requirements, human use allowances, and TMDLs can be found [here](#).

Oregon has also set numeric criteria for critical habitat areas that serve as the core for salmonid protection and restoration efforts. The requirement to protect and restore cold water is a unique provision within the temperature standard, which integrates the physical

nature of rivers and streams and the biological needs of cold water salmonids. The provision protects existing areas of cold water by limiting warming to no more than 0.5°F above cold water ambient temperatures in waterbodies that have summer seven-day-average maximum ambient temperatures colder than the biologically based criteria. It also limits warming caused from point sources discharging into or above spawning waters already below the spawning criterion. In addition, there is a narrative criterion for the protection of cold water refugia in fish migration corridor reaches of the Willamette, Columbia, John Day, and Snake rivers. The provision was included due to the recognition that some cold water salmonids are able to migrate through waters during thermally stressful times by using features that provide cold water either spatially or temporally.

Additional Resilience Measures: Additional efforts to build resilience and address the challenges posed by climate change include improving riparian conditions through voluntary restoration under the [Oregon Plan for Salmon and Watersheds](#), as well as restoring hydrologic flow and passage for fish to meet water quality and restoration goals under the State's [Conservation Strategy](#).

