

A DEEP DIVE INTO SHALLOW WATERS

Understanding and Responding to Climate-Induced Impacts on Stream Permanence in the Northwestern U.S.

Most streams in the Northwest currently run dry at some point in the year, and many more are likely to dry as the climate changes. By understanding more about **streamflow permanence**, communities can make climate-smart decisions to protect streams and the fish, wildlife and people that depend on them, along with the cultural values they support.

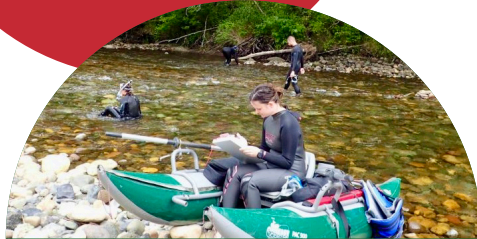
The Northwest Climate Adaptation Science Center's 2021 Deep Dive convened Northwest communities, natural resource managers and scientists to collaboratively review what is known about stream permanence and how it affects people and places in the region.

DEEP DIVE KEY FINDINGS

- > Changes in stream permanence are being observed across the Northwest and are projected to continue under a changing climate. In spite of its importance, little is known about the implications of changing stream permanence for communities across the Northwest.
- > Declining snowpack is expected to be a primary driver of climate-driven changes in stream permanence. Other potential factors include higher water demand by forests/crops, declines in summer precipitation and changes in the amount and timing of groundwater recharge.
- > Streams culturally, physically and biologically connect landscapes. As stream drying increases, these connections will become more seasonal, change or stop altogether.
- > Efforts to respond to these changes are challenged by inequitable power dynamics, a scale mismatch between river systems and societal expectations, and the constraints of western water law.



Northwest streams represent cultural values for communities & provide critical habitat for our region's fish, wildlife, insects, avian species & ecosystems.



In the Northwest, more streams are likely to run dry under climate change, prompting concern about streamflow permanence.



Incorporating different forms of knowledge into science, education & decisions can create equitable outcomes and improved resilience related to stream permanence.

- > Changes in stream permanence threaten stream-dependent species and ecosystems, with potential downstream and cascading effects. Ecological diversity can buffer plant and animal communities against the negative effects of stream drying.
- > Though various land and water stewardship actions could potentially mitigate climate-induced changes in stream permanence, little is known about which actions are most effective or how their effectiveness will vary across different landscapes.
- > Incorporating different forms of knowledge, especially Traditional Knowledge, into science, training and management decisions can facilitate equitable, innovative outcomes.



Stream with low flows in the Upper Boise Basin. Photo taken during intermittent stream survey for the NW CASC PROSPER project, 2016. Credit: Kendra Kaiser

RESEARCH NEEDS

Identified by 2021 Deep Dive participants

Hydrologic and climate studies to better quantify climate impacts on stream permanence, including surface water-groundwater connections.

Studies linking land and water use activities (e.g., logging, irrigation) and disturbance (e.g., wildfire, bark beetles) with changing stream permanence.

Evaluation of the adaptive capacity of flora and fauna to stream intermittency and the associated resilience of ecological functions.

Evaluation of the effectiveness and potential scope of mitigation actions, including land and riparian cover, water conservation and groundwater recharge.

More and better baseline data to support improved predictions of stream permanence.

CAPACITY NEEDS

Identified by 2021 Deep Dive participants

Standardized data collection and expanded implementation of low-cost, robust and automated monitoring systems for non-perennial streams.

Knowledge sharing across the region (e.g. best practices, research).

Improved collaboration between Tribes and non-Tribal entities; better incorporation of Traditional Ecological Knowledge; and more widespread training on ethical collaboration.

Tools and strategies to support adaptation, tailored to address the needs of different contexts (e.g., regulatory vs voluntary mitigation, high-desert vs montane ecosystems).