Dams provide resilience to Columbia River basin from climate change impacts

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Dams have been vilified for detrimental effects to water quality and fish passage, but a new study suggests that these structures provide "ecological and engineering resilience" to climate change in the Columbia River basin.

The study, which was published in the Canadian journal *Atmosphere-Ocean*, looked at the effects of climate warming on stream flow in the headwaters and downstream reaches of seven sub-basins of the Columbia River from 1950 to 2010. The researchers found that the peak of the annual snowmelt runoff has shifted to a few days earlier, but the downstream impacts were negligible because reservoir management counteracts these effects.

"The dams are doing what they are supposed to do, which is to use engineering – and management – to buffer us from climate variability and climate warming," said Julia Jones, an Oregon State University hydrologist and co-author on the study. "The climate change signals that people have expected in stream flow haven't been evident in the Columbia River basin because of the dams and reservoir management. That may not be the case elsewhere, however."

The study is one of several published in a special edition of the journal, which examines the iconic river as the United States and Canada begin a formal 10-year review of the Columbia River water management treaty in 2014. The treaty expires in 2024.

Jones said the net effect of reservoir management is to reduce amplitude of water flow variance by containing water upstream during peak flows for flood control, or augmenting low flows in late summer. While authorized primarily for flood control, reservoir management also considers water release strategies for fish migration, hydropower, ship navigation and recreation.

These social forces, as well as climate change impacts, have the potential to create more variability in river flow, but the decades-long hydrograph chart of the Columbia River is stable because of the dams, said Jones, who is on the faculty of the College of Earth, Ocean, and Atmospheric Sciences at OSU.

"The climate change signal on stream flow that we would expect to see is apparent in the headwaters," she said, "but not downstream. Historically, flow management in the Columbia River basin has focused on the timing of water flows and so far, despite debates about reservoir management, water scarcity has not been as prominent an issue in the Columbia basin as it has elsewhere, such as the Klamath basin."

The study, which was funded by the National Science Foundation's support to the H.J. Andrews Experimental Forest, looked at seven sub-basins of the Columbia River, as well as the main stem of the Columbia. These river systems included the Bruneau, Entiat, Snake, Pend Oreille, Priest, Salmon and Willamette rivers.

"One of the advantages of having a long-term research programs like H.J. Andrews is that you have detailed measurements over long periods of time that can tell you a lot about how climate is changing," Jones pointed out. "In the case of the Columbia River – especially downstream – the impacts haven't been as daunting as some people initially feared because of the engineering component.

"Will that be the case in the future?" she added. "It's possible, but hard to predict. Whether we see a strong climate change signal producing water shortages in the Columbia River will depend on the interplay of social forces and climate change over the next several decades."

Provided by Oregon State University

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