



Water Topic March 2024

Shannon Wilkey

Spring Runoff

This month we'll look at spring runoff and its impacts on ecological systems and water resources. With this winter's low snow accumulation, spring runoff may be quick this year.

Runoff, is an important piece of the water cycle in which precipitation moves along the earth's surface, recharging groundwater or entering streams and rivers in a watershed. **Spring runoff** is an important event in the mountain west and a crucial part of the water cycle. As the weather warms in the spring, and precipitation falls in the form of rain, we see melting snowpack that runs off the landscape, percolates soil, and enters groundwater, streams and rivers. **Peak flow** occurs when spring runoff reaches its highest concentration of runoff. This flux of water supports and benefits municipalities, irrigators, and ecological communities.

Usually during spring runoff, river levels rise, streamflow levels are high and large amounts of water move through the landscape, creating a powerful force that moves sediment and debris, which can be beneficial, but too much sediment in the water can be a source of pollution. Spring runoff also provides cold water to organisms in the stream, which is beneficial for native trout species and other aquatic organisms. Heavy runoff in the spring can also bring regional flooding. An example of this would be the flooding that occurred on the Yellowstone River in 2022, in which high spring rainfall and snowpack melting aligned to create prime flooding conditions, impacting many communities in the region.

There are several environmental variables that influence spring runoff. The big three are temperature, precipitation and elevation (as it has a strong relationship with temperature). As temperatures in mid-elevations increase and rise above freezing, runoff may occur earlier in the season than they have historically. As precipitation comes in the form of rain rather than snow, snowpack may decline and create earlier and shorter spring runoff periods. Historical observations show a trend towards earlier snowmelt and peak runoff. This earlier snowmelt and peak runoff will lead to decreased late summer water availability in watersheds where snowmelt dominates the water resources.



Runoff and streamflow shifts not only impact human use of water resources, but also the ecosystem health and aquatic species within a watershed. Lower flows in the summer lead to warmer water temperatures, which can impact aquatic organisms, especially species which need clean, well oxygenated and cold water. Similarly, heavy flooding in the winter season can effect nesting sites for certain organisms (such as salmon nests) and reduce habitat complexity.

Image Source: Niah Brass

Species such as this salmonfly are effected by warming summer water temperatures, one of the impacts of shifting spring runoff.



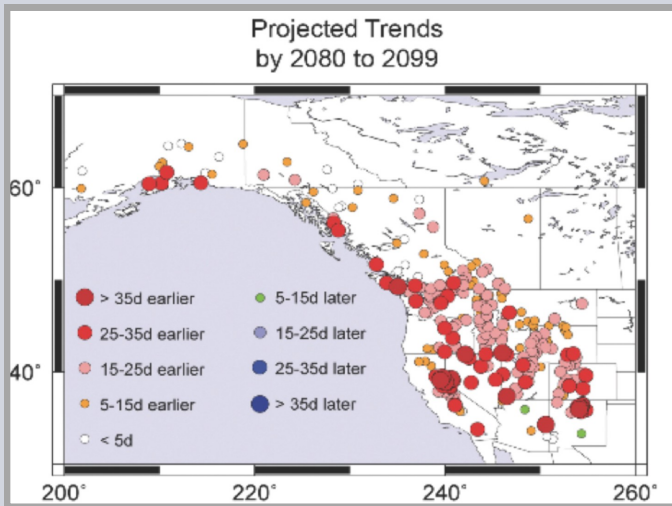
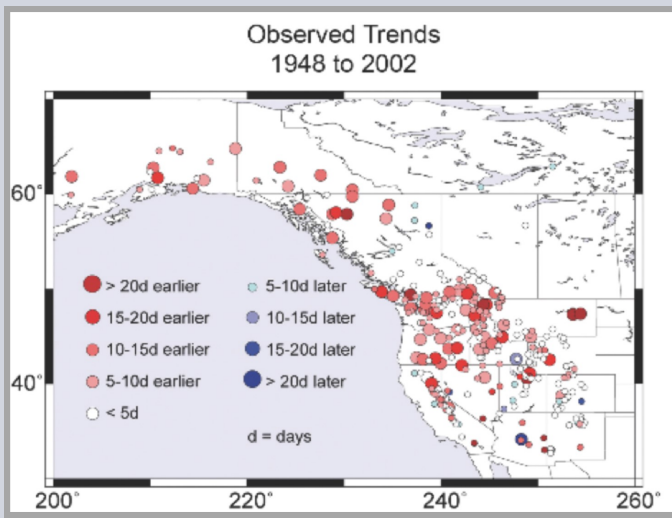
Trends in Spring Runoff

Climate model projections for snowmelt and runoff timing show consistent patterns that more water will leave watersheds during winter and early spring in watersheds with high elevation headwaters. This earlier runoff time will leave less water to supply adequate streamflow in the summer and early fall. In late summer, water resources are in high demand for agricultural use, municipalities and for recreation, making a shift in runoff highly impactful.

Observed trends have shown earlier snowmelt and spring runoff in the West based on data from the mid-1900's until early 2000's. The Projected trends for the end of the century show similar results of snow melting even earlier, up to 35 days earlier in some places! The figures to the left show these observed and projected trends around the western United States.

If you zoom in on the figures, you'll see that southwest Montana has several orange dots on the projected trends, meaning that by 2080-2099 snowmelt will occur 5-15 days earlier. However, projected trends in other areas of the west have even more drastic changes in snowmelt as seen in the figure to the left.

Source: : <https://montanaclimate.org/chapter/water>



Still Curious? Check out the Links Below!

Check out these podcasts:

Part 1: [The Upper Yellowstone River Part 1 the Floods and Listening to the River](#)

Part 2: [The Upper Yellowstone River Part 2 Recreation and a call for Community Reconnection](#)

These podcasts are the latest releases in the Stories for Action podcast. They discuss the complexities of the Yellowstone River in Paradise Valley with the floods that occurred during spring runoff in 2022.

Resources/Sources:

Stories For Action Podcast: <https://www.storiesforaction.org/podcast>

Montana Climate Assessment : <https://montanaclimate.org/chapter/water>

Flow Alteration, EPA: <https://www.epa.gov/caddis/flow-alteration>

State of Salmon in Watersheds: <https://stateofsalmon.wa.gov/statewide-data/water/#:~:text=Water%20temperatures%20greater%20than%2064,degrees%20Fahrenheit%20can%20be%20lethal.&text=Without%20actions%20to%20reduce%20water,of%20snow%20to%20some%20areas.>

