Snowpack

This indicator measures trends in mountain snowpack in western North America.

Background

Temperature and precipitation are key factors affecting snowpack, which is the amount of snow that accumulates on the ground. In a warming climate, more precipitation will be expected to fall as rain, not snow, in most areas—reducing the extent and depth of snowpack. Snow will also melt earlier in the spring.

Mountain snowpack is a key component of the water cycle in western North America, storing water in the winter when the snow falls and releasing it in spring and early summer when the snow melts. Millions of people in the West depend on the springtime melting of mountain snowpack for power, irrigation, and drinking water. In most western river basins, snowpack is a larger component of water storage than man-made reservoirs.[18]

Changes in mountain snowpack can affect agriculture, winter recreation, and tourism in some areas, as well as plants and wildlife. For example, certain types of trees rely on snow for insulation from freezing temperatures, as do some animal species. In addition, fish spawning could be disrupted if changes in snowpack or snowmelt alter the timing and abundance of stream flows.

About the Indicator

This indicator uses a measurement called snow water equivalent to determine trends in snowpack. Snow water equivalent is the amount of water contained within the snowpack at a particular location. It can be thought of as the depth of water that would result if the entire snowpack were to melt.

The U.S. Department of Agriculture and other collaborators have measured snowpack since the 1930s. In the early years of data collection, researchers measured snow water equivalent manually, but since 1980, measurements at some locations have been collected with automated instruments. This indicator is based on data from approximately 800 permanent

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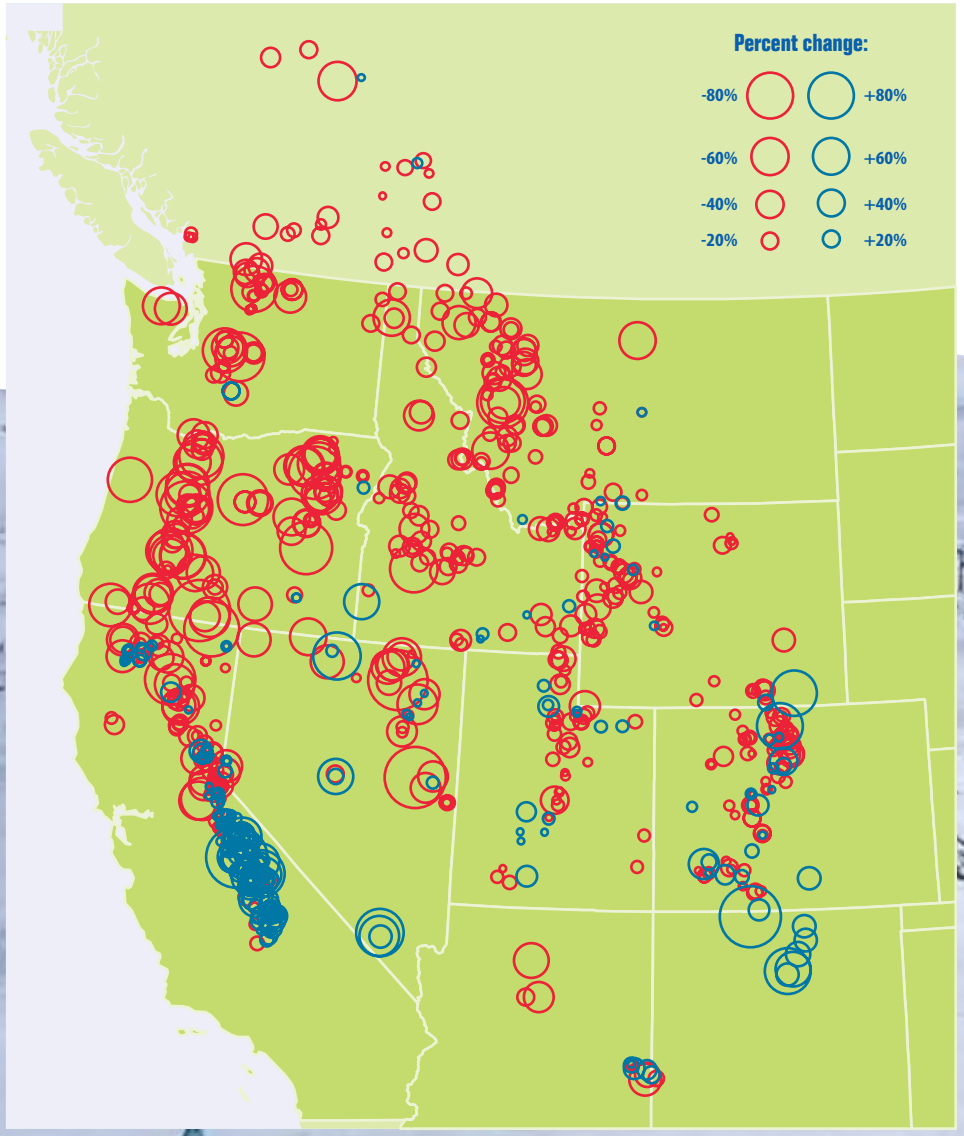
Figure 1. Trends in April Snowpack in the Western United States and Canada, 1950–2000

This map shows trends in snow water equivalent in the western United States and part of Canada. Negative trends are shown by red circles and positive trends by blue.



Data source: Mote, 2009[19]

Key Points

- From 1950 to 2000, April snow water equivalent declined at most of the measurement sites (see Figure 1), with some relative losses exceeding 75 percent.
- In general, the largest decreases were observed in western Washington, western Oregon, and northern California. April snowpack decreased to a lesser extent in the northern Rockies.
- A few areas have seen increases in snowpack, primarily in the southern Sierra Nevada of California and in the Southwest.

research sites in the western United States and Canada. The indicator shows trends for the month of April, which could reflect changes in winter snowfall as well as the timing of spring snowmelt.

Indicator Limitations

Natural changes in the Earth's climate could affect snowpack in such a way that trends might slightly differ if measured over a different time period. The 1950s registered some of the highest snowpack measurements of the 20th century in the Northwest. While these values could be magnifying the extent of the snowpack decline depicted in Figure 1, the general direction of the trend is the same regardless of the start date.

Although most parts of the West have seen reductions in snowpack, consistent with overall warming trends shown in the U.S. and Global Temperature indicator (p. 22), snowfall trends may be partially influenced by nonclimatic factors such as observation methods, land use changes, and forest canopy changes.

Data Sources

Data for this indicator came from the U.S. Department of Agriculture's Natural Resources Conservation Service Water and Climate Center. The map was constructed using methods described in Mote et al. (2005).[20] The U.S. Department of Agriculture data are available at: www.wcc.nrcs.usda.gov.