



CLIMATE SCIENCE & SERVICES ... IN ACTION

NOAA Supports Research to Assess Vulnerability of Boulder's Water Supply

After a historic drought in 2002 that drastically limited Boulder, Colo.'s water supply and required strict mandatory water use restrictions, city leaders grew concerned that its water system would not sustain future demand. For decades, Boulder, which is located in a semi-arid climate, met its annual water resource needs by capturing the spring runoff from mountain snowpack that drains into the Boulder Creek watershed through a system of dams, reservoirs and pipelines. However, as the region's population continues to grow and the climate continues to change, water managers began to ask questions about how changes in temperature or the timing and amount of precipitation could impact their critical water supply.

Some of these questions included: *How often are droughts as severe as the 2002 event likely to occur? Will the winter snowpack decline and how will this alter the spring runoff? Will water shortages become more common? Is Boulder's water system resilient enough to handle a hotter and potentially drier climate? What else needs to be done to ensure there is enough water to meet future needs?*

To address these questions, the city of Boulder collaborated with a team of climate scientists and water resource experts from NOAA, other federal, state and local agencies, universities and the private sector to conduct an in-depth analysis of vulnerabilities posed by a changing climate and other factors on their water supply. The team looked back at historic local climate records from a variety of sources, including stream flows, weather records, climate extremes, and tree-ring measurements. They also used NOAA's Geophysical Fluid Dynamics Laboratory climate models (GFDL1, GFDL0), along with general circulation models from other sources, to make climate projections for this region.

A few years ago, many residents thought that climate change would automatically mean less water for Boulder, and others refused to acknowledge that there might be any impact at all. There were discussions about whether or not to throw money and resources at a solution when we didn't know enough about the problem.

*— Carol Ellinghouse,
Water Resources Coordinator
for the City of Boulder*



On average, Boulder's annual water supply comes from Barker Reservoir on Middle Boulder Creek, Silver Lake/Lakewood Watershed on North Boulder Creek, and the Boulder Reservoir. Farmers, ranchers, residents, and wildlife living in the Boulder Valley and the South Platte River basin compete to use the meltwater from the Rocky Mountains.

The team integrated all of the collected climate information and developed various climate scenarios in order to project how conditions might change through the end of the century and to generate altered stream flow sequences for Boulder Creek. In every climate scenario, models projected that temperatures are likely to be warmer than in the past; however, they diverged over whether the future would be wetter or drier. Although it appears that a warmer climate will not pose an immediate problem to the city's short-term municipal water needs, it may affect Boulder-area farmers who need larger quantities of water to irrigate crops in the summer.

This study, "The Potential Consequences of Climate Change for Boulder Colorado's Water Supplies," is helping the city of Boulder planners in diverse ways—among them, to better prepare for and



The tree rings of certain species are sensitive to changes in moisture conditions over a tree's lifetime, making them ideal for reconstructing historical climate records.

respond to the real water challenges of today as well as the projected future challenges influenced by a changing climate. The city is now beginning to prioritize activities and projects that will help it better manage their water system. These efforts will increase the city's ability to adapt to natural disruptions such as year-to-year variations in precipitation and snowpack, and societal factors such as increases in demand and water rights.

For example, the city fast-tracked a project in its Capital Improvement Plan to rehabilitate a dam for an existing reservoir in the city's Silver Lake Watershed, in part because reservoir storage will become even more important as mountain snowpack begins melting earlier in the spring. Also, a water pipeline project that was proposed to address water quality and security concerns is now a priority for funding because it will also

provide the water utility with more flexibility in its choices of water sources in the presence of increased climate variability.

The Boulder water supply study highlights the inextricable connection between climate science and water management by providing climate scientists and water resource professionals with an opportunity to share their respective knowledge and translate it into the practical applied information — information that engineers and water managers need to plan for the future.

In addition to partially funding this collaborative study, NOAA will continue playing a vital role in helping Boulder plan for the future. According to Carol Ellinghouse, a veteran water manager who has served as Boulder's Water Resources Coordinator, there will be "ongoing interactions between NOAA scientists and area water providers at workshops and conferences designed to both increase the understanding of water providers needs and about the information that NOAA can provide."

Ellinghouse further notes that Boulder water managers actively track various NOAA publications and use NOAA research data to assess trends in water resource data to effectively manage their water supply.

NOAA continues to provide support for studies that help people and communities better plan and respond to climate change and variability. These investigations strive to identify sector-specific vulnerabilities to climate impacts and help build the capacity within that sector to adapt to climate variability and change.

For more information:

- NOAA National Climatic Data Center: www.ncdc.noaa.gov
- NOAA Climate Prediction Center: www.cpc.ncep.noaa.gov
- National Integrated Drought Information System: www.drought.gov
- Climate Portal story "Will Boulder's Water Supply Stand Up to Climate Change?" www.climatewatch.noaa.gov/article/2011/39522
- Final study report (February 2009) by Stratus Consulting: "The Potential Consequences of Climate Change for Boulder Colorado's Water Supplies": www.treeflow.info/docs/boulder_climatechange_report_2009.pdf

NOAA's Water Resources Products and Services

Long-Range (Seasonal)

- NOAA issues 3-month seasonal temperature, precipitation and drought outlooks
- NOAA works with local, state and national partners in the water, agricultural and other sectors using drought and flood information to reduce impacts and risks.

Monthly

- NOAA issues 30-day temperature and precipitation outlooks
- NOAA provides monthly El Niño/La Niña forecasts
- NOAA issues the State of the Climate, putting climate events in historic context

One to Two Weeks

- NOAA issues 8-14 day nationwide weather and water forecasts
- NOAA, USDA and the National Drought Mitigation Center issue the U.S. Drought Monitor

Daily to Weekly

- NOAA issues daily to 7-10 day nationwide weather and water forecasts
- NOAA meteorologists are deployed to fire and flood operation centers to support real-time forecasts
- NOAA conducts briefings with media and emergency response personnel

Other Products

- U.S. Snow Climatology
- Local & Regional Climatological data
- Climate Normals