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Source of water for West at risk

Forests, farmers, cities depend upon mountain-snow runoff

Shaun McKinnon
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The West's natural water-delivery system is breaking down under the strain of rising temperatures, upsetting a fragile truce between people and the dry land they inhabit.

Mountain-snow runoff already bears the scars of climate change in the highest elevations, where winter now arrives later and ends earlier. There, snow melts before downstream users need it, or vanishes in the mild-spring winds.

Scientists say this seasonal shift will deepen as temperatures rise. The change threatens not only the water but also the way it is stored and released in a delicate relay from storm clouds to mountains to streams and reservoirs.

If the timing falters, water supplies would shrink. Forests and other wildlife habitat would weaken. Wildfires would grow. Hydroelectric power production would suffer.

"Changes in runoff are only one step away from the warmth in global warming," said Brad Udall, an environmental engineer and director of the Western Water Assessment in Boulder, Colo. "Right after temperature increase, what should pop into people's mind is the question of water."

Power: Dwindling water levels threaten energy supply

Climate change could drain power from one of the cleanest and most widely used forms of renewable energy, forcing power providers to rely more heavily on pollution-spewing power plants.

Hydroelectric generators need flowing water to turn the turbines, but they're often at the back of the line when it comes to securing water rights.

Power-generating capacity decreased at Glen Canyon Dam in 2003 and 2004 after water levels dropped in Lake Powell, the reservoir that provides water for the dam's turbines. In an extreme drought, the government could stop releasing water from the dam as a way of protecting supplies for cities. If no water is released, no power can be produced.

The National Hydropower Association sought help from Congress earlier this year amid fears that power producers would lose water rights or generating capacity if climate change tightened runoff into rivers.

"Hydropower should be encouraged and supported to play an important part in solving the climate problem," said Tim Culbertson, a utility district manager in Washington state who took his industry's message to the nation's capital. "Hydropower resources should be treated as fairly and equitably as any other renewable energy."

Washington state relies on hydropower for 72 percent of its electricity and would suffer if plants shut down.

Arizona would fare better. Salt River Project draws on hydropower sources for only about 5 percent of its electricity, spokesman Scott Harelson said. Arizona Public Service Co. decommissioned its last hydroelectric dam in 2005, leaving it with no hydropower in its portfolio.

"It's a pretty small portion of our overall generating capacity," Harelson said. "It's important because it's renewable and it's not very expensive. It would likely be replaced by a fossil-fuel source that's more expensive."

Some of Arizona's rural areas rely more heavily on hydropower, much of it sold through Western Area Power Administration. The power wholesaler markets and distributes electricity generated by 56 hydropowered plants, selling to towns such as Wickenburg and Thatcher, as well as Luke Air Force Base and the Ak-Chin Indian Community.

Western is studying the potential effects on its rates if its flow of hydropower is interrupted. It has begun investing in wind and solar projects that would expand its renewable portfolio and could replace lost hydropower in extremely dry conditions.

Forests: Drought leaves trees vulnerable to damage

Arizona's forests have given scientists a real-life laboratory to study the potential effects of warming temperatures and climate change: mass insect invasions. Vegetation die-offs. Wildfires unseen before in their size and location.

The common thread throughout the battered forests: drought.

Forests lie smack in the middle of the West's watersheds and rely on winter snow and runoff to stay healthy. When the weather dries out, so do the trees, leaving them vulnerable to pests, disease and fire.

Long-term climate change would only magnify the damage caused by short-term drought.

Tom Swetnam, director of the University of Arizona's Laboratory of Tree-Ring Research, burst into the news earlier this fall during the wildfires that swept Southern California. Global warming, he told a national television audience, will fuel hotter and bigger fires.

He also took his findings to Congress, warning lawmakers that the fires in recent years should be considered the early effects of climate change.

"Lots of people think climate change and the ecological responses are 50 to 100 years away," he said. "But it's not. . . . It's happening now."

Swetnam and his researchers used streamflow gauges and other observations in their work and concluded that wildfire frequency was closely tied to the timing of snowmelt. Fires were erupting earlier in the spring and burning longer through the summer because of the drier conditions.

Changes in runoff and snowfall can cause subtler changes that, over time, can cause as much damage to a forest's health as a sustained drought.

A late-starting winter, for example, could leave the ground and trees exposed to cold weather. The ground freezes, preventing water from reaching the roots, and the roots freeze, hurting the tree's ability to draw nutrients.

Drought-weakened trees have allowed bark-beetle infestations in Arizona and Colorado, resulting in the deaths of millions of trees. In some cases, entire stands of piñon pines and junipers have died, damaging the ecosystem.

If enough trees disappear, the watershed may not produce as much runoff. Paul Brooks, a University of Arizona hydrologist, said research suggests moderately dense forests result in better and wetter snowpacks.

"The research suggests that how trees grow and how the systems develop is tightly coupled with precipitation," he said. "The vegetation lets the water melt at a little bit slower rate. It uses some of it, but it shades it too."

Habitat: Struggling rivers jeopardize wildlife diversity

Chased from its nesting grounds in reservoirs that ebbed and flowed for years, the tiny Southwestern willow flycatcher now faces an even more uncertain future as climate change threatens riparian habitat across Arizona.

Population growth already has destroyed prime wildlife habitat, paving over washes and streams, pumping groundwater away from rivers. A disrupted runoff cycle would further jeopardize those areas.

A U.S Geological Survey study warned that birds would suffer most in the desert areas of Arizona and New Mexico. The flycatcher, which nests and breeds in Arizona before returning to its tropical home in Mexico and Central America, relies on riparian vegetation that would die if water stopped flowing.

Arizona's ailing rivers provide immediate testament to the effects of losing a water source. On the San Pedro River, the already-fragile riparian corridor could suffer devastating losses if the climate turned drier, according to a study by Arizona State University ecologist Juliet Stromberg and University of South Dakota researcher Mark Dixon.

Even in models that preserved some of the rain and runoff, the river's cottonwood and willow stands suffered. In one scenario, Stromberg found that up to 90 percent of the cottonwood trees could vanish by the end of the century.

In the Northwest, uneven runoff cycles already have affected salmon and other fish that depend on regular river flows for spawning. Inland, dry conditions have eroded habitats for an array of animals.

The Center for Biological Diversity, a Tucson-based advocacy group, recently cited global warming as it sought protection for the American pika, a small relative of the rabbit that roams the uplands of the West. Warm, dry conditions have reduced its numbers.

"The American pika is California's canary in the coal mine," said Dr. Shaye Wolf, a staff biologist for the center. "As global warming raises temperatures across California, American pikas are disappearing."

Water: Early snowmelt disrupts nature's distribution

In the arid West, most climate experts say rising temperatures will cause droughts, deep droughts spanning decades, droughts that, by some accounts, will bring about a dust bowl.

Researchers base those predictions on more than just snowfall. With runoff, the size of the snowbank is just part of the story.

"Snow and runoff are part of a wonderful natural system that stores water through the winter and releases it in the spring, just as we start needing it for agriculture and the growing urban environment," said Paul Brooks, a University of Arizona hydrologist. "The problems occur when you start to shift the timing."

That shift is evident in the high mountains, where spring snowmelt occurs as much as two weeks earlier than it once did. The difference has reduced runoff at about 75 percent of the measuring stations checked by University of Washington researcher Philip Mote.

The immediate effects are felt by farmers and others who take water directly from rivers or small reservoirs. When the snow melts too soon, before planting season, for example, farmers lose some of their share.

If enough users leave water in the river, the reservoirs downstream will fill up before demand climbs high enough. Reservoir managers could be forced to release water unused.

Warmer temperatures can play havoc in other ways. In 2004 and 2006, promising snowpacks on the upper Colorado River vanished in a flurry of warm dry winds. Milder weather also could change winter snow to rain early and late in the season. Snow stores water efficiently; rain sinks into the soil or evaporates and can cause flooding.

Most of the reservoirs that supply water to Arizona can store unused water for months or years, whether it arrives as runoff from rain or snow. That will help protect water resources for Phoenix and Tucson, which may not see shortages for decades.

"We rarely get enough runoff to fill our system anyway," said Charlie Ester, water resources operations manager for Salt River Project, the Valley's largest water provider. "If it rains on the watershed and runs off, we can store it."

A bigger question for Arizona, he said, is how climate change affects the summer monsoon.

"If our winters get dry, then our landscape's going to be more and more dependent on summer rain," he said, "yet no one has any idea what's going to happen with the monsoon."

It's possible that changing ocean conditions could produce a stronger monsoon in Arizona, Ester said. In that case, SRP would benefit from storm runoff. Monsoon rains contributed as much or more to SRP's water stores as snow the past two years.

Much remains unknown about changes in the way snow refills water resources. Although runoff most often feeds rivers and streams - snow provides as much as 75 percent of the West's surface water - it also recharges underground aquifers along mountain ranges, where many of the largest cities grew up.

Hotter weather also will drive up water use by vegetation, and the ground itself will keep water, soaking up rain and snow before it runs off.

"People tend to have this idea that when it rains, it all runs off into a river," said Brad Udall, director of the Western Water Assessment, a federally supported research group.

"In fact, much of the rain never makes it into a river. It goes to plants, to evaporation. . . . That soil moisture tax you have to pay is really important, and we don't understand how it's going to work in the future."

1:11 AM Of courst the tempe town lake will still suck billions of gallons of our drinking water every year, and the state will continue to pour millions of gallons on non desert plants along the road system and of course golf courses MUST have all they can evaporate into the air while telling Joe Homeowner to cut back to a bare dribble.
And don't try to tell me golf courses using "recycled" water saves anything. That same water could be "recycled" back into the city treatment systems to be used by Joe Homeowner. Would not be any worse than the muddy goo that flows into the systems now. After all River water has everyone's "p" in it from every city and town upstream as well as thousands of tame and wild animals, and people GO SWIMMING in and pull fish from that UNTREATED water.

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Posted Nov-25 1:15 AM Speeddemonec
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Posted Nov-25 2:35 AM
Oh yes, had we continued building nuclear power plants as was being done 30 years ago, our oil dependance would have been cut by 60& to 70% by now as we would have electric and hydrogen cars on the road, but some people are just want to go back to the horse and buggy. But then what do you do with the animal waste when you live in a city?

7
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Posted Nov-25 3:25 AM
Where does river water come from, if not from pure melting ice. Animal waste is much cleaner. The only thing thats gonna help us is a big flood, and tons of snow.. Eventually we won't be able to support the lives we do now so you might as well splurge :p jk

15
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Posted Nov-25 3:37 AM
The State of Arizona MUST negotiate with the Mexican government to build a desalination plant to be located near Rocky Point, Mexico. The plant could possibly be powered by solar power. Water would then be pumped into Tucson and Phoenix metro areas. This has to be done ASAP!

12
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Posted Nov-25 4:04 AM
I live in Melbourne, Australia now--where we have water restrictions due to drought conditions. I lived in AZ for 25 years, and it amazes me there are no restrictions on water use there (ie-no car washing except at carwashes that recycle water, no water features or fountains and the like allowed to run during restrictions, no watering of lawns except for restricted times, etc) It just seems to make so much sense, and the amount of water waste when I go home for vacation just amazes me...

3
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Posted Nov-25 6:00 AM
Ralph you are right. It's sad that we don't have 'gray' water systems in every home (where dishwater etc.... but not toilet water) flows into a tank and is then used to water foliage etc... Or systems to collect rainwater (when it does fall.) It's also amazing that only now are we starting to talk about solar power (here in AZ that's a no brainer) or other alternative (non-fossil fuel) power sources. But folks just blithely go on watering away etc... And it's very cheap here too - I'm always surprised that water isn't much more expensive. Government isn't going to do anything until it's too late (when election is always around the corner who wants to be the bad guy?) So we have to do it ourselves - check out the story about the lady in Tempe who built her house out of straw bales and spent $51 for electricity in July! Build that house - add solar panels and a gray water system and you could almost live off the grid! Consumers have to do it on their own.

6
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Posted Nov-25
Out here in the west. It's simple too many people gathered around the water hole until there is not enough water for everyone. There is only so much to go around and when you get too many people that's it. Not hard to figure out.

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Desalination plants and solar farms need to happen ASAP, we won't be able to wait much longer.

6:25 AM

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Posted Nov-25 6:48 AM

good thing Mesa was smart enough to approve that gigantic waterpark

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Posted Nov-25 6:59 AM

The fact is that we waste so much water right now that when we "run out" it probably won't affect us that much. That's when water prices will finally rise, mandatory conservation will be imposed, and we will have to recognize that this is a desert. I bet most people could easily live on less than 1/4 of the water they currently use.