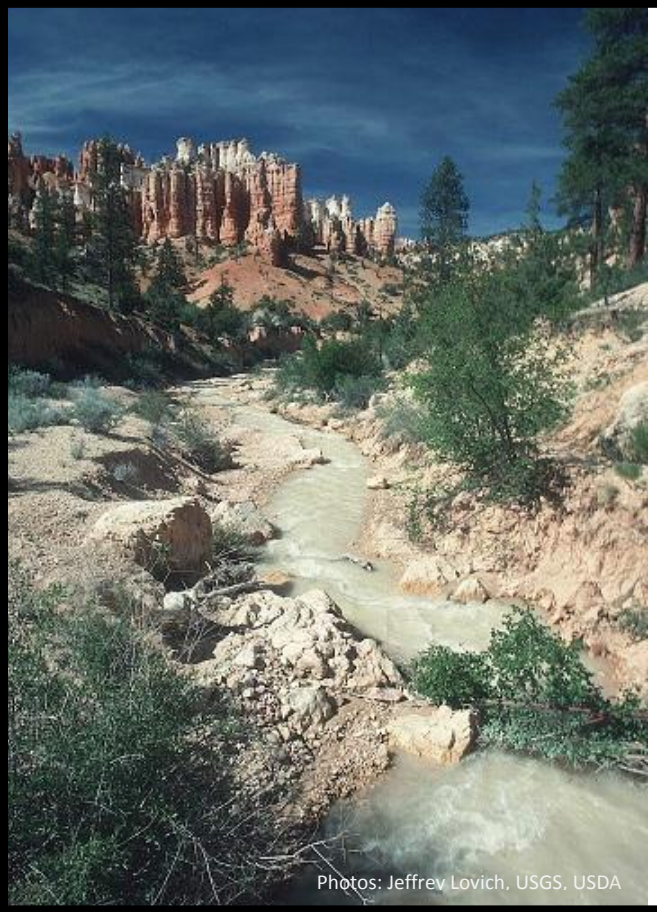
WATER RESOURCES IN THE WEST: ASSESSING TRADEOFFS IN A CHANGING CLIMATE



Photos: Jeffrey Lovich, USGS, USDA

CLIMATE CHANGE AND WATER USE

The West is responding to climate change more rapidly than anywhere else in the contiguous US. Direct effects of climate change include massive forest dieback from drought and insects, lower river flows, warmer waters, and the desiccation of wetlands. These impacts are compounded by the existing effects of human activities; nearly all western water is already appropriated for use by society. In many cases, the sustainability of freshwater resources will depend as much on the tradeoffs society makes to protect aquatic habitat as it will on direct impacts from warming.

ECOSYSTEM SERVICES AND WATER RESOURCES

Water delivery is directly connected to many critical ecosystem services—in the West, these services include food production, regional cooling, and electricity from hydropower. Different water uses will respond to water shortages and management practices differently, and these responses will impact different stakeholders in a variety of ways. With expected increases in the frequency and severity of droughts, adaptive measures will be necessary to ensure the most beneficial and equitable production of services.

MANAGING AGRICULTURAL AND URBAN ECOSYSTEMS

Western states have very high rates of per-capita water consumption because of outdoor irrigation. Although most of this water is used for agriculture, in urban ecosystems water is also used primarily outside—in many semi-arid areas, 70% of household water consumption is used outdoors. As cities look for ways to adapt to the reduced water availability predicted in climate change models, they must balance the demand for water resources with the environmental benefits of outdoor water use. These benefits include local cooling, which reduces energy costs for air conditioning and thus fossil fuel emissions, and the “greening” of urban areas through tree planting, which reduces atmospheric carbon dioxide concentrations while improving local aesthetics.

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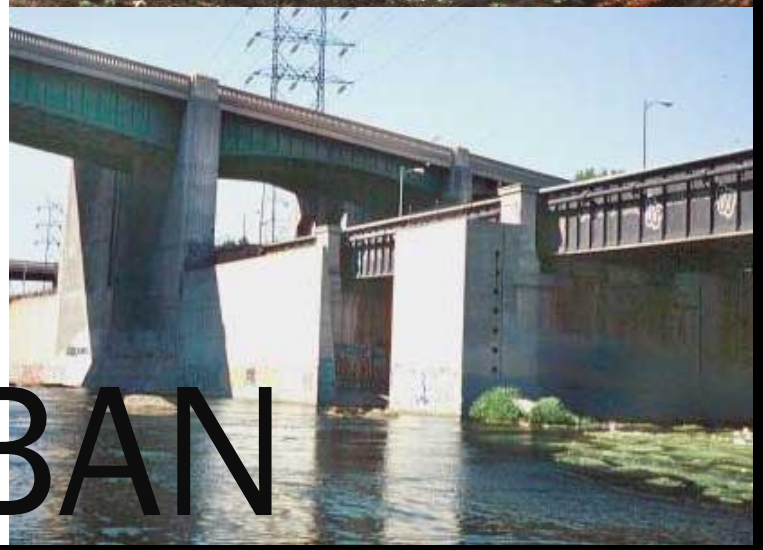
Water Allocation Tradeoffs in Different Ecosystems

NATURAL

THE COLORADO RIVER supplies water to 27-million users in seven states, and it irrigates over three million acres of farmland. But climate change is reducing the runoff that feeds the river, while the demand for water resources is growing—even the 10% runoff decline projected in conservative climate change scenarios could reduce flows by almost half a billion cubic meters— enough to supply roughly 800,000 households—40% of the time by 2025. During wet years, society will likely be able to adapt to the minor shortages that result. But during droughts, which are growing in frequency and duration in the West, the extended shortages could present a significant challenge. The river's native fisheries and ecosystems will be particularly vulnerable to changes in flow and water temperature, changes that compound existing stresses from human water consumption and land-use. Proactive water resource management that accounts for freshwater ecosystem health may help protect a number of ecosystem services while still meeting the needs of society.

MANAGED

CALIFORNIA'S CENTRAL VALLEY is among the world's most productive agricultural regions. Much of this productivity is due to its use of large-scale irrigation, however, which is highly water-intensive. Now in the midst of one of the worst droughts in state history, California has had to restrict water diversions to farms in order to protect declining fisheries and endangered aquatic species. The restrictions have forced many farms to leave fields fallow, and have produced steep increases in unemployment. But lifting the restrictions could lead to the collapse of freshwater fisheries, many of which are also at historic lows. As is the case with many ecosystem services, these tradeoffs are both economic and ecological in nature and will require attention on both fronts—ecologically sound water management strategies, coupled with economic safeguards may help the region adapt to lower water levels.



URBAN

LOS ANGELES set a goal of planting 1 million trees as part of *Green LA*, a plan to establish the city as a national leader in climate change action. Beyond enhancing aesthetics, this urban "greening" will help improve air quality, cool the city, and clean up polluted runoff. In urban areas, trees have a significant local cooling effect, reducing the need for air conditioning and, as such, air energy and associated greenhouse gas emissions. But planting trees also increases the city's water consumption. Society must therefore weigh the services provided by trees against the services provided by water. One way to approach this difficult tradeoff is by increasing water efficiency, not only technologically, but also ecologically: some trees are much more water efficient than others. By accounting for water usage when selecting urban vegetation, the city can work towards optimizing the benefits provided by both trees and water.