

# SAFEGUARDING FRESHWATER ECOSYSTEMS



## Aquatic Adaptation to Global Warming

Global warming is already affecting the quality and supply of America's freshwater. Even with aggressive reductions in greenhouse gas emissions, climate change will place additional strain on our lakes, rivers and wetlands. The fate of the nation's aquatic systems, and the fish, wildlife, and people they support, will depend on steps we take to help them survive in the face of a changing climate. **Climate change adaptation** – actions designed to safeguard our freshwater and other natural resources – will largely define a new era in America's conservation.



North Fork of the Flathead River, MT.

### AMERICA'S FRESHWATER

Freshwater is the very essence of life itself. Indeed, no other resource is as critical to people and wildlife alike as clean, abundant water. America's rivers, streams, and lakes harbor an amazing richness of aquatic lifeforms, and the United States is a global leader in the diversity of freshwater species such as fishes, salamanders, crayfish, and mussels. Unfortunately, aquatic habitats across North America—and around the world—are beleaguered by a range of human activities, including the construction and operation of dams, levees, and other structures; water diversions for agriculture and urban consumption; development in natural floodplains; destruction of riparian vegetation; and pollution. Although the clean-up of America's waters over the past few decades has been a signal environmental achievement, much work remains in restoring the ecological integrity and vitality of these waterways. In the face of global warming, that task has now become much more challenging.

### IMPACT OF GLOBAL WARMING ON FRESHWATER SYSTEMS

Climate change will further strain America's already overburdened and overallocated freshwater ecosystems. Shifts in temperature and precipitation will not only affect the timing, quantity, and characteristics of water flows, but will also impact the quality of our water. Because so many natural phenomena—from fish spawning to waterfowl breeding—are finely tuned to the seasonal rhythm of water flows, these changes will have significant implications for fish and wildlife, as well as for the human communities that depend on these freshwater resources. While the specific impacts and responses will vary considerable among diverse habitats and species, primary impacts include:

**Higher Water Temperatures** ~ Higher average air temperatures will translate into higher water temperatures in many areas. Cold-water fish such as salmon and trout will be especially hard hit and face significant declines in available stream habitat.

**More Flooding, Drought** ~ More extreme weather events are expected, with longer and more severe droughts in some regions, and heavier downpours and flooding in others. More intense rainstorms will wash higher levels of pollutants into many rivers and lakes.

**Vanishing Snowpack** ~ A reduction in average snowpack and earlier snowmelt runoff in many parts of the West will alter the timing of peak streamflows and will reduce summer flows, when competing demands for water are most intense.

**Loss of Wetlands** ~ Increased drought conditions will further strain freshwater wetlands in many areas. Drier conditions will eliminate many of the wetlands found in the Prairie Pothole region of the Great Plains, known as the continent's waterfowl factory.



Restoring lake shore vegetation in Louisiana.

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Red sockeye salmon and rainbow trout.

## FRESHWATER ECOSYSTEM ADAPTATION TO CLIMATE CHANGE

Safeguarding the nation's freshwater systems in the face of climate change will require looking at water resource management and conservation through a different lens. The impacts of climate change are especially problematic in regions where water resources are already scarce and likely to become increasingly so due to higher demands associated with a growing human population. Water resource managers and other stakeholders will need to incorporate future climate change projections into their decisions, rather than continue relying on historic trends and assume they will remain the same in the future. Although there will be a great temptation to address climate-induced water storage and flood control needs through construction of new dams and levees, whenever possible, non-structural approaches should be used that take advantage of the natural buffering capabilities and other ecosystem services provided by natural systems.

Freshwater adaptation strategies include:

- **Protect and restore riparian zones and floodplains.** Riparian vegetation will be critical for moderating the effects of warming waters, and filtering pollutants. Returning floodplains to their natural state can provide movement corridors for fish and wildlife, and reduce recurring property losses from increased flooding.
- **Restore natural streamflows and moderate water temperatures.** Selective removal of small dams can improve habitat connectivity for fish and other aquatic creatures; many larger dams can be operated to more closely reflect natural streamflows and buffer warmer temperatures through release of cool bottom water.
- **Increase water use efficiency and conservation.** Competition for scarce water resources will require increased emphasis on water conservation and efficiency measures to continue meeting human needs as well as maintaining streamflows and protecting water quality for fish and wildlife.
- **Improve stormwater and flood management.** Nonstructural approaches for stormwater and flood management should be emphasized in coping with the impact of heavier downpours. Proactive measures include limiting impervious surfaces and separating sewer and stormwater collection systems.
- **Prevent the introduction and spread of new invasive aquatic species.** Limiting the transport and introduction of new invasive aquatic species will take on increased urgency given their likely ability to flourish and cause ecological damage under future climate conditions.

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For additional information on ecosystem adaptation see P. Glick, A. Staudt, and B. Stein. 2009. *A New Era for Conservation: Review of Climate Change Adaptation Literature*, Washington, DC: National Wildlife Federation (available at: <http://www.nwf.org>).

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