WHERE RIVERS ARE BORN:

The Scientific Imperative for Defending Small Streams and Wetlands

Our nation's network of rivers, lakes and streams originates from a myriad of small streams and wetlands. The topographic maps most commonly used to trace stream networks do not show most of the nation's small, or headwater, streams and wetlands but, based upon local and regional studies, scientists know that headwater streams make up at least 80 percent of the nation's stream network. At least one out of five wetlands does not have a visible connection to a waterway, and, in some areas, more than half of the wetlands fall into that category. Despite the abundance of such wetlands, the United States has no national inventory of their numbers or locations.

With the future federal protection of small streams and wetlands in question, the Sierra Club and American Rivers asked eleven scientists to summarize the services wetlands and small streams provide society and the consequences of degrading these waters. The scientists used more than 235 scientific publications in preparing the document, ***Where Rivers Are Born: The Scientific Imperative for Defending Small Streams and Wetlands.*** *This factsheet summarizes their report; to obtain a copy of the full report, go to www.sierraclub.org/cleanwater/reports_factsheets/ or www.amrivers.org/ docs/WhereRivers Are Born1.pdf.*

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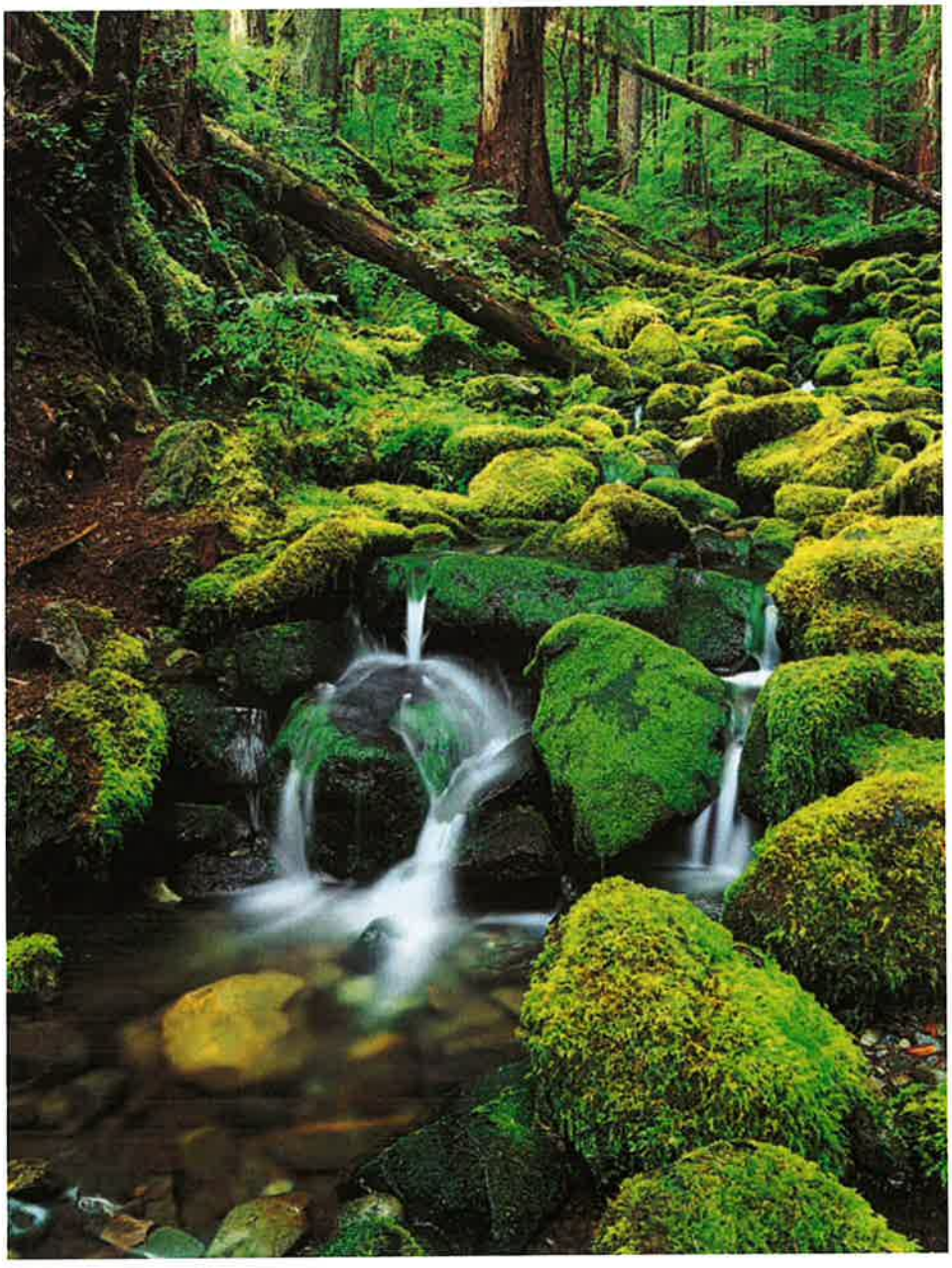

"The River itself has no beginning or end.
In its beginning, it is not yet the River;
in its end, it is no longer the River.
What we call the headwaters is only a selection
from among the innumerable sources which
flow together to compose it.
At what point in its course does the Mississippi
become what the Mississippi means?"

–T.S. Eliot

Historically, federal agencies have interpreted the protections of the Clean Water Act to cover all the waters of the United States, including these small streams and wetlands. The extent to which small streams and wetlands should remain under the protection of the Clean Water Act is currently (2003) under consideration in federal agencies and Congress.

Many ecosystem services derive from the special physical and biological characteristics of intact small streams and wetlands. Though these properties are not always apparent to the untrained eye, they provide us with benefits far greater than their small size would suggest. These services are provided by small or seasonal as well as perennial streams and wetlands, that is, those with visible surface water at all times. Seasonal streams and wetlands are usually linked to the larger network through groundwater even when they have no visible overland connections.

SMALL STREAMS AND WETLANDS PROVIDE THE FOLLOWING BENEFITS:

Protect Water Quality – Materials that wash into streams include everything from leaves and dead insects to runoff from agricultural fields and animal pastures. One of the key ecosystem services that stream networks provide is the filtering and processing of such materials. Small streams and their associated wetlands play a key role in storing and modifying potential pollutants, ranging from chemical fertilizers to rotting salmon carcasses, in ways that maintain downstream water quality. A mathematical model based on research in 14 headwater streams throughout the U.S. shows that 64 percent of inorganic nitrogen entering a small stream is retained or transformed into a less harmful substance within 1,000 yards

Center: Sycamore Creek in Arizona, an arid stream during a dry period. Photo Courtesy of Nancy Grimm

Bottom: Sycamore Creek (the same stream) after a winter storm. Photo Courtesy of Nancy Grimm

Maintain Water Supplies – Protecting headwater streams and wetlands is important for maintaining water levels needed to support everything from fish to domestic water consumption to commercial ship traffic. In wet seasons, unaltered headwater streams and wetlands recharge groundwater; these connections between groundwater and intact streams maintain stream flow during dry seasons. Alteration of small streams and wetlands disrupts the movement of water between the surface and groundwater, reducing the availability of water in a stream and river system. The US Geological Survey estimates that, on average, from 40 to 50 percent of water in streams and larger rivers comes from groundwater.

Provide Natural Flood Control – In their natural state, small streams and wetlands absorb significant amounts of rainwater, runoff and snowmelt before flooding. As regions become more urbanized, humans intentionally alter many natural stream channels by replacing them with storm sewers and other artificial conduits. When pipes are substituted for rough-bottomed stream channels, flood frequency and size increases downstream. For example, three decades of growth in storm sewers and paved surfaces around Watts Branch Creek, Maryland more than tripled the number of floods and increased average annual flood size by 23 percent.

Trap Excess Sediment – One study found that land disturbances such as urban construction can, at minimum, double the amount of sediment entering headwater streams from a watershed. Increased sediment raises water purification costs for municipal and industrial users, requires extensive dredging to maintain navigational channels, and degrades aquatic habitats. Intact headwater streams and wetlands can trap and retain significant amounts of sediment, reducing the volume transported to downstream ecosystems.

Sustain Downstream Ecosystems – Ecological processes that recycle organic carbon contained in the bodies of dead plants and animals are essential to every food web on the planet. In freshwater ecosystems, much of the recycling happens in small streams and wetlands, where microorganisms transform everything from leaf litter and downed logs to dead salamanders into food for other organisms in the aquatic food web. Like nitrogen and phosphorus, carbon is essential to life but can be harmful to ecosystems if it is present in excess or in the wrong chemical form. If all organic material received by headwater streams and wetlands went directly downstream, the glut of decomposing material could deplete oxygen in downstream rivers, thereby damaging and even killing fish and other aquatic life.

Stream networks filter and process everything from leaves and dead insects to runoff from agricultural fields and animal pastures. Without such processing, algal blooms can ruin living conditions for fish and the quality of drinking water. Here, algae overtakes a lake in Iowa. Photo courtesy of Lynn Betts, USDA NRCS

A coho salmon migrating up a spring-fed tributary of the Snoqualmie River watershed in Washington's Puget Sound region. Many anadromous fish species spawn in headwater streams that are so small as to be omitted from standard USGS topographical maps. Photo courtesy of Washington Trout.

Maintain Biological Diversity -

The large variety of headwater systems results in diverse headwater plants and animals. Many of these species are headwater specialists and are most abundant in or restricted to headwaters. Fishes commonly found in large rivers rely on small streams for critical parts of their life cycles and/or as a refuge from environmental extremes. The presence of wetlands adds another aspect of habitat diversity to headwater systems and therefore increases the variety of species a headwater system may support. Of the 450 species, subspecies, or varieties of plants found in California's vernal pools, 44 are vernal pool specialists. Several such plants are already on the federal Endangered Species list. Plant biodiversity peaks in fens, unique perennial wetlands that occur where groundwater flows to the surface.

The natural processes that occur in small streams and wetlands provide Americans with a host of benefits. Scientific research shows that healthy headwater systems are critical to the healthy functioning of larger streams, rivers, lakes and estuaries downstream. The goal of protecting water quality, plant and animal habitat, navigable waterways, and other downstream resources is not achievable without careful protection of headwater stream systems.

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Top: Caddis flies and other aquatic insects spend their larval stage in streams, feeding on the algae, vegetation and decaying plant matter. The Brachycentris, a caddis fly found in headwater streams of eastern North America, constructs a protective case out of twigs, leaves and other debris. Photo courtesy of David H. Funk

Center: Although spotted salamanders are generally terrestrial animals, they only breed and reproduce in vernal pools. Photo courtesy of Vernal Pool Association

Bottom: American dippers rely on headwater streams for sustenance, walking along stream bottoms and feeding on insect larvae and crustaceans among the rocks of the streambed. This American dipper was photographed at Tanner's Flat, just east of Salt Lake City. Photo courtesy of Pomera M. France

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Bringing Rivers to Life
American Rivers
Founded 1973

For information related to policy issues concerning the scope of waters protected by the Clean Water Act, please contact Ed Hopkins at Sierra Club (ed.hopkins@sierraclub.org or 202-675-7908) or Betsy Otto at American Rivers (botto@amrivers.org or 202-347-7550).