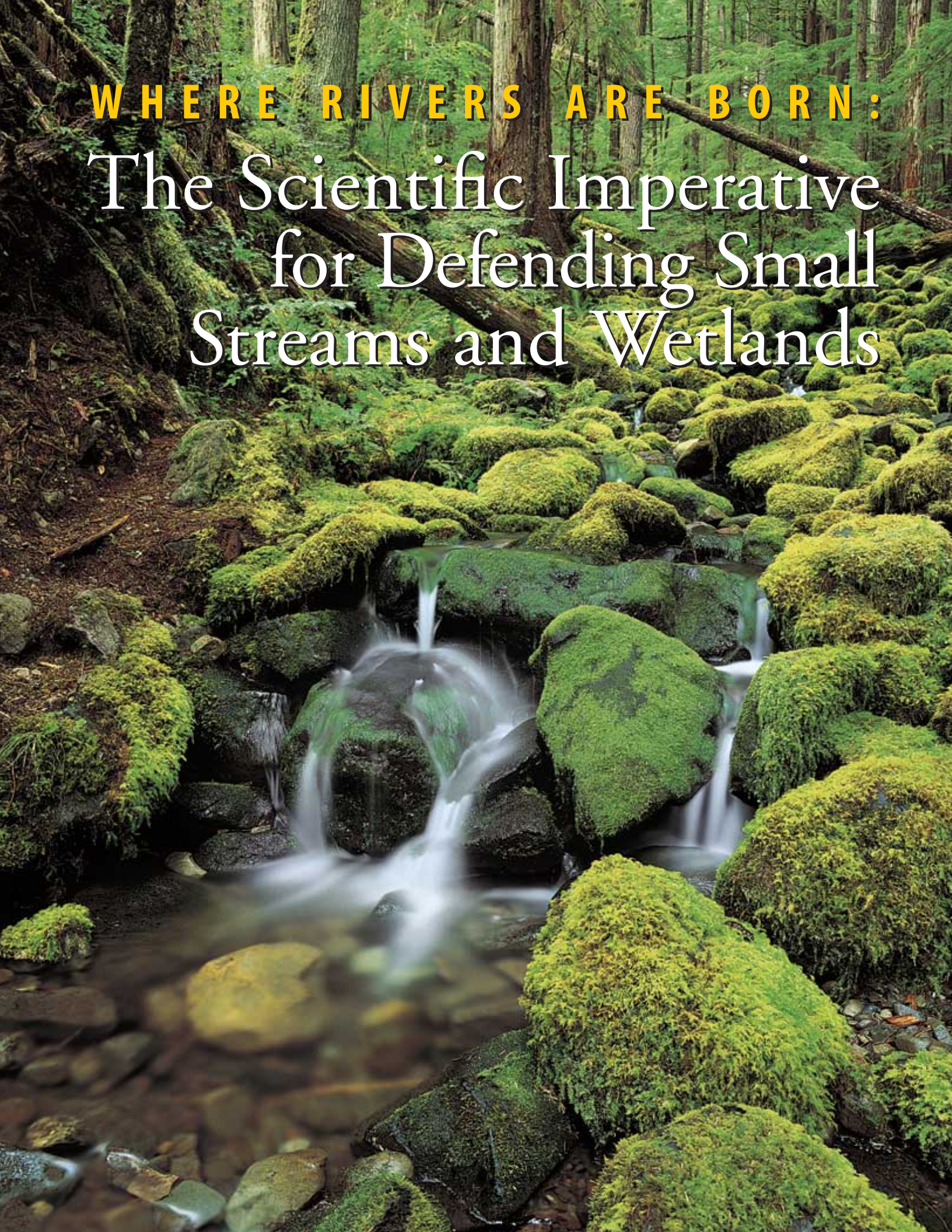


WHERE RIVERS ARE BORN:

The Scientific Imperative
for Defending Small
Streams and Wetlands



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American Rivers and Sierra Club, sponsors of this publication, are extremely grateful for the contributions the authors have made in describing the ecological importance of headwater streams and wetlands and the benefits they provide to humans. We extend special thanks to Judy Meyer for coordinating the project. We also thank editors Mari N. Jensen and David Sutton.

This publication was funded by grants from the Sierra Club Foundation, The Turner Foundation and American Rivers and its supporters.

September, 2003

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EXECUTIVE SUMMARY

Our nation's network of rivers, lakes and streams originates from a myriad of small streams and wetlands, many so small they do not appear on any map. Yet these headwater streams and wetlands exert critical influences on the character and quality of downstream waters. The natural processes that occur in such headwater systems benefit humans by mitigating flooding, maintaining water quality and quantity, recycling nutrients, and providing habitat for plants and animals. This paper summarizes the scientific basis for understanding that the health and productivity of rivers and lakes depends upon intact small streams and wetlands.

Historically, federal agencies have interpreted the protections of the Clean Water Act to cover all the waters of the United States, including small streams and wetlands. Despite this, many of these ecosystems have been destroyed by agriculture, mining, development and other human activities. 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. Extensive scientific studies document the significance of these small systems and form the basis for this paper. Further references are provided at the end of the document.

We know from local/regional studies that small, or headwater, streams make up at least 80 percent of the nation's stream network. However, scientists' abilities to extend these local and regional studies to provide a national perspective is hindered by the absence of a comprehensive database that catalogs the full extent of streams in the United States. The topographic maps most commonly used to trace stream networks do not show most of the nation's headwater



streams and wetlands. Thus, such maps do not provide detailed enough information to serve as a basis for stream protection and management.

Scientists often refer to the benefits humans receive from the natural functioning of ecosystems as ecosystem services. The special physical and biological characteristics of intact small streams and wetlands provide natural flood control, recharge groundwater, trap sediments and pollution from fertilizers, recycle nutrients, create and maintain biological diversity, and sustain the biological productivity of downstream rivers, lakes and estuaries. These ecosystem services are provided by seasonal as well as perennial streams and wetlands. Even when such systems have no visible overland connections to the stream network, small streams and wetlands are usually linked to the larger network through groundwater.

Small streams and wetlands offer an enormous array of habitats for plant, animal and microbial life. Such small freshwater systems provide shelter,



food, protection from predators, spawning sites and nursery areas, and travel corridors through the landscape. Many species depend on small streams and wetlands at some point in their life history. For example, headwater streams are vital for maintaining many of America's fish species, including trout and salmon. Both perennial and seasonal streams and wetlands provide valuable habitat. Headwater streams and wetlands also provide a rich resource base that contributes to the productivity of both local food webs and those farther downstream. However, the unique and diverse biota of headwater systems is increasingly imperiled. Human-induced changes to such waters, including filling streams and wetlands, water pollution, and the introduction of exotic species, can diminish the biological diversity of such small freshwater systems, thereby also affecting downstream rivers and streams.

Because small streams and wetlands are the source of the nation's fresh waters, changes that degrade these headwater systems affect streams, lakes, and rivers downstream. Land-use changes in the vicinity of small streams and wetlands can impair the natural functions of such headwater systems. Changes in surrounding vegetation, development that paves and hardens soil surfaces, and the total elimination of some small streams reduces the amount of rainwater, runoff and snowmelt the stream network can absorb before flooding. The increased volume of water in small streams scours stream channels, changing them in a way that promotes further flooding. Such altered channels have bigger and more frequent floods. The altered channels are also less effective at recharging groundwater, trapping sediment, and recycling nutrients. As a result, downstream lakes and rivers have poorer water quality, less reliable water flows, and less diverse aquatic life. Algal blooms and fish kills can become more common, causing problems for commercial and sport fisheries. Recreational uses may be compromised. In addition, the excess sediment can be costly, requiring additional dredging to clear navigational channels and harbors and increasing water filtration costs for municipalities and industry.

The natural processes that occur in small streams and wetlands provide Americans with a host of benefits, including flood control, adequate high-quality water, and habitat for a variety of plants and animals. Scientific research shows that healthy headwater systems are critical to the healthy functioning of downstream streams, rivers, lakes and estuaries. To provide the ecosystem services that sustain the health of our nation's waters, the hydrological, geological, and biological characteristics of small streams and wetlands require protection.